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## THE ENCYCLOPÆDIA BRITANNICA A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION ELEVENTH EDITION

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Convention to Copyright

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COOPER, SAMUEL	COPYING MACHINES
COOPER, THOMAS (1517-1594)	COPYRIGHT
COOPER, THOMAS (1759-1840)	

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**CONVENTION** (Lat. *\_conventio\_*, an assembly or agreement, from *\_convenire\_*, to come together), a meeting or assembly; an agreement between parties; a general agreement on which is based some custom, institution, rule of behaviour or taste, or canon of art; hence extended to the abuse of such an agreement, whereby the rules based upon it become lifeless and artificial. The word is of some interest historically and politically. It is used of an assembly of the representatives of a nation, state or party, and is particularly contrasted with the formal meetings of a legislature. It is thus applied to those parliaments in English history which, owing to the abeyance of the crown, have assembled without the formal summons of the sovereign; in 1660 a convention parliament restored Charles II. to the throne, and in 1689 the Houses of Commons and Lords were summoned informally to a convention by William, prince of Orange, as were the Estates of Scotland, and declared the throne abdicated by James II. and settled the disposition of the realm. Similarly, the assembly which ruled France from September 1792 to October 1795 was known as the National Convention (see below); the statutory assembly of delegates which framed the constitution of the United States of America in 1787 was called the Constitutional

Convention; and the various American state constitutions have been drafted and sometimes revised by constitutional conventions. In the party system of the United States the nomination of party candidates for office or election is in the hands of delegates, chosen by the primaries, meeting in the convention of the party; the convention system is universal, from the national conventions of the Republican and Democratic parties, which nominate the candidates for the presidency and vice-presidency, down to a ward convention, which nominates the candidate for a town-councillorship. In diplomacy, "convention" is a general name given to international agreements other than treaties, but not necessarily differing either in form or subject-matter from a treaty, and sometimes used quite widely of all forms of such agreements. Many conventions have been made for the formation of international "unions" to regulate and protect various economic, industrial and other non-political interests, such as postal and telegraphic services, trade-marks, patents, copyright, quarantine, &c. Thus the Latin Monetary Union was created in 1865 by the Convention of Paris, and the abolition of bounties on the production and exportation of sugar by the Convention of Brussels in 1902 (see [TREATIES](#)).

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**CONVENTION, THE NATIONAL**, in France, the constitutional and legislative assembly which sat from the 20th of September 1792 to the 26th of October 1795 (the 4th of Brumaire of the year IV.). On the 10th of August 1792, when the populace of Paris stormed the Tuileries and demanded the abolition of the monarchy, the Legislative Assembly decreed the provisional suspension of the king and the convocation of a national convention which should draw up a constitution. At the same time it was decided that the deputies to that convention should be elected by all Frenchmen 25 years old, domiciled for a year and living by the product of their labour. The National Convention was therefore the first French assembly elected by universal suffrage, without distinctions of class. The age limit of the electors was further lowered to 21, and that of eligibility was fixed at 25 years.

The first session was held on the 20th of September 1792. The next day royalty was abolished, and on the 22nd it was decided that all documents should be henceforth dated from the year I. of the French Republic. The Convention was destined to last for three years. The country was at war, and it seemed best to postpone the new constitution until peace should be concluded. At the same time as the Convention prolonged its powers it extended them considerably in order to meet the pressing dangers which menaced the Republic. Though a legislative assembly, it took over the executive power, entrusting it to its own members. This "confusion of powers," which was contrary to the philosophical theories—those of Montesquieu especially—which had inspired the Revolution at first, was one of the essential characteristics of the Convention. The series of exceptional measures by which that confusion of powers was created constitutes the "Revolutionary government" in the strict sense of the word, a government which was principally in vigour during the period called "the Terror." It is thus necessary to distinguish, in the work of the Convention, the temporary expedients from measures intended to be permanent.

The Convention held its first session in a hall of the Tuileries, then it sat in the hall of *Manège*, and finally from the 10th of May 1793 in that of the *Spectacles* (or *Machines*), an immense hall in which the deputies were but loosely scattered. This last hall had tribunes for the public, which often influenced the debate by interruptions or applause. The full number of deputies was 749, not counting 33 from the colonies, of whom only a section arrived in Paris. Besides these, however, the departments annexed from 1792 to 1795 were allowed to send deputations. Many of the original deputies died or were exiled during the Convention, but not all their places were filled by *suppléants*. Some of those proscribed during the Terror returned after the 9th of Thermidor. Finally, many members were sent away either to the departments or to the armies, on missions which lasted sometimes for a considerable length of time. For all these reasons it is difficult to find out the number of deputies present at any given date, for votes by roll-call were rare. In the Terror the number of those voting averaged only 250. The members of the Convention were drawn from all classes of society, but the most numerous were lawyers. Seventy-five members had sat in the Constituent Assembly, 183 in the Legislative.

According to its own ruling, the Convention elected its president every fortnight. He was eligible for re-election after the lapse of a fortnight. Ordinarily the sessions were held in the morning, but evening sessions were also frequent, often extending late into the night.

Sometimes in exceptional circumstances the Convention declared itself in permanent session and sat for several days without interruption. For both legislative and administrative purposes the Convention used committees, with powers more or less widely extended and regulated by successive laws. The most famous of these committees are those of Public Safety, of General Security, of Education (*Comité de salut public, Comité de sûreté générale, Comité de l'instruction*).

The work of the Convention was immense in all branches of public affairs. To appreciate it without prejudice, one should recall that this assembly saved France from a civil war and invasion, that it founded the system of public education (*Muséum, École Polytechnique, École Normale Supérieure, École des Langues orientales, Conservatoire*), created institutions of capital importance, like that of the *Grand Livre de la Dette publique*, and definitely established the social and political gains of the Revolution.

See [FRENCH REVOLUTION](#); [GIRONDISTS](#); [MOUNTAIN](#); [DANTON](#); [ROBESPIERRE](#); [MARAT](#), &c.

BIBLIOGRAPHY.—The Convention published a *Procès-verbal* of its sessions, which, although lacking the value of those published by assemblies to-day, is an official document of capital importance. Copies of it are rare, however, and it has been too much neglected by historians. See F. A. Aulard, *Recueil des actes du comité de Salut Public avec la correspondance officielle des représentants en mission, et le registre du conseil exécutif provisoire* (Paris, 1889 et seq.); M. J. Guillaume, *Procès-verbaux du comité d'Instruction Publique de la Convention Nationale* (Paris, 1891-1904, 5 vols. 4to); F. A. Aulard, *Histoire politique de la Révolution française* (Paris, 1903); Mortimer-Ternaux, *Histoire de la Terreur* (1862-1881), a work based on and comprising documents, but written with strong royalist bias; Eugène Despois, *Le Vandalisme révolutionnaire* (1868), for the scientific work of the Convention. A detailed bibliography of the documents relating to the Convention is given in the *Répertoire général des sources manuscrites de l'histoire de Paris pendant la Révolution française*, vol. viii. &c. (1908), edited by A. Tueléy under the auspices of the municipality of Paris. For a more summary bibliography see M. Tourneux, *Bibliog. de l'histoire de Paris pendant la Révolution française*, i. 89-95 (Paris, 1890).

(R. A.\*)

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**CONVERSANO**, a town and episcopal see of Apulia, Italy, in the province of Bari, 17 m. S.E. by rail from the town of Bari. Pop. (1901) 13,685. It has a fine southern Romanesque cathedral of the end of the 11th century, with a modernized interior, and a castle which from 1456 belonged to the Acquaviva family, dukes of Atri and counts of Conversano. The convent of S. Benedetto is one of the earliest offshoots of Montecassino. (See S. Simone, *Il Duomo di Conversano*, Trani, 1896). Here, or in the vicinity, is the site of the unimportant ancient town of Norba.

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**CONVERSION** (Lat. *conversio*, from *convertere*, to turn or change), a general term for the operation of converting, changing, or transposing; used technically in special senses in logic, theology and law.

1. *In logic*, conversion is one of three chief methods of immediate inference by which a conclusion is obtained directly from a single premise without the intervention of another premise or middle term. A proposition is said to be "converted" when the subject and the predicate change places; the original proposition is the "convertend," the new one the "converse." The chief rule governing conversion is that no term which was not *distributed*<sup>1</sup> in the convertend may be distributed in the converse; nor may the quality of the proposition (affirmative or negative) be changed. It follows that of the four possible forms of propositions A, E, I and O (see article A), E and I can be converted simply. If no A is B (E), it follows that no B is A; if some A is B, it follows that some B is A. This form of conversion is called Simple Conversion; E propositions convert into E, and I into I. On the other hand, A cannot be converted simply. If all men are mortal, the most that can follow by conversion is that some mortals are men. This is called Conversion by Limitation or *Per Accidens*. Only if

it be known from external or non-logical sources that the predicate also is distributed can there be simple conversion of a universal affirmative. Neither of these forms of conversion can be applied to the particular negative proposition O, which has to be dealt with under a secondary system of conversion, as follows. The terminology by which these secondary processes are described is not altogether satisfactory, and logicians are not agreed as to the application of the terms. The following system is perhaps the most commonly used. We have seen that the converse of "all A is B" is "some B is A"; we can, in addition, derive from it another, though purely formal, proposition "no A is not-B"; *i.e.* an E proposition. This process is called Obversion, Permutation or Immediate Inference by Privative Conception; it is applicable to every proposition including O. A further process, known as Contraposition or Conversion by Negation, consists of conversion following on obversion. Thus from "all A is B," we get "no not-B is A." In the case of the O proposition we get (by obversion) "some A is not-B" and then (by conversion) "some not-B is A" (*i.e.* an I proposition). In the case of the I proposition the contrapositive is impossible, as infringing the main rule of conversion. Another term, Inversion, has been used by some logicians for a still more complicated process by the alternative use of conversion and obversion, which is applicable to A and E, and results in obtaining a proposition concerning the contradictory of the original subject; thus "all A is B" becomes "some not-A is not B."

Considerable discussion has centred on the problem as to whether the process of conversion can properly be regarded as inference. The essence of inference is that the conclusion should embody knowledge which is not in the premise or premises, and many logicians have contended that no fact is stated in the converse which was not in the convertend, or, in other words, that conversion is merely a transformation or verbal change of the same statement. Hence the term *Eductions and Equivalent Propositional Forms* have been given to converse propositions. It is clear, for instance, that if the universal affirmative is taken connotatively as a scientific law, and not historically, no real inference is achieved by stating as another scientific fact its converse, the particular affirmative. Moreover, even if the convertend is stated as an historic fact, though there is acquired a certain new significance, it may well be argued that the inference is not immediate but syllogistic.

For this controversy see J. S. Mill, *Logic*, II. i. 2; Bradley, *Logic*, III. pt. i. chap. ii. 30-37; H. W. B. Joseph, *Introduction to Logic* (1906), pp. 209 foll.; J. N. Keynes, *Formal Logic* (3rd ed., 1894).

2. *In theology*, conversion (the equivalent of the Gr. στρέφειν, ἐπιστρέφειν) is originally the acceptance of Christianity by heathens. It is also used generally for a change from one religion to another, or in a narrower sense for a complete change of attitude towards God, involving a deeper conviction of the ultimate religious and moral truths. Considerable difference of opinion has always existed, and still exists, within the Christian Church as to the true nature and the causes of conversion, especially in the sense last described. Some have held that man is merely the passive recipient of the Divine Grace, a view based largely on the rendering of the Authorized Version of Isaiah vi. 10 as quoted in Matt. xiii. 15, Mark iv. 12, and John xii. 40. Others again hold that baptism, as involving a second birth of the baptized person, makes subsequent conversion unnecessary or even meaningless, or conversely that conversion is this very second birth and renders baptism unnecessary. The reply generally made to such arguments is that baptism implies regeneration only, which is a change wrought from the outside by the Divine Spirit in general disposition or spiritual status, while conversion is a positive or concrete demonstration of that change, not merely the negative beginning of a new life but the positive "returning" to God in faith and repentance. The precise connexion between conversion and repentance is again a vexed question. How far and in what sense does man take an active part in his own conversion? To this it is frequently answered that while the initial stage of conversion is and can be the work of the Holy Spirit alone, it lies with man to make it complete by accepting the proffered grace in repentance and faith (cf. Acts vii. 51, "Ye stiffnecked and uncircumcised in heart and ears, ye do always resist the Holy Ghost"). A man may of his own free will avoid those surroundings which predispose him to such "resistance." The view that man cannot convert himself is clearly stated in Article X. by the Church of England. "The condition of man after the fall of Adam is such that he cannot turn (*sese convertere*) and prepare himself by his own natural strength and good works, to faith, and calling upon God: wherefore we have no power to do good works pleasant and acceptable to God, without the grace of God by Christ preventing us that we may have a good will, and working with us, when we have that good will." Further problems are connected with the possibility of repeated conversions of the same man, the necessity of a single strongly marked conversion completed in a single process, the significance of sudden conversion of persons in a highly emotional state, such as has been common in revivalist meetings, especially in Wales and the United States of

America. Conversions of the last kind have followed frequently on striking physical phenomena, perceived in many cases only by the convert himself, such as a sudden bright light or a noise like a clap of thunder.<sup>2</sup> In all cases of conversion, however, the criterion of its validity is generally taken to be the resultant change of a man's character as manifested in his mode of life and thought, in the abstention from sin, and in devotion to good works.

(X.)

3. *In English law*, conversion is the unauthorized exercise of dominion by one person over the property (other than money or chattels real) of another, in a manner inconsistent with his rights of possession, or the unauthorized assumption by another of the powers of the true owner of goods. The history and exact definition of this form of actionable wrong have occupied the attention of many learned writers, and the incidents of actions to assert the rights of the true owner form a considerable part of treatises on the rules and forms of civil pleading. There are many ways in which the wrong may be committed. In some cases the exercise of the dominion may amount to an act of trespass or to a crime, *e.g.* where the taking amounts to larceny, or fraudulent appropriation by a bailee or agent entrusted with the property of another (Larceny Acts of 1861 and 1901). But in such cases, except where money is taken, the civil remedy of the owner is by action for conversion or detention of the property, subject in the case of larceny to the rule that criminal prosecution should precede restitution by the taker. The remedy in use in these cases used to be by what was called an action on the case for trover and conversion, the plaintiff putting aside all suggestions of trespass and of crime, and resting his case on the fiction that the defendant had found and used goods not his own. The fictitious averment of loss was abolished in 1852, and under the present procedure, in which the old forms of action are not in use, the remedy is by a claim (still usually called conversion) for wrongfully depriving the true owner of personal property of its use by some specified act inconsistent with his dominion over it, usually by dealing with the property in a manner inconsistent with the owner's rights. Originally, the action of trover and conversion was limited to goods and chattels, but it is now accepted as applying to valuable securities, such as cheques and bills of exchange.

The gist of the action is in the unauthorized dealing, for however short a time and for however limited a purpose, with the personal property of another. Even refusal to deliver up to the owner is sufficient to prove conversion, though it is often made the ground of an action for detinue, if the plaintiff desires to have the property returned in specie. The knowledge, motive or good faith of the person wrongfully dealing with the property of another is for civil purposes immaterial, and the action is often brought to try the title of two claimants to the same goods; *e.g.* where a person who has innocently bought or taken in pledge goods stolen or illegally procured resists the claim of the original owner for the return of the goods. A warehouseman may render himself liable to the owner of goods deposited with him, through delivering the goods to a third person on a forged authority or without authority, or by issuing a warehouse receipt representing the goods to be in his possession or control when they have ceased to be so.

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The exact measure of compensation due to a plaintiff whose goods have been wrongfully converted may be merely nominal if the wrong is technical and the defendant can return the goods; it may be limited to the actual damage where the goods can be returned, but the wrong is substantial; but in ordinary cases it is the full value to the owner of the goods of which he has been deprived.

Fraudulent conversion by any person to his own use (or that of persons other than the owner) of property entrusted to him is a crime in the case of custodians of property, factors, trustees under express trusts in writing (Larceny Act, 1861, ss. 77-85; Larceny Act, 1901).

The law of Ireland, of most British possessions, and of the United States, follows that of England as to the civil or criminal remedies for conversion.

The term "conversion" is also used in English law with reference to the rule of courts of equity which, in certain cases (following the maxim of treating as done what ought to have been done), treats as converted into personalty land which has been directed so to be converted by a will, contract or settlement, or as converted into land personalty which has been by such instrument directed to be applied for purchase of realty. The rule is also applied where a vendor of land dies between the making of the contract of sale and its completion by conveyance of the land. The importance of the rule lies in the different destination of realty and personalty under the laws relating to inheritance and succession.

See Bullen and Leake, *Precedents of Pleading* (3rd ed., 1868, 6th ed. by Dodd and Chitty, 1905); F. Pollock, on *Torts* (7th ed., 1904); Clerk and Lindsell, on *Torts* (3rd ed., 1904); Lewin, on *Trusts* (11th ed., 1904); Jarman, on *Wills* (5th ed., 1893); Dart, *Vendors and*

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- 1 A term is said to be “distributed” when it is taken universally: in the proposition “men are mortal” (meaning “all men”) the term “men” is “distributed” while “mortal” is undistributed, because there are mortal beings which are not men.
  - 2 Numerous instances, drawn from other religions besides Christianity, are given in Professor William James’s *The Varieties of Religious Experience* (1902).
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**CONVEX** (Lat. *convexus*, carried round, rounded, from *con-*, with, and *vehere*, to carry), a term for the exterior side of a curved or rounded surface, as opposed to “concave” (Lat. *con-*, and *cavus*, hollow), the inner surface.

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**CONVEYANCE**, primarily the act or process of conveying anything. The verb “to convey,” now used in the senses of carrying, transporting, transmitting, communicating or handing over, originally had the same meaning as “convoy” (*q.v.*), *i.e.* to accompany, a meaning which still survived in the 18th century. Like “convoy” it is ultimately derived from the Late Lat. *conviare* (not from *convehere*), but through the old Norman French form *conveier*, which in central France passed into the form *convoier*, mod. Fr. *convoyer*, whence “convoy.” Apart from the general sense given above the word conveyance is now used in three special senses: (1) a carriage or other means of transport, (2) in law, the transference of property by deed or writing between living persons, and (3) the written instrument by which such transference is effected. (See [CONVEYANCING](#).)

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**CONVEYANCING**, in English law, the art or science of conveying or effecting the transfer of property, or modifying interests in relation to property, by means of written documents.

In early legal systems the main element in the transfer of property was the change, generally accompanied by some public ceremony, in the actual physical possession: the function of documents, where used, being merely the preservation of evidence. Thus, in Great Britain in the feudal period, the common mode of conveying an immediate freehold was by *feoffment with livery of seisin*—a proceeding in which the transferee was publicly invested with the feudal possession or *seisin*, usually through the medium of some symbolic act performed in the presence of witnesses upon the land itself. A deed or charter of feoffment was commonly executed at the same time by way of record, but formed no essential part of the conveyance. In the language of the old rule of the common law, the immediate freehold in corporeal hereditaments lay in livery, whereas reversions and remainders and all incorporeal hereditaments lay in grant, *i.e.* passed by the delivery of the deed of conveyance or grant without any further ceremony. The process by which this distinction was broken down and the present uniform system of private conveyancing by simple deed was established, constitutes a long chapter in English legal history.

The land of a feudal owner was subject to the risk of forfeiture for treason, and to military and other burdens. The common law did not allow him to dispose of it by will. By the law of mortmain religious houses were prohibited from acquiring it. The desire to escape from these burdens and limitations gave rise to the practice of making feoffments to the *use* of, or upon trust for, persons other than those to whom the seisin or legal possession was delivered. The common law recognized only the legal tenant; but the *cestui que use* or beneficial owner gradually secured for his wishes and directions concerning the profits of

the land the strong protection of the chancellors as exercising the equitable jurisdiction of the king. The resulting loss to the crown and the great lords of the feudal dues and privileges, coupled with the public disadvantages arising from ownership of land which, in an increasing degree, was merely nominal, brought about the passing in the year 1535 of the famous Statute of Uses, the object of which was to destroy altogether the system of uses and equitable estates. It enacted, in substance, that whoever should have a use or trust in any hereditaments should be deemed to have the legal seisin, estate and possession for the same interest that he had in the use; in other words, that he should become in effect the feudal tenant without actual delivery of possession to him by the actual feoffee to uses or trustee: In its result the statute was a fiasco. It was solemnly decided that the act transferred the legal possession to the use once only, and that in the case of a conveyance to A to the use of B to the use of or upon trust for C, it gave the legal estate to B, and left C with an interest in the position of the use before the statute. Thus was completed the foundation of the modern system of trusts fastened upon legal estates and protected by the equitable doctrines and practice of the judicature.

But the statute not only failed to abolish uses: it also opened the way to the evasion of the public ceremony of livery of seisin, and the avoidance of all notoriety in conveyances. Other ways, besides an actual feoffment to uses, of creating a use had been in vogue before the statute. If A bargained with B, in writing or not, for the sale of land, and B paid the price, but A remained in legal possession, the court of chancery enforced the use or equitable interest in favour of B. The effect of a *bargain and sale* (as such a transaction was called) after the statute was to give B the legal interest without any livery of seisin. This fresh danger was met in the very year of the statute itself by an enactment that a bargain and sale of an estate of inheritance or freehold should be made by deed publicly enrolled. But the Statute of Enrolments was in terms limited to estates of freehold. It was allowed that a bargain and sale for a term, say, of one year, must transfer the seisin to the bargainee without enrolment. And since what remained in the bargainer was merely a reversion which "lay in grant," it was an easy matter to release this by deed the day after. By this ingenious device was the publicity of feoffment or enrolment avoided, and the *lease and release*, as the process was called, remained the usual mode of conveying a freehold, in possession down to the 19th century.

It was not until 1845 that the modern system of transfer by a single deed was finally established. By the Real Property Act of that year it was enacted that all corporeal hereditaments should, as regards the immediate freehold, be deemed to lie in grant as well as in livery. Since this act the ancient modes of conveyance, though not abolished by it, have in practice become obsolete. Traces of the old learning connected with them remain, however, embedded in the modern conveyance. Many a purchase-deed recites that the vendor is *seised* in fee-simple of the property. It is the practice, moreover, to convey not only "to" but also "to the use of" a purchaser. For before the Statute of Uses, a conveyance made without any consideration or declaration of uses was deemed to be made to the use of the party conveying. In view of the operation of the statute upon the legal estate in such circumstances, it is usual in all conveyances, whether for value or not, to declare a use in favour of the party to whom the grant is made.

In its popular usage the word "conveyance" signifies the document employed to carry out a purchase of land. But the term "conveyancing" is of much wider import, and comprises the preparation and completion of all kinds of legal instruments. A well-known branch of the conveyancer's business is the investigation of title—an important function in the case of purchases or mortgages of real estate. With personal estate (other than leasehold) he has perhaps not so much concern. Chattels are usually transferred by delivery, and stocks or shares by means of printed instruments which can be bought at a law-stationer's. The common settlements and wills, however, deal wholly or mainly with personal property; and an interest in settled personalty is frequently the subject of a mortgage. Of late years, also, there has been an enormous increase in the volume of conveyancing business in connexion with limited joint-stock companies.

In the preparation of legal documents the practitioner is much assisted by the use of *precedents*. These are outlines or models of instruments of all kinds, exhibiting in accepted legal phraseology their usual form and contents with additions and variations adapted to particular circumstances. Collections of them have been in use from early times, certainly since printing became common. The modern precedent is, upon the whole, concise and businesslike. The prolixity which formerly characterized most legal documents has largely disappeared, mainly through the operation of statutes which enable many clauses previously inserted at great length to be, in some cases, *e.g.* covenants for title, incorporated by the use of a few prescribed words, and in others safely omitted altogether. The Solicitors' Remuneration Act 1881, has also assisted the process of curtailment, for there is now little



or no connexion between the length of a deed and the cost of its preparation. So long as the draftsman adheres to recognized legal phraseology and to the well-settled methods of carrying out legal operations, there is no reason why modern instruments should not be made as terse and businesslike as possible.

It is not usual for land to be sold without a formal agreement in writing being entered into. This precaution is due, partly to the Statute of Frauds (§ 4), which renders a contract for the sale of land unenforceable by action “unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing and signed by the party to be charged therewith or some other person thereunto by him lawfully authorized,” and partly to the fact that there are few titles which can with prudence be exposed to all the requisitions that a purchaser under an “open contract” is entitled by law to make. Such a purchaser may, for example, require a forty years’ title (Vendor and Purchaser Act 1874). Under an open contract a vendor is presumed to be selling the fee-simple in possession, free from any incumbrance, or liability, or restriction as to user or otherwise; and if he cannot deduce a title of the statutory length, or procure an incumbrance or restriction to be removed, the purchaser may repudiate the contract. The preparation of an agreement for sale involves accordingly an examination of the vendor’s title, and the exercise of skill and judgment in deciding how the vendor may be protected against trouble and expense without prejudice to the sale. Upon a sale by auction the agreement is made up of (1) the particulars, which describe the property; (2) the conditions of sale, which state the terms upon which it is offered; and (3) the memorandum or formal contract at the foot of the conditions, which incorporates by reference the particulars and conditions, names or sufficiently refers to the vendor, and is signed by the purchaser after the sale. The object of the agreement, whether the sale is by private contract or by auction, is to define accurately what is sold, to provide for the length of title and the evidence in support of or in connexion with the title which is to be required except so far as it is intended that the general law shall regulate the rights of the parties, and to fix the times at which the principal steps in the transaction are to be taken. It is also usual to provide for the payment of interest at a prescribed rate upon the purchase money if the completion shall be delayed beyond the day fixed for any cause other than the vendor’s wilful default, and also that the vendor shall be at liberty to rescind the contract without paying costs or compensation if the purchaser insists upon any requisition or objection which the vendor is unable or, upon the ground of expense or other reasonable ground, is unwilling to comply with or remove. Upon a sale by auction it is the rule to require a deposit to be paid by way of security to the vendor against default on the part of the purchaser.

The signature of the agreement is followed by the delivery to the purchaser or his solicitor of the abstract of title, which is an epitome of the various instruments and events under and in consequence of which the vendor derives his title. A purchaser is entitled to an abstract at the vendor’s expense unless otherwise stipulated. It begins with the instrument fixed by the contract for the commencement of the title, or, if there has been no agreement upon the subject, with an instrument of such character and date as is prescribed by the law in the absence of stipulation between the parties. From its commencement as so determined the abstract, if properly prepared, shows the history of the title down to the sale; every instrument, marriage, birth, death, or other fact or event constituting a link in the chain of title, being sufficiently set forth in its proper order. The next step is the verification of the abstract on the purchaser’s behalf by a comparison of it with the originals of the deeds, the probates of the wills, and office copies of the instruments of record through which the title is traced. The vendor is bound to produce the original documents, except such as are of record or have been lost or destroyed, but, unless otherwise stipulated, the expense of producing those which are not in his possession falls upon the purchaser (Conveyancing Act 1881). After being thus verified, the abstract is perused by the purchaser’s advisers with the object of seeing whether a title to the property sold is deduced according to the contract, and what evidence, information or objection, in respect of matters appearing or arising upon the abstract, ought to be called for or taken. For this purpose it is necessary to consider the legal effect of the abstracted instruments, whether they have been properly completed, whether incumbrances, adverse interests, defects, liabilities in respect of duties, or any other burdens or restrictions disclosed by the abstract, have been already got rid of or satisfied, or remain to be dealt with before the completion of the sale. The result of the consideration of these matters is embodied in “requisitions upon title,” which are delivered to the vendor’s solicitors within a time usually fixed for the purpose by the contract. In making or insisting upon requisitions regard

**Contracts for sale.**

**Abstract of title.**

**Requisitions.**

is had, among other things, to any special conditions in the contract dealing with points as to which evidence or objection might otherwise have been required or taken, and to a variety of provisions contained in the Vendor and Purchaser Act 1874, and the Conveyancing Act 1881, which apply, except so far as otherwise agreed, and of which the following are the most important: (1) Recitals, statements and descriptions of facts, matters and parties contained in instruments twenty years old at the date of the contract are, unless proved inaccurate, to be taken as sufficient evidence of the truth of such facts, matters and descriptions; (2) a purchaser cannot require the production of, or make any requisition or objection in respect of, any document dated before the commencement of the title; (3) the cost of obtaining evidence and information not in the vendor's possession must be borne by the purchaser. The possibility of the rescission clause now commonly found in contracts for the sale of real estate being exercised in order to avoid compliance with an onerous requisition, is also an important factor in the situation. The requisitions are in due course replied to, and further requisitions may arise out of the answers. A summary method of obtaining a judicial determination of questions connected with the contract, but not affecting its validity, is provided by the Vendor and Purchaser Act 1874. Before completion it is usual for the purchaser to cause searches to be made in various official registers for matters required to be entered therein, such as judgments, land charges, and pending actions, which may affect the vendor's title to sell, or amount to an incumbrance upon the property.

When the title has been approved, or so soon as it appears reasonably certain that it will be accepted, the draft conveyance is prepared and submitted to the vendor. This is commonly done by and at the expense of the purchaser, who is entitled to determine the form of the conveyance, provided that the vendor is not thereby prejudiced, or put to additional expense. The common mode of conveying a freehold is now, as already mentioned, by ordinary deed, called in this case an *indenture*, from the old practice, where a deed was made between two or more parties, of writing copies upon the same parchment and then dividing it by an indented or toothed line. Indenting is, however, not necessary, and in modern practice is disused. A deed derives its efficacy from its being sealed and delivered. It is still a matter of doubt whether signing is essential. It is not necessary that its execution should be attested except in special circumstances, as, *e.g.* where made under a power requiring the instrument exercising it to be attested. But in practice conveyances are not only sealed, but also signed, and attested by one or two witnesses. The details of a conveyance in any particular case depend upon the subject-matter and terms of the sale, and the state of the title as appearing by the abstract. The framework, however, of an ordinary purchase-deed consists of (1) the date and parties, (2) the recitals, (3) the testatum or witnessing-part, containing the statement of the consideration for the sale, the words incorporating covenants for title and the operative words, (4) the parcels or description of the property, (5) the habendum, showing the estate or interest to be taken by the purchaser, and (6) any provisos or covenants that may be required. A few words will illustrate the object and effect of these component parts.

(1) The parties are the persons from whom the property, or some estate or interest in or in relation to it, is to pass to the purchaser, or whose concurrence is rendered necessary by the state of the title in order to give the purchaser the full benefit of his contract and to complete it according to law. It is often necessary that other persons besides the actual vendor should join in the conveyance, *e.g.* a mortgagee who is to be paid off and convey his estate, a trustee of an outstanding legal estate, a person entitled to some charge or restriction who is to release it, or trustees who are to receive the purchase-money where a limited owner is selling under a power (*e.g.* a tenant for life under the power given by the Settled Land Act 1882). Parties are described by their names, addresses and occupations or titles, each person with a separate interest, or filling a distinct character, being of a separate part. (2) The recitals explain the circumstances of the title, the interests of the parties in relation to the property, and the agreement or object intended to be carried into effect by the conveyance. Where the sale is by an absolute owner there is no need for recitals, and they are frequently dispensed with; but where there are several parties occupying different positions, recitals in chronological order of the instruments and facts giving rise to their connexion with the property are generally necessary in order to make the deed intelligible. (3) It is usual to mention the consideration. Where it consists of money the statement of its payment is followed by an acknowledgment, in a parenthesis, of its receipt, which, in deeds executed since the Conveyancing Act 1881, dispenses with any endorsed or further receipt. A vendor, who is the absolute beneficial owner, now conveys expressly "as beneficial owner," which words, by virtue of the Conveyancing Act 1881, imply covenants by him with the purchaser that he has a right to convey, for quiet enjoyment, freedom from

incumbrances, and for further assurance—limited, however, to the acts and defaults of the covenantor and those through whom he derives his title otherwise than by purchase for value. A trustee or an incumbrancer joining in the deed conveys “as trustee” or “as mortgagee,” by which words covenants are implied that the covenantor individually has not done or suffered anything to incumber the property, or prevent him from conveying as expressed. As to the operative words, any expression showing an intention to pass the estate is effectual. Since the Conveyancing Act 1881, “convey” has become as common as “grant,” which was formerly used. (4) The property may be described either in the body of the deed or in a schedule, or compendiously in the one and in detail in the other. In any case it is usual to annex a plan. Different kinds of property have their appropriate technical words of description. *Hereditaments* is the most comprehensive term, and is generally used either alone or in conjunction with other words more specifically descriptive of the property conveyed. (5) The habendum begins with the words “to hold,” and the estate, on a sale in fee-simple, is limited, as already mentioned, not only *to*, but also *to the use of*, the purchaser. Before the Conveyancing Act 1881, it was necessary to add, after the name of the purchaser, the words “and his heirs,” or “his heir and assigns,” though the word “assigns” never had any conveyancing force. But since that Act it is sufficient to add “in fee-simple” without using the word “heirs.” Unless, however, one or other of these additions is made, the purchaser will even now get only an estate for his life. If the property is to be held subject to a lease or incumbrance, or is released by the deed from an incumbrance previously existing, this is expressed after the words of limitation. (6) Where any special covenants or provisions have been stipulated for, or are required in the circumstances of the title, they are, as a rule, inserted at the end of the conveyance. In simple cases none are needed. Where, however, a vendor retains documents of title, which he is entitled to do where he sells a part only of the estate to which they relate, it is the practice for him by the conveyance to acknowledge the right of the purchaser to production and delivery of copies of such of them as are not instruments of record like wills or orders of court, and to undertake for their safe custody. This acknowledgment and undertaking supply the place of the lengthy covenants to the like effect which were usual before the Conveyancing Act 1881. A trustee or mortgagee joining gives an acknowledgment as to documents retained by him, but not an undertaking. The foregoing outline of a conveyance will be illustrated by the following specimen of a simple purchase-deed of part of an estate belonging to an absolute owner in fee:—

THIS INDENTURE made the            day of            between A. B. of, &c., of the one part and C. D. of, &c., of the other part WHEREAS the said A. B. is seised (among other hereditaments) of the messuage hereinafter described and hereby conveyed for an estate in fee simple in possession free from incumbrances and has agreed to sell the same to the said C. D. for £100 NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of £100 paid to the said A. B. by the said C. D. (the receipt whereof the said A. B. doth hereby acknowledge) the said A. B. as beneficial owner doth hereby convey unto the said C. D. ALL THAT messuage or tenement situate &c., and known as, &c. TO HOLD the premises unto and to the use of the said C. D. his heirs and assigns [*or in fee simple*] And the said A. B. doth hereby acknowledge the right of the said C. D. to production and delivery of copies of the following documents of title [*mentioning them*] and doth undertake for the safe custody thereof IN WITNESS, &c.

It will be observed that throughout the deed there are no stops, the commencement of the several parts being indicated by capital letters. The draft conveyance having been approved on behalf of the vendor, it is engrossed upon stout paper or parchment, and there remains only the completion of the sale, which usually takes place at the office of the vendor’s solicitor. A purchaser is not entitled to require the vendor to attend personally and execute the conveyance in his presence or that of his solicitor. The practice is for the deed to be previously executed by the vendor and delivered to his solicitor, and for the solicitor to receive the purchase-money on his client’s behalf, since a purchaser is, under the Conveyancing Act 1881, safe in paying the purchase-money to a solicitor producing a deed so executed, when it contains the usual acknowledgment by the vendor of the receipt of the money. Upon the completion, the documents of title are handed over except in the case above referred to, and any claims between the parties in respect of interest upon the purchase-money, apportioned outgoings, or otherwise, are settled. The conveyance is, of course, delivered to the purchaser, upon whom rests the obligation of affixing the proper stamp—which he may do without penalty within thirty days after execution (Stamp Act 1891). It may be added that, subject to any special bargain, which is rarely made, the costs of the execution by the vendor and other parties whose concurrence is necessary, and of any act required to be done by the vendor to carry out his contract, are borne by the vendor.

Ordinary leases at rack-rents are not generally preceded by a formal agreement, such as is common on a sale of land, or by an investigation into the lessor's title. As a rule, the principal terms are arranged between the parties, and embodied with various ancillary provisions in a draft lease, which is prepared by the lessor's advisers and submitted to the lessee, the ultimate form and contents of the instrument being adjusted by negotiation. If an intending lessee desires to examine the title he must make an express bargain to that effect, for under a contract to grant a lease the intended lessee is not entitled, in the absence of such express stipulation, to call for the title to the freehold (Vendor and Purchaser Act 1874). By the Statute of Frauds all leases, except leases for a term not exceeding three years, and at not less than two-thirds of the rack-rent, were required to be in writing. And now by the Real Property Act 1845, leases required by law to be in writing are void *at law* unless made by deed. An instrument, void as a lease under the act, may, however, be valid as an agreement to take a lease; and since the Judicature Act 1873, under which equitable doctrines prevail in the High Court, a person holding under an agreement for a lease, of which specific performance would be granted, is treated in all branches of that court as if such a lease were already executed. Unless otherwise agreed, a lease is always prepared by a lessor's solicitor at the expense of the lessee; but the cost of the counterpart (*i.e.* the duplicate executed by the lessee) is usually borne by the lessor.

Upon the sale and conveyance of a leasehold property substantially the same procedure is observed as above indicated in the case of a freehold. A few additional points, however, may be specially mentioned. Under an open contract the vendor cannot be called upon to show the title to the freehold reversion (Vendor and Purchaser Act 1874; Conveyancing Act 1881). Accordingly, the abstract of title begins with the lease, however old; but the subsequent title need not be carried back for more than forty years before the sale. The purchaser, apart from stipulation, must assume, unless the contrary appears, that the lease was duly granted, and upon production of the receipt for the last payment due for rent before completion, that all the covenants and provisions of the lease have been duly performed and observed up to the date of actual completion. The appropriate word of conveyance is "assign," and a conveyance of leaseholds is generally called an assignment. The vendor's covenants for title implied by his assigning "as beneficial owner" include, in addition to the covenants implied by those words in a conveyance of freehold, a covenant limited in manner above mentioned, that the lease is valid, and that the rent and the provisions of the lease have been paid and observed up to the time of conveyance (Conveyancing Act 1881). Where the vendor, as is the common case, remains liable after the assignment for the rent and the performance of the covenants, the purchaser must covenant to pay the rent, and perform and observe the covenants and provisions of the lease, and keep the vendor indemnified in those respects.

A mortgage is prepared by the solicitor of the mortgagee, and the mortgagor bears the whole expenses of the transaction. It is seldom that there is any preliminary agreement, because (1) a contract to lend money is not specifically enforceable; and (2) inasmuch as the primary object of a mortgagee is to have his money well secured, he is not, generally, willing to submit to restrictions as to title or evidence of title which might give rise to difficulty or expense in the event of a sale of the mortgaged property. An intending mortgagor is accordingly required to show a title easily marketable, and to verify it at his own cost. A mortgage follows the same general form as a conveyance on sale, the principal points of difference being that the conveyance of the property is preceded by a covenant for the payment of the mortgage money and interest, and followed by a proviso for reconveyance upon such payment, and by any special provisions necessary or proper in the circumstances, such as a covenant for insurance and repairs where the security comprises buildings. The covenants for title implied by a mortgagor conveying "as beneficial owner" are the same as in the case of a vendor, but they are absolute and not qualified in the manner above pointed out.

The beneficial operation of the Conveyancing Act 1881 in shortening conveyances is well illustrated by a modern mortgage. For, by virtue of the act, a mortgagee by deed executed after its commencement has, subject to any contrary provisions contained in the deed, the following powers to the like extent as if they had been conferred in terms: (1) a power of sale exercisable after the mortgage money has become due (a) if notice requiring payment has been served and not complied with for three months, (b) if any interest is in arrear for two months, or (c) there has been a breach of some obligation under the deed or the act other than the covenant for payment of the mortgage money or interest; (2) a power to insure subject to certain restrictions; (3) a power, when entitled to sell, to appoint a receiver; and (4) a power while in possession to cut and sell timber. The act contains ancillary provisions

enabling a mortgagee upon a sale to convey the property for such estate or interest as is the subject of the mortgage, and to give a valid receipt for the purchase-money, and the purchaser is amply protected against any irregularities of which he had no notice. There are also large powers of leasing conferred by the act upon mortgagor and mortgagee while respectively in possession, and a power for the mortgagor, whilst entitled to redeem, to inspect and take copies of title-deeds in the mortgagee's possession. The elaborate provisions for all these purposes which were formerly inserted in mortgage deeds are now omitted; but sometimes the operation of the act is modified in certain respects. The procedure upon a sale by a mortgagee is the same as in the case of any other vendor. He conveys, however, "as mortgagee," these words implying only a covenant by him against incumbrances arising from his own acts.

The frame of a strict settlement of real estate, which is usually made either on marriage or by way of resettlement on a tenant in tail under an existing settlement attaining twenty-one, has been much simplified; but such settlements still remain the most **Settlements.** technical and most complicated of legal instruments. By virtue of the Settled Land Acts 1882 to 1890, tenants for life and many other limited owners have extensive powers of sale, of leasing, and of doing numerous other acts required in a due course of management. These powers cannot be excluded or fettered by settlors. They are, as a rule, considered in practice to be sufficient, and the corresponding elaborate provisions formerly inserted in settlements are now omitted, the operation of the acts being merely supplemented, where desirable, by some extension of the statutory powers, in relation, *e.g.*, to the investment and application of capital money. To complete the statutory machinery it is desirable that persons should be nominated by the settlement trustees for the purposes of the acts. Since the Conveyancing Act 1881, provisions for the protection of jointresses or persons entitled under settlements to rent charges or annual sums issuing out of the land are no longer required, as all such persons have now powers of distress and entry, and of limiting terms to secure their respective interests. Terms for raising portions must still, however, be expressly created. The Conveyancing Act 1881 also confers large powers of management during the minorities of infants beneficially entitled upon persons either appointed for the purpose by the instrument or being such trustees such as are mentioned in § 42. An estate in tail may now be limited by the use of the words "in tail" without the words "heirs of the body" formerly necessary. And a settlor generally conveys "as settlor," by which only a covenant for further assurance is implied under the Conveyancing Act 1881. Personal settlements are most often made upon marriage. The settled property is vested in trustees, either by the settlement itself, or in the case of cash, mortgage debts, stocks or shares, by previous delivery or transfer, upon trusts declared by the instrument.

The normal trusts after the marriage are (1) for investment; (2) for payment of the income of the husband's property to him for life, and of the wife's property to her for life for her separate use without power of anticipation whilst under coverture; (3) for payment to the survivor for his or her life of the income of both properties; (4) after the death of the survivor, both as to capital and income, for the issue of the marriage as the husband and wife shall jointly by deed appoint, and in default of joint appointment as the survivor shall by deed or will appoint, and in default of such appointment for the children of the marriage who attain twenty-one, or being daughters marry, in equal shares, with the addition of a clause (called the hotchpot clause) precluding a child who or whose issue takes a part of the fund by appointment from sharing in the unappointed part without bringing the appointed share into account. Then follows a power for the trustees with the consent of the parents whilst respectively living to raise a part (usually a half) of the share of a child and apply it for his or her advancement or benefit. Power to apply income, after the death of the life tenants, for the maintenance and education of infants entitled in expectancy, is conferred upon trustees by the Conveyancing Act 1881. The ultimate trusts in the event of there being no children who attain vested interests are (1) of the husband's property for him absolutely; and (2) of the wife's property for such persons as she shall when discover by deed, or whether covert or discover by will, appoint, and in default of appointment, for her absolutely if she survive the husband, but if not, then for her next of kin under the Statute of Distributions, excluding the husband. For all ordinary purposes the trustees have now under various statutes sufficient powers and indemnities. They may, however, in some cases need special protection against liability. A power of appointing new trustees is supplied by the Trustee Act 1893. It is usually made exercisable by the husband and wife during their joint lives, and by the survivor during his or her life.

The form and contents of wills are extremely diverse. A will of, perhaps, the commonest type (a) appoints executors and trustees; (b) makes a specific disposition of a freehold or leasehold residence; (c) gives a few legacies or annuities; and (d) devises and bequeaths to

**Wills.** the executors and trustees the residue of the real and personal estate upon trust to sell and convert, to invest the proceeds (after payment of debts and funeral and testamentary expenses) in a specified manner, to pay the income of the investments to the testator's widow for life or until another marriage, and subject to her interest, to hold the capital and income in trust for his children who attain twenty-one, or being daughters marry, in equal shares, with a power of advancement. Daughters' shares are frequently settled by testators upon them and their issue on the same lines and with the same statutory incidents as above mentioned in the observations upon settlements; and sometimes a will contains in like manner a strict settlement of real estate. It is a point often overlooked by testators desirous of benefiting remote descendants that future interests in property must, under what is known as the rule against perpetuities, be restricted within a life or lives in being and twenty-one years afterwards. In disposing of real estate "devise" is the appropriate word of conveyance, and of personal estate "bequeath." But neither word is at all necessary. "I leave all I have to A. B. and appoint him my executor" would make an effectual will for a testator who wished to give all his property, whether real or personal, after payment of his debts, to a single person. By virtue of the Land Transfer Act 1897, Part I., real estate of an owner dying after 1897 now vests for administrative purposes in his executors or administrators, notwithstanding any testamentary disposition.

It remains to mention that by the Land Transfer Act 1897 a system of compulsory registration of title, limited to the county of London, was established. (See [LAND REGISTRATION](#).)

*Conveyancing counsel to the court* (i.e. to the chancery division of the High Court) are certain counsel, in actual practice as conveyancers, of not less than ten years' standing, who are appointed by the lord chancellor, to the number of six, under s. 40 of the Master in Chancery Abolition Act 1852. They are appointed for the purpose of assisting the court in the investigation of the title to any estate, and upon their opinion the court or any judge thereof may act. Any party who objects to the opinion given by any conveyancing counsel may have the point in dispute disposed of by the judge at chambers or in court. Business to be referred to conveyancing counsel is distributed among them in rotation, and their fees are regulated by the taxing officers.

*United States.*—American legislation favours the general policy of registering all documents in the contents of which the public have an interest, and its tendency has been steadily towards more and more full registration both of documents and statistics. From the early days of the colonial era it has been customary to record wills and conveyances of real estate in full in public books, suitably indexed, to which free access was given. During the last decade of the 19th century, three states—Illinois, Massachusetts, and Ohio—adopted the main features of the Torrens or Prussian system for registering title to land rather than conveyances under which title may be claimed. These are the ascertainment by public officers of the state of the title to some or all of the parcels of real estate which are the subject of individual property within the state; the description of each parcel (giving its proper boundaries and characteristics) on a separate page of a public register, and of the manner in which the title is vested; the issue of a certificate to the owner that he is the owner; the official notation on this register of each change of title thereafter; and a warranty by the government of the title to which it may have certified. To make the system complete it is further requisite that every landowner should be compelled to make use of it, and that it should be impossible to transfer a title effectually without the issue of such a government certificate in favour of the purchaser.

Constitutional provisions have been found to prevent or embarrass legislation in these directions in some of the states, but it is believed that they are nowhere such as cannot be obeyed without any serious encroachment on the principles of the new system (*People v. Chase*, 165 Illinois Reports, 527; *State v. Guilbert*, 56 Ohio State Reports, 575; *People v. Simon*, 176 Illinois Reports, 165; *Tyler v. Judges*, 173 Massachusetts Reports; 55 North-Eastern Reporter, 812; *Hamilton v. Brown*, 161 United States Reports, 256).

Conveyances which have been duly recorded become of comparatively little importance in the United States. The party claiming immediately under them, if forced to sue to vindicate his title, must produce them or account for their loss; but any one deriving title from him can procure a certified copy of the original conveyance from the recording officer and rely on that. Equitable mortgages by a deposit of title-deeds are unknown.

The general prevalence of public registry systems has had an influence in the development of American jurisprudence in the direction of supporting provisions in wills and conveyances, which, unless generally known, might tend to mislead and deceive, such as spendthrift trusts (*Nichols v. Eaton*, 91 United States Reports, 716).

Conveyances of real estate are simple in form, and are often prepared by those who have had no professional training for the purpose. Printed blanks, sold at the law-stationers, are commonly employed. The lawyers in each state have devised forms for such blanks, sometimes peculiar in some points to the particular state, and sometimes copied verbatim from those in use elsewhere. Deeds intended to convey an absolute estate are generally either of the form known as *warranty deed* or of that known as *release deed*. The release deed is often used as a primary conveyance without warranty to one who has no prior interest in the land. Uniformity in deeds is rendered particularly desirable from the general prevalence of the system of recording all conveyances at length in a public office. Record books are printed for this purpose, containing printed pages corresponding to the printed blanks in use in the particular state, and the recording officer simply has to fill up each page as the deed of similar form was filled up. One set of books may thus be kept for recording warranty deeds, another for recording release deeds, another for recording mortgage deeds, another for leases, &c.

AUTHORITIES.—Davidson, *Precedents and Forms in Conveyancing* (London, 1877 and 1885); Key and Elphinstone, *Compendium of Precedents in Conveyancing* (London, 1904); Elphinstone, *Introduction to Conveyancing* (London, 1900); Prideaux, *Precedents in Conveyancing* (1904); Pollock, *The Land Laws* (London, 1896).

(S. WA.; S. E. B.)

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**CONVEYORS.** “Conveyor” (for derivation see [CONVEYANCE](#)) is a term generally applied to mechanical devices designed for the purpose of moving material in a horizontal or slightly inclined direction; in this article, however, are included a variety of appliances for moving materials in horizontal, vertical and combined horizontal and vertical directions. The material so handled may be conveyed in a practically uninterrupted stream, as in the case of worms, bands and pushplate conveyors, or elevators carrying grain or coal, &c.; or it may be conveyed from one point to another, intermittently, that is to say in a succession of separate loads, as happens with single bucket elevators, furnace hoists, rope and chain haulage, and also in the case of ropeways and aerial cableways. Some of these devices are of great antiquity, others are of quite modern origin. The principles of their construction are simple and easy of understanding, but by variations in the details of their construction the engineer has adapted these few appliances to the most varied work. At one end of the scale they may be used for such light duties as conveying the goods purchased by a customer to the packers and bringing them back made up into a parcel or for taking his money to the cashier and returning the change. At the other they are adopted for handling large quantities of heavy material at a minimum expenditure of human labour. Coal, for instance, a more or less friable substance, the value of which is seriously diminished by fracture, may be mechanically handled with a minimum risk of breakage. The difficult problem of handling the contents of gas retorts and coke ovens, and of simultaneously quenching and conveying the glowing material, has been solved. Perhaps an even more astonishing piece of work is the manipulation of the iron from the blast furnace; for instance, liquid metal is drawn from a furnace into pouring pots which in their turn discharge it to and distribute it over a pig-iron casting machine, which is practically a conveyor for liquid metal, consisting of a strand of moving moulds from which the solidified pigs, after cooling in water, are automatically removed after reaching the loading terminal over the railway trucks. Certain types of conveyors may be made to combine efficiently, with their primary work of transport, complex sorting, sifting, drying and weighing operations.

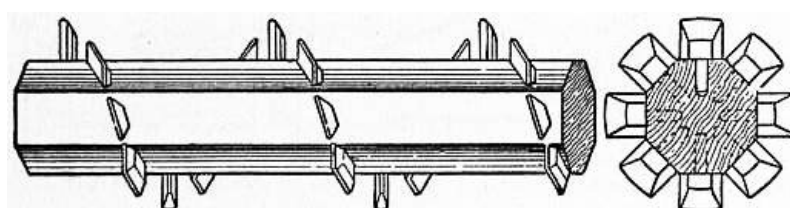


FIG. 1.—Early Flour Mill Conveyor.<sup>1</sup>

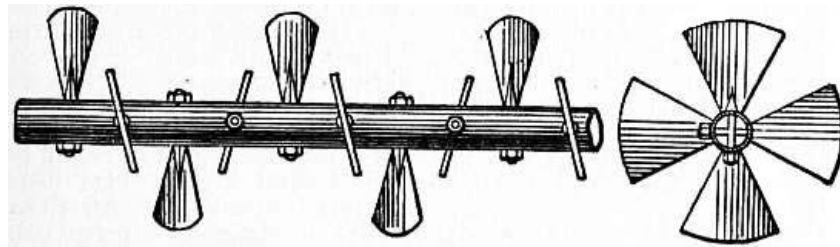


FIG. 2.—Paddle Worm Conveyor.

*Worm Conveyors.*—The worm conveyor, also known as the Archimedean screw, is doubtless the most ancient form of conveyor. It consists of a continuous or broken blade screw set on a spindle. This spindle is made to revolve in a suitable trough, and as it revolves any material put in is propelled by the screw from one end of the trough to the other. Such conveyors have been used in flour-mills for centuries. The writer has seen in an East Anglian mill which was over 250 years old disused screw conveyors, probably as old as the mill, consisting of spindles of octagonal shape, made of not too hard wood, around which a broken blade screw was formed by the insertion at regular intervals of small blades of hard wood (fig. 1). Modern worm conveyors usually consist of a spindle formed of a length of wrought iron piping, to which is fitted either a broken or continuous worm. In the former case (fig. 2) the worm is composed of a series of blades or paddles arranged like a spiral round the spindle; each blade is fixed, by means of its shank, in a transverse hole in the spindle, and the shank is held in position by being tapped and fitted with a nut. In this way is formed, out of separate blades, a practically complete screw, technically known as a "paddle worm." The lengths or sections of the worm run to about 8 ft., the various lengths being coupled by turned gudgeons, which also serve as journals for the bearings. In the so-called continuous worm conveyors the screw is formed of a continuous sheet-iron spiral (fig. 3). Sometimes a narrow groove is cut in spiral form on the spindle, and in this groove the sheet-iron spiral is secured.

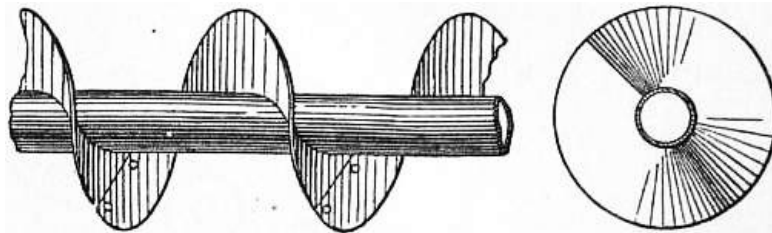


FIG. 3.—Continuous Worm Conveyor.

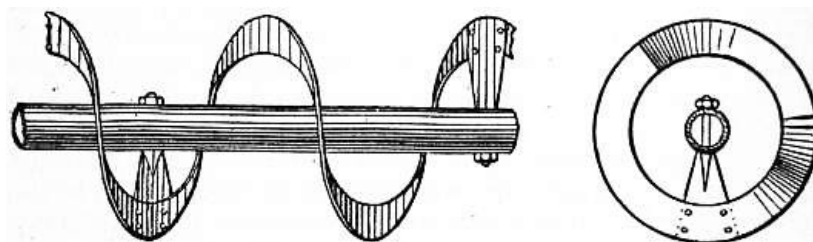


FIG. 4.—Spiral or Anti-Friction Conveyor.

The *spiral* or *anti-friction* conveyor (fig. 4) was introduced about 1887. In this case a narrow spiral, which passes concentrically round the spindle, with a space between both, is fixed to it at set intervals by small blades, each of which is itself fixed by its shank and a nut to the spindle. The spiral may be made of almost any section, from a round bar about  $\frac{1}{2}$  in. in diameter to L or T section, but is preferably a flat bar. Worms are fitted into wooden or iron troughs leaving a clearance of  $\frac{1}{8}$  to  $\frac{1}{4}$  in. The spindle must be supported at suitable intervals by bearings, preferably of the bush type. A continuous worm, being more rigid than a paddle worm, needs fewer supports. The lid of the worm trough should be loose, not screwed on, because in case of an accumulation of feed through a choke in a delivery spout the paddles of a paddle worm would be broken, or a continuous worm stripped, unless the material could throw off the lid and relieve the worm. The ratios of the pitch of the worm to the diameter must be regulated by the nature of the material to be conveyed, and will vary from one-third to a pitch equal to, or even exceeding, the diameter. The greater the pitch the larger the capacity, but also the greater the driving power required, at the same speed. For handling materials of greater specific gravity, such as cement, &c., it is advisable to use



a smaller pitch than for substances of lower specific gravity, such as grain. The capacity of a continuous worm exceeds that of either a paddle or spiral conveyor of the same diameter, pitch and speed. As regards the relative efficiency of paddle and spiral conveyors a series of careful tests made by the writer indicated that, run at a slow speed the paddle worm, but at a high speed the spiral worm, has the greater efficiency. There is of course a speed at which the efficiency of both types is about equal, and that is at 150 revolutions per minute for conveyors 4 to 6 in. in diameter.

The power necessary to drive worm conveyors under normal conditions is very considerable; a continuous worm of 18 to 20 in. diameter running at 60 revolutions per minute will convey 50 tons of grain per hour over a distance of a hundred feet at an expenditure of 18½ to 19 H.P. A material like cement would require rather more power because of the greater friction of the cement against the blades and the trough. Delivery from a worm conveyor can be effected at any desired point, all that is necessary being to cut an outlet, which should preferably be as wide as the diameter of the worm, because the worm delivers only on its leading side, and is practically empty on the other side, so that a smaller outlet might only give exit to a portion of the feed, unless it was on the leading side.

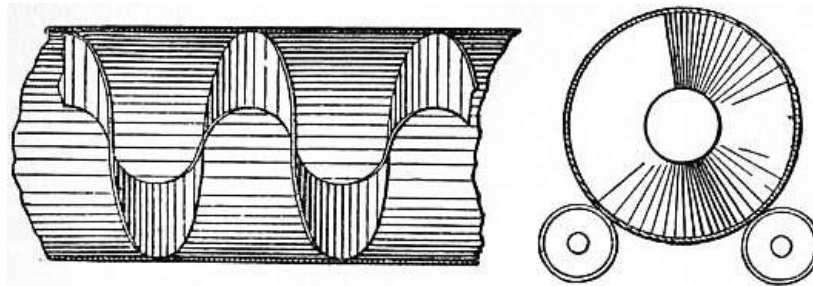


FIG. 5.—Tubular Worm Conveyor.

A special form of worm conveyor is the *tubular* (fig. 5), which consists of an iron tube with a continuous spiral fitted to its inner periphery, or of iron or wooden tubes of square sections fitted with fixed baffle plates inside. In working it revolves bodily on suitable rollers. This type is more costly than the ordinary worm conveyors, and also requires more power. Its efficiency is, moreover, easily impaired if run at too high a speed, because the centrifugal force asserts itself and counteracts the propulsion, which in this case is effected by gravity. Some experiments made in 1868 by George Fosbery Lyster, engineer of the Liverpool docks, gave convincing results (see *Proc. Inst. Mech. Eng.*, August 1869). The tubular worm conveyor is suitable where a granular material has to be moved over a comparatively short distance, say from one building to another on the same level, and where no bridge is available for the installation of any other kind of conveyor. Conveyors of this type have, however, come into use for conveying hard and cutting substances over considerable lengths. Ordinary worm conveyors are practically debarred from use for such substances on account of the short life of the intermediate bearings, which are not necessary with externally supported tubular worms.

To sum up, worm conveyors are of the simplest construction and of small prime cost. The terminals again are much less expensive than those of most other kinds of conveyors. When the distance to be traversed by the material is short, the worm conveyor has this advantage, that it is cheaper than other kinds of conveyors. If it be desired not only to convey but also to mix two or more materials, such as cement and sand in a dry state, or poultry food, this appliance is thoroughly well adapted for the work. On the other hand, there is a grinding action exercised on any material conveyed, and when hard or cutting substances are handled the wear and tear on the conveyor blades, trough and bearings is very great, and the power absorbed by a worm conveyor is a sensible item.

*Band Conveyors.*—The inventor of band conveyors for the handling of grain and minerals was G. F. Lyster, who, as already mentioned, in 1868 carried out exhaustive experiments at the Liverpool docks, where he established the band conveyor as a grain-handler. For granaries the band conveyor is an ideal appliance. Its capacity is great, and it can be run at relatively high speeds with a moderate expenditure of power. The band conveyor of to-day is an endless belt of canvas or more often india-rubber with insertion, and when fitted with the usual receiving and delivery appliances can be used to handle grain from or into granaries and also to feed bins or sections of a warehouse. The endless bands run over terminal pulleys, and are also supported on their way by a series of guide rollers, which are in greater number on the loaded than on the empty strand. The band is usually run quite flat,

except that at the point or points where the grain is fed on it is slightly hollowed for a few feet, by means of two curving rolls which are set obliquely so as to make it trough-shaped. The supporting or guide rollers are 4 in. to 6 in. in diameter, and are sometimes made of wood, but more often consist of steel tubes to which spindles with conical end gudgeons are secured. The gudgeons generally run in suitable bush-bearings, which should be well lubricated. Band conveyors should be driven on the delivery and not the receiving terminal, as the tight side of the band is the flattest. The guide rollers, for ordinary grain conveyors, are fitted to the upper or working side of the band at intervals of about 6 ft., and at distances of 12 ft. on the lower or return strand. In cases where both strands of the band are used for carrying grain, the lower strand must be supported by as many rollers as the upper. Under such conditions, terminal pulleys must be of larger diameter than usual, the object being to throw the two strands farther apart, so as to give sufficient space between the two strands to spout the feed in and out again at the other end. The two strands can be run any distance apart by the use of two additional pulleys for the terminals. This arrangement would be in place where it was desired, as it might be, to run one strand of the band along the top floor of the granary to distribute, while the other strand travelled along the ground-floor or basement to withdraw, the grain.

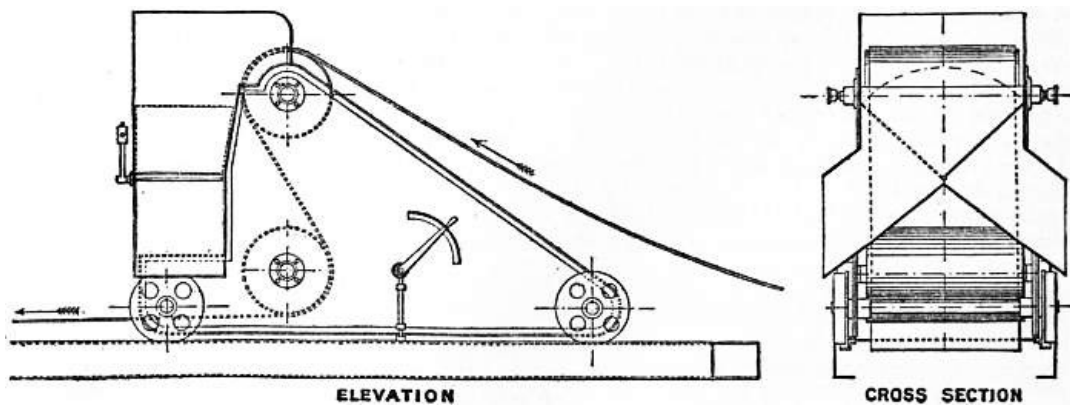
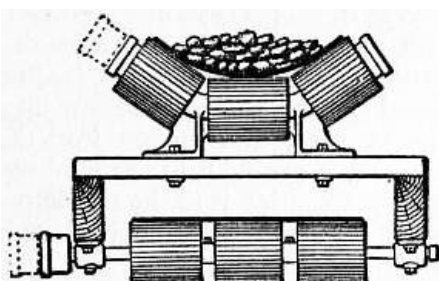


FIG. 6.—Throw-off Carriage for Band Conveyor.

Band conveyors are kept tight, when the band is not very long, by a tightening gear, similar to that used on elevators, and consisting of two screws which push or better pull the two pedestals of one terminal pulley farther away from the other terminal. If the band is of such length that an adjustment of 4 to 5 ft. on the tightening gear is not sufficient, it is advisable to use in place of screws a tightening pulley, over which the belt passes, but which is itself held in tension by weights. The choice of the exact tightening gear will depend on various considerations, the length of the belt, the type of throw-off carriage used, and the quality of the belt all being factors to be considered. The throw-off carriage (fig. 6), which serves to withdraw material from the band at any desired point, is a simple but ingenious appliance consisting essentially of guide pulleys which by raising one part of the band and lowering the other have the effect of causing the grain to quit the surface of the band at the point where it is deflected upwards. The grain is thus cast clear of the band, and into the air, being caught as it falls in a hopper and spouted in any desired direction. Throw-off carriages differ in certain details, but the principle is the same. For feeding a band conveyor it is important to give the material a horizontal velocity, approaching that of the band. The grain should therefore be fed through a spout rather less in breadth than half of the width of the band, and set at an incline of  $42\frac{1}{2}^\circ$  to the horizontal. Band conveyors run at a speed of 400 to 600 ft. per minute, according to the nature of the material; oats, for instance, would be liable to be blown off the band at a speed in excess of 500, which would be suitable for wheat. Nuts, maize and the heavier seeds could be carried at 600. The power consumption by a grain-laden band compares favourably with any other form of conveyor. An 18-in. band 100 ft. in length running 500 ft. per minute would carry 50 tons per hour at an expenditure of only 4.5 H.P.



While the band conveyor is an ideal conveyor in warehouses and mills, it is also capable of rendering good service in handling such heavy materials as coal and minerals. Of course for such purposes the band and its fittings must be of much more substantial construction. The central portions of the band carrying the load, being subjected to great wear and tear, are often made of solid india-rubber extending to nearly half the

thickness of the band in the middle, and tapering off towards the edges, while the surface facing the guide rollers is of insertion coated with india-rubber. Bands properly prepared and stretched will bear a strain of 3 tons to the square inch. Balata bands may be used in place of india-rubber, but though less expensive are not so lasting. Bands that have to carry coal or minerals are usually curved along the entire length of the upper or loaded strand into a trough shape by guide rollers (fig. 7). Bands of woven wire are sometimes used with coal-washing plants, but have the disadvantage of lack of durability. They are more liable to stretch and are high in price. They may be run as high as about 600 ft. per minute, but to ensure proper grip-driving terminals must either be faced with leather or made of wood.

The speed of band conveyors loaded with coal or minerals greatly depends on the size of the fragments; the proper speed for large pieces would be 150-200 ft. per minute, while smaller material could be carried at a maximum velocity of 700-750 ft. Band conveyors will carry in an upward direction, up to 24 degrees, without any loss of capacity. They can be used not only to carry light and heavy bodies, such as grain and coal, in a continuous stream, but also to convey relatively large bodies such as sacks of flour, or cement, &c., intermittently. Thus a band 26 in. wide and 350 ft. long is used at a flour-mill in York to load sacks of flour into railway trucks; by this means 12 wagons can be loaded by two men in 1 hour. Band conveyors are not necessarily fixed in one place. A portable model has rendered good service in tunnel-cutting, mining and quarrying. This band is mounted in a light steel frame, itself fitted with small wheels, so as to be readily put in any required position, and is entirely self-contained, being provided with tightening gear, a small motor, &c. If required, several lengths can be joined together, or one band can deliver upon another at a lower level. The same advantages that attend the use of the band-conveyor for handling grain may be claimed for this appliance when carrying coal and heavy bodies, namely the demand for relatively small power, smooth and noiseless work, and gentle handling of material. On the other hand the feed cannot be withdrawn at intermediate points except by means of a throw-off carriage. The numerous bearings of the guide rollers require careful lubrication, and the rubber bands should be protected as much as possible from changes of temperature.

The *metal band* or belt conveyor, a modification of the rubber or canvas band conveyors, is an endless belt composed of iron plates connected to endless chains, usually of malleable cast iron, running under the plates. Such appliances, being obviously more cumbrous than band conveyors, are only used in handling material of a hard and cutting nature. They usually deliver only at the end, but if intermediate delivery be desired a scraper may be so fixed across the band at a given point, at an angle of 45°, as to scrape the whole or part of the feed into a shoot, or a scraper may be mounted obliquely on a suitable carriage which can be moved to any points at which delivery may be required. In some bands of this type supporting rollers are attached to the links and travel with them, or are fixed to the framing so that the band runs over them, an arrangement which has the advantage of economizing driving power and of promoting smooth running. Metal band conveyors are tightened in the same way as textile or rubber bands, and may run at a speed of 60 to 120 ft. per minute. The driving gear must always be placed at the delivery terminal, so that the loaded strand is in tension. Such appliances are often used as sorting tables or picking bands, for instance, for coal, cement, minerals, &c.

In another modification of the metal band conveyor, the *travelling trough* conveyor, the sides of each plate are turned up so as to form the conveying surface of the band into a continuous trough. With this arrangement intermediate delivery is impossible, as the sides of the trough will not allow the use of a scraper. As compared with push-plate conveyors (which consist of scrapers mounted on endless travelling chains that run usually in troughs), travelling trough conveyors are gentle handlers of material.

A conveyor which is capable of dealing with many different kinds of material is known as the *vibrating trough* conveyor. It is so far like the band and travelling trough conveyor that the material it conveys from one point to another is conveyed without the use of any stirring or pushing agent, such as belong to worm, push-plate and cable trough conveyors. For materials requiring gentle treatment, this type of conveyor is eminently suitable. There are different kinds of vibrating trough conveyors. In one type the trough is caused to make a reciprocating motion by means of a crank and connecting rod, the trough itself being supported on rollers. In another type the trough is actuated by a cam, or by cranks with some kind of quick return motion. In the appliance known as the Zimmer or swinging conveyor the trough is supported in its reciprocating motion by means of laminated spring legs set obliquely to the trough. These legs are securely bolted at one end to the floor or any other solid support, and at the other end to the trough itself; hence no lubrication is

required, as would be the case with supporting rollers. Moreover the combined action of the reciprocating motion of the crank and the rocking of the spring legs has the effect of causing the material to travel faster in the trough with a given stroke of the crank than would be the case with any other support. The material to be conveyed is not carried along with its support as in the case of a band or travelling trough conveyor, but is caused to move in a series of hops, to use popular language.

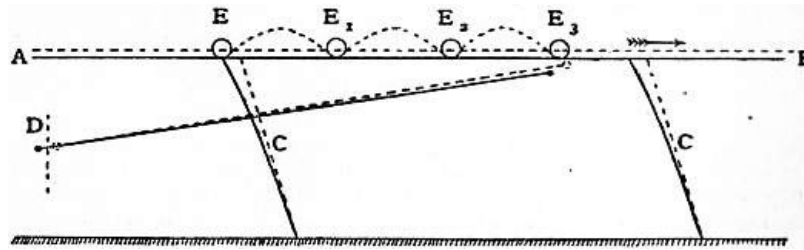


FIG. 8.—Swinging or Zimmer Conveyor.

The action will be sufficiently explained by the appended diagram (fig. 8), which, however, is exaggerated to give a clearer idea of the actual movements, which are on quite a small scale. The line AB represents the bottom of the trough, while CC are two of the spring legs; the full lines indicate the spring legs at the extreme backward position of the crank, while the dotted lines show the spring legs and bottom of the trough at the extreme forward position of the crank D. The material to be conveyed, represented by E, is thrown forward by the forward movement of the crank, and describes a short parabolic curve; it is thrown at about a right angle to the inclined legs CC, but before it has time to complete its parabolic course, the trough has been moved by the crank into its original position. As soon as the material has dropped down, the trough makes another forward movement, whereupon the material is thrown forward another stage, and this process, which is continually repeated, as indicated by the letters E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>, has the effect of carrying or conveying the material in the direction desired. It is important to note that the actual movement both of trough and material is within narrow bounds; the horizontal movement of the trough is only about 1 in., while the vertical or upward movement is about  $\frac{1}{8}$  in. The material is conveyed by this vibrating trough with a minimum of friction, as it is evident that the material is carried forward without any contact with the trough, while the very nature of the motion precludes injurious friction between the particles themselves. When the trough is full the material will move as it were in a solid mass.

An important improvement in this type of vibrating trough conveyor is the balanced conveyor, in which the trough is made in two sections, one being placed at a slightly lower level than the other, so that one-half may deliver into the other half. The two sections are driven by triple or quadruple cranks set at an angle of about 180° to one another. In this case one-half of the conveyor will move forward while the other moves backward, thus balancing each other (fig. 9). At the same time the material keeps moving in the same direction because all the spring legs are of the same inclination. It is usual to drive balanced conveyors at or near the centre of their length, but they may also be driven from one end, in which case the balancing of the conveyor would be effected by a powerful volute spring which is compressed and released by a crank and connecting rod, in place of being connected to one-half of the conveyor. Two sections of a Zimmer conveyor can be made to run in opposite directions by merely reversing the inclination of the spring legs; in such a case the sections of a trough would be connected by a flexible coupling. Conveyors of this type have been used in lengths up to 500 ft., and in widths of over 6 ft. The feed can be received or discharged at any desired point in the length; for drawing off material at intermediate points it is only necessary to open a slide in the bottom of the trough. If a great increase be desired in the capacity of this conveyor the connecting rod may be attached, not to the trough at all, but to the spring legs at a point of about a third or half-way from the base, so that the free ends of the legs can swing the trough backward and forward; by this means the stroke is amplified and consequently the capacity is increased, while the driving power required is practically the same.

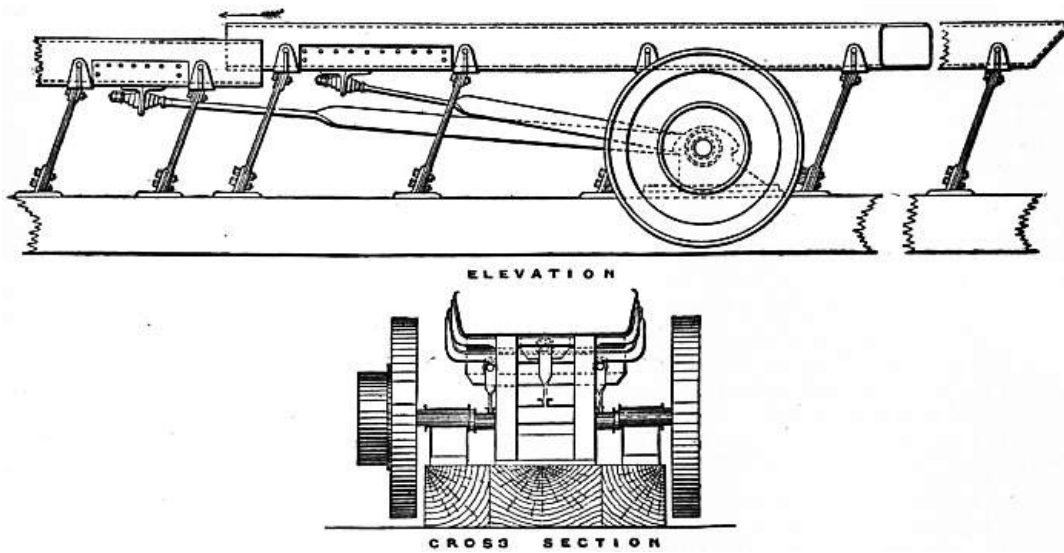


FIG. 9.

The power absorbed by the Zimmer conveyor is comparatively small; a length of 100 ft. conveying a load of 50 tons per hour takes 8.75 h.p. With a speed of 300-370 revolutions per minute of the conveyor, the material will traverse 40-70 ft. per minute. The gentle action of this appliance has caused it to be largely used in dealing with friable materials, such as coal. The simplicity of the mechanism leaves little to get out of order, and the entire absence of travelling gear, such as supporting rollers, is a valuable feature. The capacity of the conveyor may be sensibly increased by running it on a downward gradient, while the capacity will be correspondingly diminished by working in an upward direction. Among many purposes for which this type of conveyor has been found suitable is that of a drainer in connexion with coal-washing plants. A perforated plate at the head will allow the water to escape, while the coal is carried to the other end. A slight upward slant permits the water left with the coal to run back and escape. In colliery work this conveyor makes a suitable picking table. The motion of the trough, while not so fast as to baffle the pickers, has the advantage of uniformly spreading the lumps of coal. This apparatus also lends itself to the grading of coal. All that is necessary is to fit the trough with a sieve which divides it into an upper and lower deck. The coarser material passes along the top of the sieve, while the finer coal, sifted out by the perforations, travels along the bottom of the trough till discharged. In spite of the gentle propelling action of this conveyor, it has a thorough sifting action; a perforated plate from 10 to 12 ft. long is usually sufficient to separate any desired grade, and at a certain Belgian colliery a conveyor of this type fitted with grading sieves feeds seven trucks standing in a row, but each on a different siding, and each taking coal of a different size. This conveyor has been found useful both as a drying and cooling appliance. Several substances of a sticky nature, such as moist sugar, which are difficult to deal with mechanically, can be efficiently handled by the swinging conveyor.

The *gravity* or *tilting bucket* conveyor can be used as a combined elevator and conveyor. It consists essentially of two endless chains or ropes held at fixed distances apart by suitable bars which are fitted with small rollers at each end. Every link, or second link, carries a bucket, and the whole forms an endless chain of buckets. But these buckets, unlike elevator buckets, which are bolted on to a band or chain, are free to move on the axis on which they are suspended above their centre of gravity. When the conveyor is at work the buckets will always be in an upright position, whether the motion be vertical or horizontal. Each bucket carries its load to the point at which delivery is required, where an adjustable tipping device is ready to catch and tilt the bucket, thus emptying it. This type of conveyor is chiefly used in connexion with coal stores and boiler houses, where it has undeniable advantages. For instance, in feeding overhead bunkers a well-designed gravity bucket conveyor may do the work of (1) a horizontal conveyor in bringing coal from the railway siding, (2) a vertical elevator in raising it to the bunkers, and (3) a horizontal conveyor in distributing it to the respective bunkers. In some cases the returning empty strand of buckets is used to clear the ashes from under the boilers.

Conveyors of this type run at a mean rate of 40 ft. per minute, and if it be desired to attain a given capacity the size of the buckets must be adapted to the increased load as an increase of speed for a higher capacity is impracticable. The power absorbed is not great, the heaviest demand on the motive force being made by the elevating operation. Such conveyors have the merit of handling the material gently, while feeding and discharging can take place at any point. There are many journals to be looked after, but in the most approved systems their lubrication is effected automatically. Whilst such a plant has the advantage of

requiring only one driving gear, a breakdown at one point of the installation means the stoppage of the whole.

Among typical conveyors on this system is the Hunt conveyor (fig. 10), which consists of a double link carrying a series of pivoted buckets which are free to revolve on their axes at all points, except at that point at which they discharge. This operation is effected by a cam action, the buckets on their release righting themselves and becoming ready for refilling. The driving gear propels the chain by means of pawls which engage with the cross studs of the chain and have a central thrusting action. Another well-known appliance of this type is the pan bucket conveyor. This consists of a continuous trough built in sections and supported on axles and guide wheels running on suitable rails. There is one axle to each section, and in each section of the trough a bucket is pivoted to the sides. There are several other conveyors of this type, amongst which the "Tipit" should be mentioned. For the Bousse gravity conveyor it is claimed that it will go round any curve backwards or forwards in both planes, and is therefore adaptable for installations when the typical gravity bucket would be useless. The buckets of this conveyor are coupled together by a link in the middle, which obviously allows more latitude in negotiating curves than the double chain of most of the other types.

*Pneumatic Grain Elevators* have been employed with good effect in loading and unloading grain from ships. This method of conveying grain falls under three systems: (1) the blast system; (2) the suction system; and (3) the combined blast and suction system.

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In the first system a barge, known as a machinery barge, is fitted with a steam boiler, a set of air compressing engines, and a length of flexible piping long enough to reach from any part of the barge to the farthest corner of the ship to be loaded. A small pipe, known as the nozzle, is inserted at the inlet end of the piping, where the grain is taken in, and communicates with the air compressor at the other end. Compressed air can be admitted to the nozzle or shut off by a valve. The inlet end of the flexible pipe is pushed into the grain in the barge, while the other end is led over the hatches of the vessel to be loaded. As the compressor is set to work and the valve of the compressed air supply pipe opened, the air naturally rushes up the pipe and escapes at the other end which is lying over the ship's hatchway. If the inlet nozzle be immersed in the grain to the depth of 12 to 18 in. the induced atmospheric air will follow the lead of the compressed air, and drawing the grain around into the inlet nozzle will carry it up the pipe and deliver it into the hold of the vessel loading.

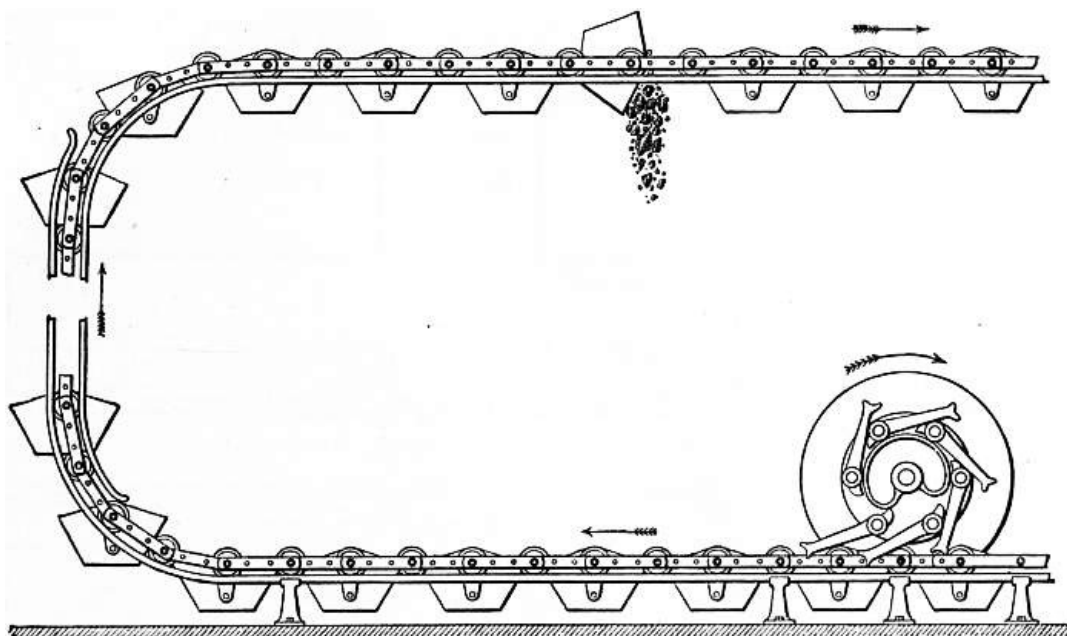


FIG. 10.—Travelling Bucket Elevator.

In the suction system, which is identified with the name of F. E. Duckham, the process is somewhat different. An air-tight tank or receiver, 8 to 10 ft. in diameter and 10 to 20 ft. high, is fitted with a hopper bottom, and is erected, if floating, on a barge, at a sufficient height to allow grain falling from the hopper bottom, and passing through an air lock, to be delivered by gravity through a shoot into the vessel being loaded. A pipe connects the vacuum tank with the exhaust pumps. Several flexible pipes of sufficient length to reach any corner of the ship to be unloaded, may be connected with the vacuum tank. As the air pumps are set working a partial vacuum is formed within the tank, and as the nozzle end of the pipe

is immersed into the grain to the depth of a few inches, the air and grain are drawn in at the mouth of the nozzle and carried along the pipe to the vacuum tank. The natural expansion of the air then lets the grain drop to the hopper bottom, whence it issues from an air-lock valve, while the air is drawn away by a pipe communicating with the pumps and is thence discharged into the open.

In the third system, or blast and suction combined, the grain is sucked into a vacuum tank, as just described, and drops from this through valves into a second receptacle, whence it is conveyed to any desired point by flexible pipes. This second tank is divided into two sections and provided with valves so that the two sections will alternately be under the influence of blast or suction. Alternatively the grain is discharged by an automatic valve from the vacuum tank into the second air-tight chamber which communicates with the compressed air chamber. From this section the grain is discharged by an outlet pipe by the agency of compressed air. A similar system was introduced by Messrs Haviland & Farmer, who have, however, since abandoned it on account of difficulties connected with the application of the blast, which was found to abrade the grain rather severely, especially at the bends in the pipes. An even greater objection was the delivery of dust with the grain, which made it impossible for trimmers to remain in the hold while the elevator was at work. Messrs Haviland and Farmer now work on the suction system, in which they claim to have introduced several improvements, notably in regard to the purification of the air between the vacuum chamber and the exhaustors, and in devising a new automatic air trap.

The first pneumatic suction elevator in Great Britain was erected at the Millwall docks (London) under the Duckham patents. At Sulina, on the Lower Danube, a pneumatic elevator erected on the Haviland-Farmer system, which has undergone one or two reconstructions, has been proved capable of elevating 160 tons of grain per hour with 375 i.h.p.

The only objection to pneumatic elevators appears to be that of expense. The cost of installation is relatively heavy, and the power required for working is large. But in dealing with vessels carrying heavy cargoes of grain the saving of labour and demurrage is sufficient to justify the large outlay of capital required in ports where there is sufficient grain traffic.

*Hot Coke Conveyors.*—Hot coke is admittedly one of the most difficult materials to handle by mechanical means, and though it might be too much to say that all difficulties have been surmounted by the engineer, it has, since the end of the 19th century, been more or less satisfactorily handled by machinery. Even in a dry state coke is a troublesome material to handle by machinery. It is of a gritty and rasping nature, and is at the same time very friable. Unless it is gently handled, breakage is bound to occur and to result in the making of a certain proportion of fine dust known as "breeze." Apart from the depreciation in the value of the coke, this breeze is a sharp, cutting material, calculated to do considerable injury to the working parts of the conveyor, such as chains, and to the bearings, if it can get inside. Of course the conveying of the coke in an incandescent condition is another serious difficulty, as this glowing material must be quenched by water, a sufficiently delicate operation in itself. The chief use for hot coke conveyors has been found in connexion with gas works, but attempts have also been made to provide efficient machinery for the service of coke ovens of great capacity.

The justification of any kind of machinery must rest on its relative efficiency and economy. As compared with some other materials the mechanical handling of hot coke does not realize such a striking economy; a hot coke conveyor is expensive to build—on account of the great wear and tear it must be very solidly constructed—and it is costly in upkeep. Still in large gas works the use of machinery for treating glowing coke is economically advisable. Exact calculations are not very easy to make, because while the cost of hand labour in this department of a gas works is accurately known, the efficiency of different hot coke conveyors varies. G. E. Stephenson, of the Gathorn gas works, estimated that a saving of  $4\frac{3}{4}$ d. per ton had been realized on each ton of coke conveyed to the yard from the retort house, as against the same material wheeled in barrows. This saving represented the difference between the cost of twelve men, who formerly handled the hot coke with shovels and barrows, and the cost of one conveyor with the wages of one man to look after it. In an ordinary way one man would rake out the coke from the retort mouthpiece into a barrow placed underneath, while a second man quenched the glowing coke with buckets of water, or better still with a hose. Then the barrow would be wheeled out into the yard. Obviously this is a slow and relatively expensive method, apart from the deleterious fumes arising from the quenching of the coke. Some improvement was effected by the substitution for the old hand-barrows of cage-like tipping trucks; these are run on narrow gauge rails out of the retort house and the red-hot coke they contain is quenched by a copious spray, the truck being placed the while over a grating through which the surplus water is drained away,

under an inverted funnel with an uptake to carry away the fumes and vapours. These trucks have been hauled, in lieu of human arms, by endless ropes or even small locomotives.

The earlier hot coke conveyors were of the *pushplate* type. The trough, some 27 in. wide, consisted of cast iron sections, while the pushplates, formed of malleable castings, were attached at a pitch of 24 in. to a central chain and were pulled along on a wrought iron bar, which could be renewed when necessary. These conveyors with a speed of 48 ft. per minute, had a capacity of some 20 tons per hour. A conveyor constructed on these lines was installed at the Gathorn works in 1903. The wear and tear was very great; moreover the chain, being central, suffered severely from the hot coke, to the action of which it was directly exposed.

The New Conveyor Company's conveyor consists of a water-tight trough through which pass closely-fitting tray plates, attached to a single chain. These plates are joggled down at one end to receive the flat front part of the succeeding plate, with the aim of excluding the breeze from the under part of the carrying plate. The chain is made entirely of steel with side rollers attached to every third plate, the plates,  $\frac{1}{4}$  in. thick, are dished in the shape of a tray, which is less liable to distortion (from heat) than a flat plate. The speed of travel is about 45 ft. per minute, while the capacity when handling coke from 20 ft. retorts is some 30 tons per hour.

A conveyor made by Messrs Graham, Morton & Co., consists of a travelling tray, the sections of which are joined together by steel spindles provided with a roller at each end, the latter running on suitable rails. These sections consist of steel castings with a number of lateral slots; thus the tray has the appearance of a travelling grating. To receive the quenching water that escapes through the grating a trough is placed beneath, and a scraper is used to free the trough of the dust escaping through the grating.

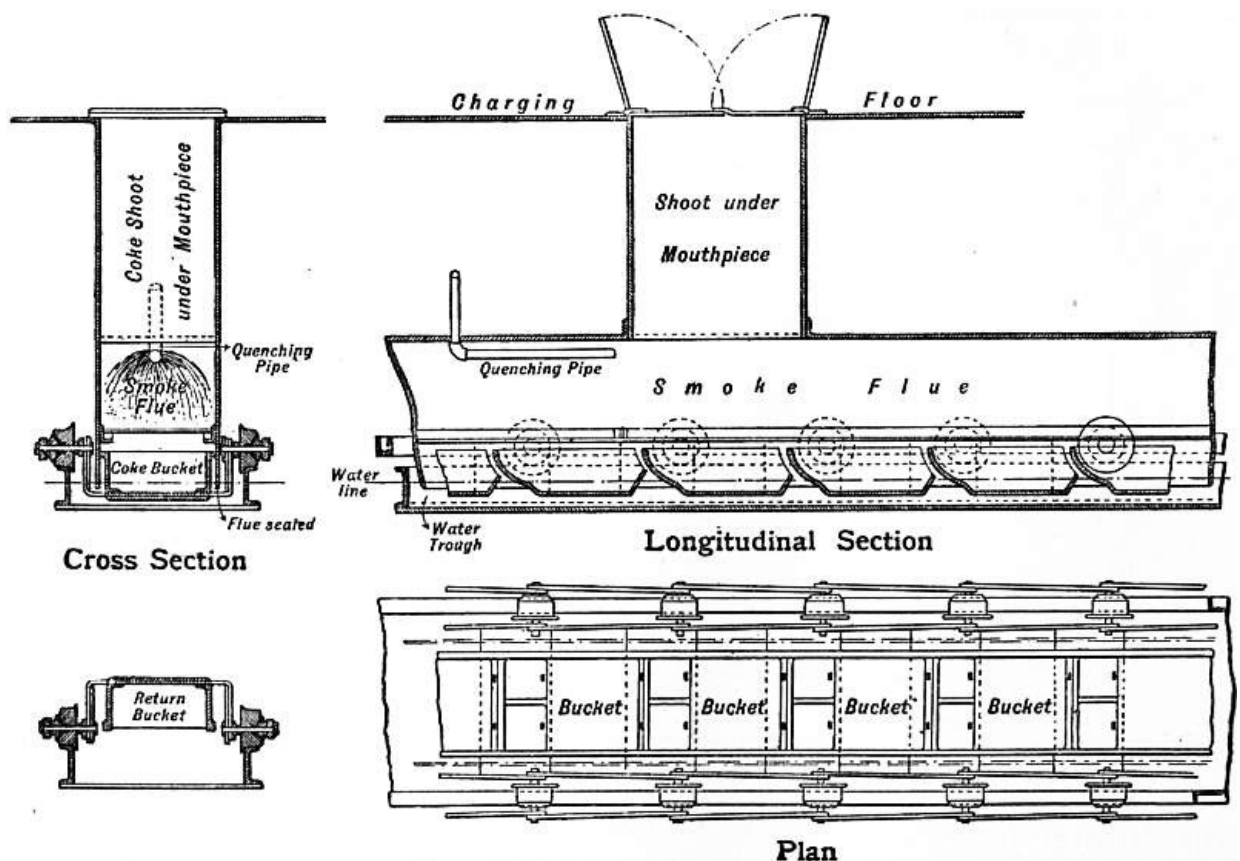


FIG. 11.—Bronder Hot Coke Conveyor.

An interesting conveyor is that of G. A. Bronder, of New York (fig. 11), which has some affinity with the gravity bucket conveyor. It runs in a water-tight trough which is filled up to a certain height, the water being slowly circulated by mechanism which resembles a water wheel. The chain of buckets runs in the trough, the sides forming the rails for the supporting rollers. The conveyor is covered in along its whole length, and forms a sort of flue which is connected at each bench with a number of shoots through which the coke drops into the conveyor buckets. A pipe of large diameter is connected with an exhaust fan, which draws away the fumes created by the quenching process, and sends them into a chimney discharging into the open. The chain and buckets, being carried on rollers which run on the outer edge of the trough, cannot come in contact either with the hot coke or with gritty particles. The chain of buckets is connected by horseshoe-shaped brackets extending upwards beyond the sides of the buckets and connected with the links of the driving chains.



When the conveyor is at work the covers of the mouth-pieces are opened and the coke is fed into the buckets; simultaneously the water valves are opened and the glowing coke is quenched. Any breeze which may have fallen between the buckets is collected by a scraper and delivered into a tank at one end, while the propeller wheel draws the water from this tank and drives it back to the other end of the trough. The top strand is the working strand and delivers its load at the terminal. One important difference between an ordinary gravity bucket conveyor and this apparatus is that the buckets are here rigidly connected to the supporting wheels.

The West hot coke conveyor consists of a strongly-built trough in which a single wide chain partly carries and partly drags the coke. In the trough is a false bottom, the plates of which are loosely fixed and kept in position by angle irons on which the chain drags. By two arm-like extensions the links of the chain are widened right across the trough. The pitch of the chain is 12 in., so that all the large pieces of coke are more carried than dragged. The speed of travel is about 40 ft. per minute.

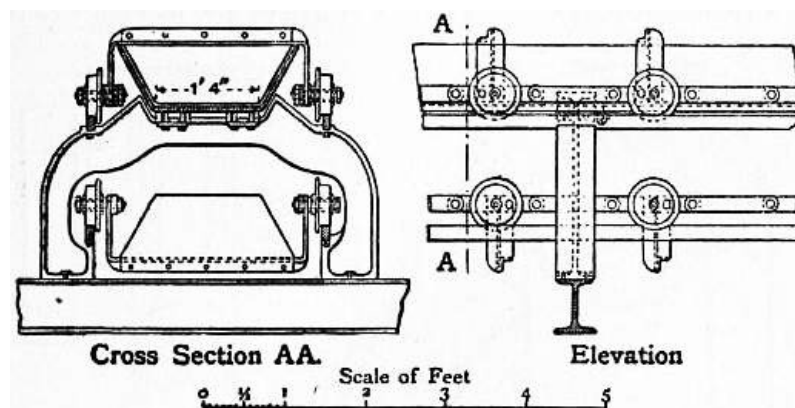


FIG. 12.—Wild Coke Conveyor.

The Wild conveyor (fig. 12) consists of a cast iron or steel trough 24 to 30 in. wide by 9 in. deep, supported by cast iron brackets to which the rails that support the strands of the chain are secured. Both chains run outside the trough, and are secured on either side to the pushplates, so that only the scraper comes in contact with the hot coke. Every second link of the 12 in. pitch chain carries a push or scraper-plate, as shown in illustration.

The De Brouwer hot coke conveyor, which is much used in gas works both in Great Britain and on the continent of Europe, was invented by a Belgian engineer. Its construction has undergone many modifications which experience has shown to be desirable. It consists of a trough of cast or wrought iron, or mild steel, 20 to 36 in. wide and 3 to 6 in. deep. Double endless chains run in the corners of the trough, the two chains being connected together by round cross bars set 30 in. apart, so as to form a sort of ladder. The hot coke is carried or dragged along by these bars. One end of the trough is closed and the other is bent upwards with a view to retaining the quenching water. As the hot coke is dragged along it is subjected to the action of jets of water. The conveyor bars, which act as scrapers, sweep the water and the coke along the trough till the point is reached where the latter curves upwards. Then the water flows back like a small cascade on the half-quenched coke, which is thus thoroughly extinguished. Considerable inclines can be negotiated with this conveyor; in some installations on the continent of Europe angles of 30° to the horizontal have been surmounted. In a modification of the De Brouwer conveyor, installed at the Cassel gas works, the bars which form the rungs of the conveyor were replaced by cast iron rakes. In another modified form, the work of F. A. Marshall, to be found in the Copenhagen gas works, sluices are provided for withdrawing an excess of water at any point in the trough.

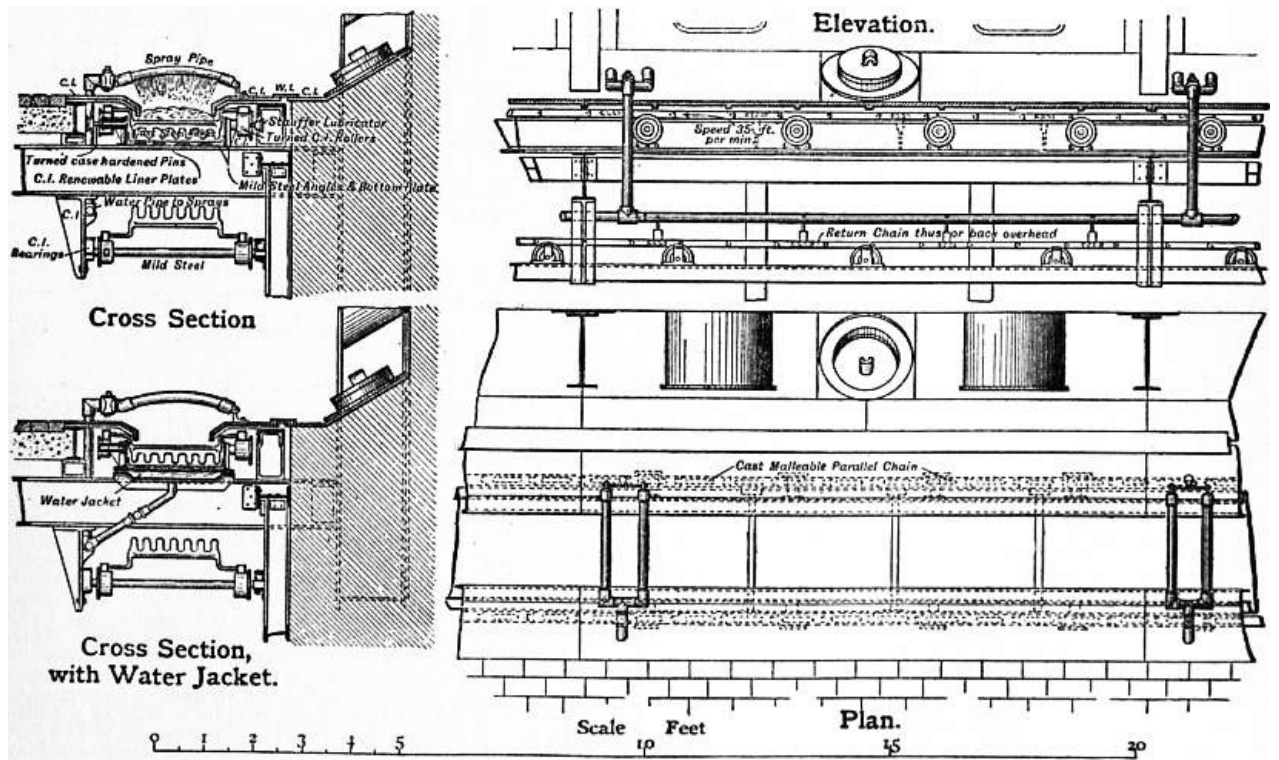


FIG. 13.—Sempster Coke Conveyor.

In Great Britain a hot coke conveyor has been designed on similar lines by Messrs R. Dempster & Sons, Ltd. (fig. 13). The chains are parallel from end to end, and are composed of identical and interchangeable malleable cast links. Instead of the chains carrying the rollers, as is often the case, the chains are themselves carried and guided by flanged rollers supported from the framework. This arrangement has the advantage of decreasing the weight of the chain, as neither the rollers nor the lubricators have to be conveyed, being stationary. The scrapers are of cast steel and have a rake-like shape with a view to minimize the breakage of coke.

The essential features in a hot coke conveyor are strength and simplicity, a minimum of wearing parts, interchangeability of wearing surfaces and of worn and broken parts, protection of wearing and working parts from contact with the hot coke, and facilities for keeping the temperature of the conveyor as even as possible, so as to avoid distortion of parts through sudden changes. To attain these latter conditions, it appears essential to construct conveyors of the pushplate type. In these the hot coke is kept continually moving, and thus the good effect is secured of heating the conveyor from end to end uniformly and gradually. This applies particularly to gas works conveyors.

For the service of coke ovens the plate or tray conveyor might be suitable because more gentle. It must be remembered that coke oven conveyors must be of large capacity, and moreover in this case there is more scope for cooling the coke in front of the oven before it is removed to the conveyor, the work being all effected in the open.

*Elevators.*—This term is here confined to its proper meaning (in English engineering treatises) of a device for raising material in a vertical or slanting direction by means of buckets attached to endless belts or chains. Lifts for passengers are also sometimes termed elevators (*q.v.*), and in America the term is also currently applied to the granary or warehouse in which grain is stored (see [GRANARIES](#)).

In the bucket elevator, an endless belt or chain runs over terminal pulleys which are fixed at different levels, the distance from centre to centre of these pulleys being known as the length of the elevator. The design and construction of the elevator will be varied to suit its purpose. Grain elevators are invariably cased in wooden or iron trunks, and the head and foot are also of wood or iron, iron trunks being particularly used in so-called fire-proof buildings. The trunk of the grain elevator (fig. 14) is almost always vertical whilst the band to which the buckets are attached may consist of leather, cotton, hemp, webbing or other suitable substances. When an elevator is intended for lifting heavy materials, such as coal, coke or cement, it is usually set at a slant (figs. 15 and 16), and the endless belt is replaced by one or two strands of endless chain which support the buckets and run over the terminal sprocket wheels. The buckets are attached to the links of the chains, and to prevent these heavy buckets and chains from sagging in their inclined position, rollers or more often short skidder bars are fixed to each bucket, sliding on well-oiled angle bars on each side of the

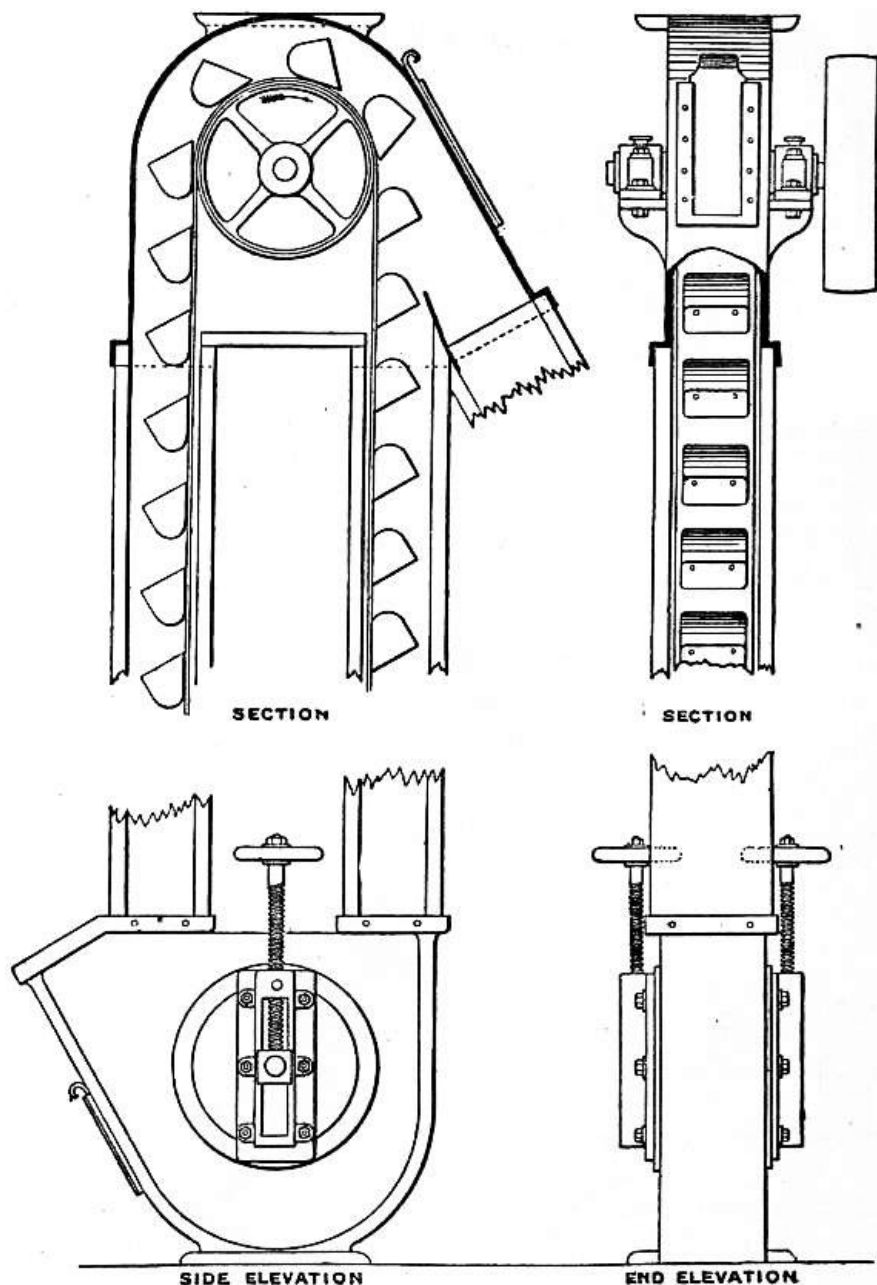


FIG. 14.—Grain Elevator.

Both grain and mineral elevators are usually fitted with tightening gears to keep the belt or chain taut; these are generally placed at the lower or well end so as not to interfere with the position of the upper terminal, which is almost invariably the driven one. The tightening of the band at the bottom terminal in the elevator well necessarily alters the space between the terminal pulley and the bottom of the well. This is of little consequence in grain elevators, but for elevators intended to handle coal or any material of varying size the ordinary tightening gear is unsuitable. In such a case the best plan is to attach the elevator-well to the terminal in such a way as to go up or down with the sprocket wheel when the chain is loosened or tightened, while the foot bracket which supports the well and terminal spindle remains a fixture. In order to tighten elevator chains without interfering with either of the terminals, adjustable jockey pulleys at some suitable point may be used, and the desired effect can thus be attained by pressing against the chains and thereby taking up the slack without any interference with either the feed or delivery end.

Elevator buckets must be proportioned to the size and nature of the material they are intended to carry, and care must be taken to maintain a uniform feed. This may readily be effected by adjustable outlets and spouts for grain and the like, and by certain feeding devices for handling minerals of uneven size. For instance, an oscillating feed shoot making from 30 to 60 oscillations per minute can be installed in such a case, and adjusted to deposit at each backward and forward stroke the exact amount of material adapted to the capacity of the elevator. The speed of the shoot will naturally vary with the size of material to be fed. For small coal 60 oscillations would be about the correct speed; for large coal the speed

might be reduced to 30 or less. Speaking generally, care should always be taken to prevent an undue rush of feed, that is, more than the elevator can take up, and if tenacious materials are handled, feeding devices should be employed provided with stirrers or agitators that will effectually keep the material moving and prevent any larger lumps from arching over the feed spout, and thus producing chokes. Elevators should always be fed from that side on which the buckets ascend, that the stream of material may meet the elevator buckets on their upward journey. This will prevent the material from filling up the elevator well and spare the buckets from dredging through an accumulation of feed. Elevators erected at an incline are best fed at a point several feet above the well into the chain of ascending buckets, as under such conditions little will miss the buckets and drop into the well.

The reason why grain elevators are set vertically, whereas elevators intended to carry heavy bodies such as coal and ore are generally inclined at an angle, is that the former can be run at a much greater velocity than the latter. Grain, for instance, would be uninjured by a velocity at the delivery end which would fracture coal and seriously reduce its value, to say nothing of the dust production and the damage which would be done to the receiving spouts and shoots. Elevators carrying a light material can be run at a circumferential velocity of 250 to 350 ft. per minute, and if vertically set, will throw the grain, &c., clear of the elevator into the shoot for its reception. On the other hand, elevators handling heavy material must be set at an angle in order to give a clear delivery at a much lower speed of 50 to 60 ft. per minute; in other words, the elevator is so inclined that the shoot for the reception of the material can be put underneath the delivering buckets which slowly disgorge their load. To obtain good results, without taking up too much space, an elevator carrying heavy material should be set at 40° to 60° to the horizontal. The same results can be obtained if the main portion of the elevator is vertical and only the upper portion inclined, or so curved as to bring the delivery over the shoot. The speed at which vertical elevators should be run will depend on the diameter of the terminal pulley, that is, the pulley over which the buckets and bands pass. The centrifugal force of pulleys revolving at the same speed is in direct proportion to their diameters, and this is twice as much in a 2 ft. as in a 1 ft. pulley. It may be taken that the centrifugal force of a pulley will increase in proportion to the square of its velocity; hence the centrifugal force of a pulley 2 ft. in diameter running at 50 revolutions per minute will be four times the centrifugal force of a pulley of the same diameter making only 25 revolutions per minute. It must not be forgotten that to effect a clean discharge of the buckets of a vertical elevator, the centrifugal force must be sufficient to overcome the gravity of the material, because the material thrown off the delivery pulley in a horizontal direction will be more rapidly deflected into a parabolic curve the higher its specific gravity. It follows that for a specifically heavy material a greater centrifugal force will be required; that is to say, the elevator will have to be higher speeded than in dealing with a lighter material.

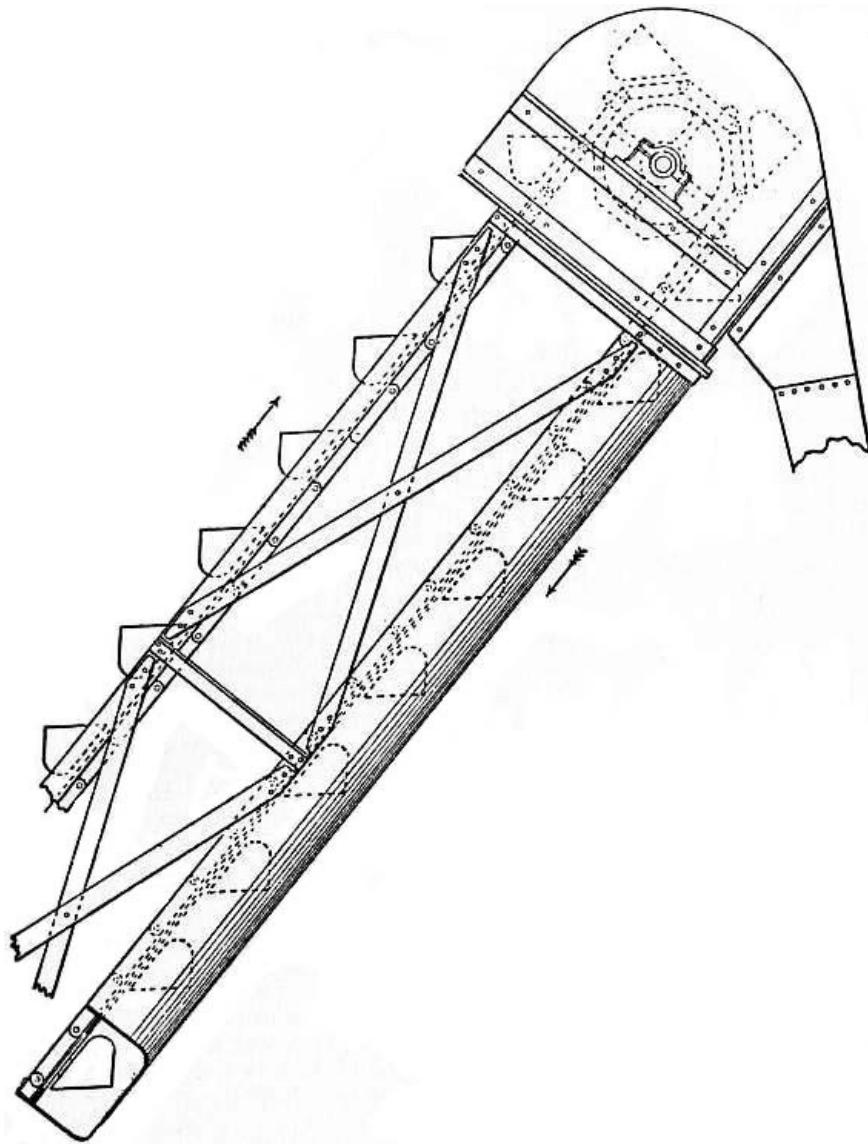


FIG. 15.—Mineral Elevator, upper terminal.

Elevator buckets must be varied according to the nature of the material; for instance, shallow buckets will be found best for a soft and clinging material such as flour, moist sugar, sand, small coal, &c., while for a hard or semi-hard body such as wheat, coal, &c., deeper buckets are preferable. On account of their lower speed, elevators for specifically heavy material require much larger buckets and chains than grain elevators of the same bulk capacity. The most economical form of elevator is fitted with a continuous chain of buckets. Such elevators may be constructed to carry either grain or minerals. The advantages are greater capacity than an ordinary elevator of the same dimensions and a more uniform delivery; moreover, smoother running is secured, since the buckets being close together need not plunge intermittently through the contents of the elevator-well.

*Intermittent Conveyors.*—The elevators we have been considering, whether used for carrying and distributing coal or grain, have this in common, that they raise material from a lower to a higher level, so to speak, in a continuous stream, the continuity being broken only by the short spaces between the buckets. In the continuous bucket type indeed the stream of material is practically, if not absolutely, continuous. In all these cases the elevator is fed with the material in a continuous stream, and by some mechanical means; whether by band, worm or shoot, is immaterial. Elevators of a somewhat different and more substantial construction may be and are often used for handling filled sacks, barrels, carcasses of animals and other bulky objects, which cannot be delivered in a uniform stream, but may have to be conveyed by the elevator intermittently. The ordinary buckets used for grain or coal are replaced by other appliances for gripping and holding the object to be raised from a lower to a higher level, but in principle these appliances are essentially elevators.

Another kind of elevator, known as a *lift* or *hoist*, is used in mines and quarries and in serving blast furnaces. This is an elevator with one or two buckets. Essentially a heavy load lifter, it is intended for material of too large a bulk to be handled economically by ordinary elevators, and is employed for lifting in either a vertical or, more often, an inclined direction.

For elevating materials, such as large coal, iron ore, limestone, &c., which are too large to

be fed into ordinary elevators, and must therefore be handled intermittently, the single bucket elevator or hoist may be used with advantage. But as the essential use of mechanical appliances for handling material is to save human labour as far as possible, that hoist will prove the most economical the operation of which is as automatic as possible. The Americans seem to have been pioneers in the construction of *furnace hoists*, which form the principal elevators of this class, but some excellent examples of the modern furnace hoist are now to be found in Great Britain and elsewhere in Europe. Generally speaking, a furnace hoist consists of an inclined iron bridge girder set at an angle to the upright shaft of the furnace. On this incline are laid rails for the ascent and descent of the bucket, which in this case is known as a skip and is provided with suitable wheels, while the hoisting gear manipulating the skips by a steel rope is erected on or near the ground level. The rails when they approach the upper terminus are usually bent in a more or less horizontal position so as automatically to tilt and thereby unload the skip. To attain the same end, the rails supporting the back wheels of the skips may be bent at the terminus, or the back wheels may have additional wheels of a larger diameter on the other side of their flanges, so that during the ascent and descent the skip runs on its four normal wheels, while at the upper terminus the outer and larger back wheels engage with short lengths of extra rails and thus tilt and effect the automatic clearance of the skip. The dead weight of the skip may be balanced by a counter weight, or double tracks may be laid, so that the empty skip descends on one track whilst the loaded skip is being raised on the other. In this case the distributing hopper at the top of the furnace has an elongated shape so as to take the charges alternately from buckets on either track. Again, the two tracks may be laid one above the other, so that one skip runs on the upper rails and the other on the lower. The two buckets will pass each other at about the centre of the framing, where there will be plenty of room for clearance.

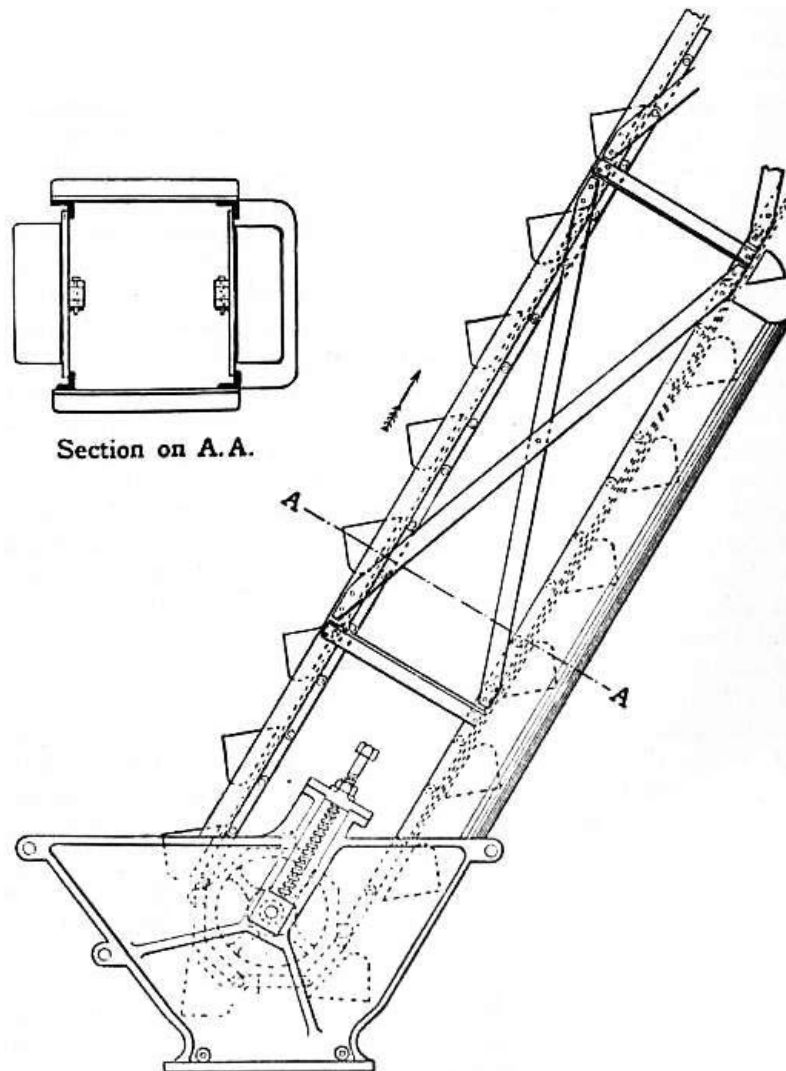


FIG. 16.—Mineral Elevator, lower terminal.

The capacity of the skip will of course depend to some extent on the capacity of the furnace, but an average charge may be put down at 2 tons of ore and lime, or 1 ton of coke. To raise such a charge to a furnace 80 ft. high would require, assuming no counter weight were used, a motor of about 100 h.p. On account of the great speed at which the hoist works, the time taken in raising the charged skip, discharging it, and returning it empty

would be only 30 to 40 seconds. The hoist cable runs over guide pulleys placed at the top of the furnace, and the cable is often manipulated by an electrically driven winch in a cabin below. The descent of the empty skip in more modern installations is utilized to effect an even distribution of the feed from the hopper to the furnace by causing the hopper to revolve. To this end the latter is provided with an ingenious mechanism which only comes into operation as the car descends. After every charge shot into the hopper the latter is revolved a few degrees, and this has the effect of giving the delivery of the next load in another direction, so that the charges of the skip are in turn distributed over the whole area of the surface. This is deemed a most essential point in furnace-charging, and it is not one of the least recommendations of this mechanical system of furnace-charging that it can give an even feed without any hand labour whatever. A double hoist has been designed which has the advantage that if one elevator breaks down the work of the furnace is not interrupted. In this system two furnaces are connected at the top by a gantry or bridge, against which, between the furnaces, two inclined elevators are set, so that each can serve either furnace. The skips are on wheels and detachable from the elevator, and are loaded from the ore pockets at the lower terminal and drawn up on a cradle; as this reaches the top where the rails on the gantry correspond with the gauge of the skip or car, the latter is carried by its own weight down a slight incline to either furnace, discharging its contents as it passes over the conical mouth. Another advantage claimed for this system is that the rails of the cradle, when in its lowest position, correspond with the rails which lie parallel to the furnaces and run right under the store bins from which the skip is loaded. The economy to be realized from a furnace hoist will be in direct proportion to the use made of mechanical means of feed conveyance. For instance, the store bins in connexion with such elevators might be economically fed by suitable conveyors, or the material might be brought in self-unloading hopped trucks into conveniently placed bins, ready to be drawn into the skips.

*Ropeways.*—A ropeway has been defined as that method of handling material which consists of drawing buckets on ropes, and by means of ropes, such buckets being filled with the material to be handled and being automatically or otherwise discharged. At what period of history ropeways were first used it is impossible to say, but the fact that pulley blocks, and even wire ropes, were known to the ancients, renders a pedigree of 2000 years at least possible. In more modern days, an old engraving shows a single ropeway in working order in 1644 in the city of Danzig. This, the work of Adam Wybe, a Dutch engineer, was a single ropeway in its simplest form, consisting of an endless rope passing over pulleys suspended on posts; to the rope were attached a number of small buckets, which evidently carried earth from a hill outside the city to the rampart inside the moat. The rope was probably of hemp. Modern ropeways worked with wire ropes date from about 1860, when a ropeway was erected in the Harz Mountains. Since then several systems have been evolved, but in the main ropeways may be divided into the single and double rope class.

The ropeway is essentially an intermittent conveyor, the material being carried in buckets or skips, and practice has proved it an economical means of handling heavy material. The prime cost of a ropeway is usually moderate, though of course it varies with the ground and other local conditions. Working expenses should be low, because under the supervision of one competent engineer unskilled labour is quite sufficient. A ropeway may be carried over ground over which rails could only be laid at enormous cost. To a certain extent ropeways are independent of weather conditions, because their working need not be interrupted even by heavy snowfalls. Their construction is very simple, and there is little gear to get out of order. Sound workmanship and good material will ensure a relatively long life. As an instance, a certain rope in a Spanish ropeway tested new to a breaking strain of 29½ tons was shown after carrying 160,000 tons (in two years' incessant work) still to possess a breaking strain of 27½ tons. The power absorbed by a ropeway is relatively moderate, and under special conditions may be nil. The only demand it makes on the superficial area of the ground traversed is the small emplacements of the standards, which in modern ropeways are few and far between. Wayleaves, or the permission to erect standards and run the line over private land, may of course mean an item in the capital outlay. This circumstance may have checked ropeway construction in Great Britain, but it must also be borne in mind that a large portion of that country is comparatively level and well provided with railways. In building a ropeway it is essential to take as straight a line as possible, because curves generally necessitate angle stations, which mean extra capital and working cost. On the other hand, ground that would be difficult for the railway engineer, such as steep hills, deep valleys and turbulent streams, has no terror for the ropeway erector. There is a case of a ropeway of a total length of 5400 ft. with a total difference in altitude of 2000 ft.; it is claimed this ground could not be covered by a railway with less than 15 m. of line graded at 1 in 40.

Perhaps the simplest type of a single rope system is an endless running rope from which the carriers are suspended, and with which they move by frictional contact. Or the carriers may be fixed to this rope and move with it. The ropeway itself would consist of an endless rope running between two drums, one, known as the driving drum, being provided with power receiving and transmitting gear, while the drum at the opposite terminal would be fitted with tightening gear. The endless rope is carried on suitable pulleys which themselves are supported on standards or trestles spaced at intervals varying with the nature of the ground. The rope runs at an average speed of 4 m. per hour, a speed at which the bucket or skip can automatically unload itself. In the double ropeway the carrier runs on a fixed rope, which takes the place of the rails of a railway. The carrier is fitted with running heads furnished with grooved steel wheels. The load is borne by a hanger pivoted from the carrier, and is conveyed along the rail rope by an endless hauling rope at an average speed of 4 to 6 m. per hour. The hauling is operated by driving gear at one end, and controlled by tightening gear at the other end just as in the single rope system. Double ropeways have been carried in one section over 18 to 20 m., and will transport single loads of 6 cwt. to a ton or more.

Broadly speaking, the single ropeway is not so suitable for heavy loads and long distances as the double, but in this connexion the work of Ropeways Limited should be noted, which favours a single rope system. Their engineer, J. Pearce Roe, introduced multiple sheaves for supporting the rope at each standard. Thus the rope may pass over one, two or four sheaves, which are provided with balance beams that have the advantage of adjusting themselves to the angle caused by the rope passing over the sheaves, thus equalizing the pressure over a number of sheaves. A ropeway erected on this system in Japan spans 4000 yds. of very broken ground; yet only 17 trestles are used, and as each support is placed as high as possible, no one is of great height. An altitude of 1130 ft. is reached in a distance of 1200 yds. The ropeway has a daily carrying capacity of 60 tons in one direction and of 30 tons in the other. Another installation on this system, which serves an iron mine in Spain, spans 6500 yds. of very rough country, so steep that in many places the sure-footed mule cannot keep on the track. This ropeway can deal with 85 tons per hour. The greatest distance covered by this system, on one section, is 7100 yds., or about 4 m., and the carrying capacity is 45 tons per hour.

The motive power required for a ropeway will vary with the conditions. In cases of descending loads the power generated is sometimes so considerable as to render it available for driving other machinery, or it may have to be absorbed by some special brake device. In a ropeway in Japan of 1800 yds., which runs mostly at an incline of 1 in 1½, the force generated is absorbed by a hydraulic brake the revolving fan of which drives the water against fixed vanes which repel and heat it. In this way, 50 h.p. is absorbed and the speed brought under the control of a hand brake.

*Aerial Cableways.*—The aerial cableway is a development of the ropeway, and is a conveyor capable of hoisting and dumping at any desired point. The load is carried along a trackway consisting of a single span of suspended cable, which covers a comparatively short distance. The trackway may either run in a more or less horizontal direction, *i.e.* the terminals may be on the same level, or it may be inclined at such an angle that the load will descend by gravity. The trackway or rail rope rests upon saddles of iron or hard wood on the tops of terminal supports, usually known as towers. These towers may be constructed either of wood or iron, and if the exigencies of the work render it desirable, they may be mounted on trolleys and rails, in which case the cableway is rendered portable, and can be moved about, sometimes a great advantage in excavating work. The motive power may be either steam, gas, or electricity. The motor is situated in what is termed the head tower, which is sometimes a little higher than the other or tail tower. Sometimes, but not frequently, the latter is also fitted with a motor. The span between the two towers sometimes extends to 2000 ft., but this is exceptional. Very heavy loads are dealt with, sometimes as much as 8 tons in a single load. The load, which may be carried in a skip or a tray, is borne by an apparatus called the carrier, which is a modification of a running head, consisting of pulleys and blocks and running along the main cable or trackway. The carrier is also fitted with pulleys or guides for the dump line. The carrier is drawn along the main cable by an endless or hauling rope which passes from the carrier over the head tower and is wound several times round the drum of the winding engine to secure frictional hold, then back over the head tower, to the tail tower, returning to the rear end of the carrier. The hoisting rope passes from the engine to the fall block for raising the load. The dump line comes from the other side of the winding engine drum and passes to a smaller block attached to the rear end of the skip or tray. The whole weight of the skip is borne by the hoisting rope, while the dump line comes in slack, but at the same rate of speed. Whenever it is desired to dump the load, the dump line is shifted to a section of the drum having a slightly larger diameter, and being thus drawn in at a higher rate of speed the load is discharged. The engine is then



reversed, and the carriage brought back for the next load.

This is in outline the mode of operating all cableways. This appliance has rendered great service as a labour saver in navvying, quarrying and mining work; in placer-mining, for instance, cableways have been found very useful when fitted with a self-filling drag bucket, which will take the place of a great number of hands. Cableways can be worked at a great speed, but a good mean speed would be 500 to 750 ft. for conveying and 200 to 300 ft. for hoisting. A cableway used in excavating work in Chicago was credited with a capacity of 400 to 600 cub. yds. per day at a total cost of 2d. per yard, including labour, coal, oil, waste, &c.

*Coaling Ships at Sea.*—In the coaling of ships at sea the cableway has rendered great service. The conditions under which this operation has to be carried out present many difficulties, especially in rough water. One of the chief obstacles is the maintenance of the necessary tension on the cable used in conveying the coal from the collier to the ship. The first test in coaling ships at sea, made by the British admiralty, took place in 1890 in the Atlantic at a point 500 m. south of the Azores in water 2000 fathoms deep. Ten ships of war were coaled, each vessel taking enough coal to enable it to steam back to Torbay, 1800 m. away. In this case the collier was lashed alongside the battleship it was feeding, thick fenders being interposed to prevent damage, but nevertheless as the colliers got light they pitched considerably, and one or two sustained dents in their sides. The ships did not roll, being kept bows-on to the swell, which became heavy before the coaling was completed. The coal was taken in by derricks at the main deck ports. It is clear that had the sea been really rough coaling in this fashion would have been impossible.

The most practicable method of coaling at sea yet devised is the marine cableway of Spencer Miller, which has been tried with some success in the American navy. It is intended for use between vessels 350 to 500 ft. apart. The ship being coaled takes the collier in tow, steaming at the rate of 4 to 8 knots; it has been found that a speed of five knots in moderately rough water will keep the cableway taut and maintain a sufficient distance between the crafts. The collier is fitted with an engine having double cylinders and double friction drums, which is placed just abaft the foremast. A steel rope  $\frac{3}{4}$  in. in diameter is led from one drum over a pulley at the mast head and thence to a pulley at the head of shearpoles on the vessel being coaled, and brought back to the other drum. The engine moves in the same direction all the time and keeps on winding in both the strands of the conveying rope. Should the two vessels increase the distance between them during the operation of conveying the coal bags, of which two, weighing 420 lb each, may be fastened to the carrier, the extra rope called for is obtained by slipping the upper strand from the drum; this increases the speed of the upper cable. On the other hand should the distance between the vessels be reduced, this operation is reversed, the speed of the upper strand being reduced. To keep the carriage steady on its return empty, a rope, known as the sea-anchor line, is stretched above the two strands of the conveyor line, and under a pulley on the carriage. This cable is attached to the vessel, resting on a saddle on the shear head, whence it leads through the carriage over pulleys at the head of the foremast and mainmast of the collier, running on astern several hundred feet into the sea. A drag or sea-anchor, usually made of canvas and cone-shaped, is attached to the end of this rope. This anchor is used to support the empty carriage on its return to the collier. The diameter of the cone's base is graduated to the speed of the vessels. Thus in a smooth-water test, with a ship steaming at 6 knots, one 7 ft. in diameter was used, while the same anchor answered its purpose very well with a ship doing 5 knots in rough water.

The results given by this system of coaling at sea are relatively satisfactory. Tests made in the United States navy showed that 20 to 25 tons of coal per hour could be delivered by a collier to a war-vessel during a moderate gale. As the ship was under steam all the time and consumed 3 to 4 tons of coal per hour, the balance of the coal bunkered amounted to between 16 and 20 tons per hour, or say 384 tons in 24 hours. It has been suggested that under service conditions the speed of the towing vessel might be increased to 8 or 10 knots an hour; this would of course increase the coal consumption unless the collier proceeded under her own steam. But in such a case the space between the two crafts might be diminished, which would have the effect of causing the cable to sag and of stopping the work, since the conveyor cable to act properly must be kept taut. In Great Britain the Temperley Transporter Company have taken up this method of coaling at sea, working in collaboration with Spencer Miller, and have introduced several improvements in detail. Their system has been tried by the British admiralty.

The coaling of a large vessel by this appliance has the advantage of economizing hand labour. One man is required to work the hoist on the collier, while 20 men will be in the hold filling the bags and delivering them to the deck, where 15 or so will transfer the bags to the

lift. One or two men suffice for the overhead work; their station is in the trestle trees. On board the receiving ship a few men will be stationed at the shear head to empty the bags into a canvas shoot, and then return them, while there will be the usual force of bunker trimmers. A ton of coal per minute has been transferred from the collier to the vessel, but for this capacity the ships must not be too far apart, else the rope would not remain taut under such loads. During the Russo-Japanese War, many of the Russian battleships were coaled by means of aerial cableways. The coaling of vessels in this manner seems a success, but it would be desirable to increase the carrying capacity of the cableway or to duplicate the installations.

*Telpherage.*—A telpher ropeway or cableway may be defined as a ropeway or cableway worked and controlled electrically, only a rail rope being required besides the live rail or wire from which the electric current is taken. Telpherage was devised by Professor Fleeming Jenkin in 1881, and developed by him in conjunction with Professors W. E. Ayrton and J. Perry. The telpher itself consists of a light two-wheeled truck, carrying the driving motors, which, to avoid gearing or other complicated mechanism, are usually coupled directly to the axles of the telpher. Thus the telpher is a self-propelled electric carrier running on a mono-rail, which, according to the conditions, may be a steel rail or a steel cable. From the telpher are suspended carriers which can be adapted to any kind of material. In many cases the whole load may be suspended from the telpher, or the load, especially if of some length, may be supported at one end by a telpher, and at the other end by what is known as a trailer, or again, two telfers may be installed, one at each end of the load. The telpher carries a small trolley sheave or bow which serves to collect the current from a trolley wire stretched a little above the rail. Frequently the telpher is accompanied by an attendant who manipulates it, but by dividing the trolley wire into sections any system of telpherage may be constructed to work automatically, and by switching off the current from the section in which the telpher is required to stop it can be brought to a standstill at any required point. The speed of the telpher may be readily regulated by the introduction of a resistance between any section of the line and the supply of electricity. The speed may be high, as much as 1500 ft. per minute over the straight portions of the line, but slackened at curves and loading stations, or when approaching a terminus. The required power may be obtained from the mains of an ordinary electric supply with either direct or alternating current, but the former is preferable. The mean expenditure of power in a working day is said to average (including electrical hoisting) 1 H.P. per ton of average load.

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The uses of telpherage are many and various. In factories and warehouses, where the buildings are scattered, it has been installed with excellent results. Being essentially an overhead system, there is a saving of floor space, the ground not being obstructed by trucks or trolleys. The same reasons which render ropeways an economical means of handling such material as coal, ore, stone, slate, &c., between the mine or quarry and the rail or barge, may be adduced in favour of telpherage. For the unloading of railway trucks in a crowded goods-yard it is undoubtedly applicable. Any kind of tipping or hoisting operations can be automatically effected by its aid, and any sort of grab may be used in dealing with such materials as sand, clay or gravel. Telpherage is clearly a labour-saving method of handling materials, but of course the exact conditions under which any system is to be used need careful study, while the economy to be effected by the installation of a telpher line must to a great extent depend upon the available supply of electrical energy.

(G. F. Z.)

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1 The illustrations in this article are taken, by kind permission, from the *Proceedings of the Institution of Civil Engineers*.

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**CONVOCATION** (Lat. *convocatio*, a calling together), an assembly of persons met together in answer to a summons. The term is more usually applied in a restricted sense to assemblies of the clergy or of the graduates of certain universities.

In the American Protestant Episcopal Church a convocation is a voluntary deliberative conference of the clergy; it has no legislative function, and like the convocation of a university, assembles primarily to discuss matters of common interest.

In England the name "convocation" is specifically given to an assembly of the spirituality

of the realm of England, which is summoned by the metropolitan archbishops of Canterbury and of York respectively, within their ecclesiastical provinces, pursuant to a royal writ, whenever the parliament of the realm is summoned, and which is also continued or discharged, as the case may be, whenever the parliament is prorogued or dissolved. These assemblies consist of two Houses, an upper and lower. In the upper house sit the archbishops and bishops, and in the lower the deans and archdeacons of every cathedral, the provost of Eton College, with one proctor elected by each cathedral chapter and two by the beneficed clergy in each diocese in the province of Canterbury (in the province of York two proctors are elected by each archdeacon), with a prolocutor at their head. When and how this convocation originated is not historically clear. This much is known from authentic records, that the present constitution of the convocation of the prelates and clergy of the province of Canterbury was recognized as early as in the eleventh year of the reign of Edward I. (1283) as its normal constitution; and that in extorting that recognition from the crown, which the clergy accomplished by refusing to attend unless summoned in lawful manner (*debito modo*) through their metropolitan, the clergy of the province of Canterbury taught the laity the possibility of maintaining the freedom of the nation against the encroachments of the royal power. It had been a provision of the Anglo-Saxon period, the origin of which is generally referred to the council of Clovesho (747), that the possessions of the church should be exempt from taxation by the secular power, and that it should be left to the benevolence of the clergy to grant such subsidies to the crown from the endowments of their churches as they should agree to in their own assemblies. It may be inferred, however, from the language of the various writs issued by the crown for the collection of the "aids" voted by the *Commune Concilium* of the realm in the reign of Henry III., that the clergy were unable to maintain the exemption of church property from being taxed to those "aids" during that king's reign; and it was not until some years had elapsed of the reign of Edward I. that the spirituality succeeded in vindicating their constitutional privilege of voting in their own assemblies their free gifts or "benevolences," and in insisting on the crown observing the lawful form of convoking those assemblies through the metropolitan of each province.

The form of the royal writ, which it is customary to issue in the present day to the metropolitan of each province, is identical in its purport with the writ issued by the crown in 1283 to the metropolitan of the province of Canterbury, after the clergy of that province had refused to meet at Northampton in the previous year, because they had not been summoned in lawful manner; whilst the mandates issued by the metropolitans in pursuance of the royal writs, and the citations issued by the bishops in pursuance of the mandates of their respective metropolitans, are identical in their purport and form with those used in summoning the convocation of 1283, which met at the New Temple in the city of London, and voted a "benevolence" to the crown, as having been convoked in lawful manner. The existing constitution of the convocation of the province of Canterbury—and the same observation will apply to that of the province of York—in respect of its comprising representatives of the chapters and of the beneficed clergy, in addition to the bishops and other dignitaries of the church, would thus appear to be of even more ancient date than the existing constitution of the parliament of the realm.

From this period down to the eleventh year of the reign of Edward III. there were continual contests between the spirituality of the realm and the crown,—the spirituality contending for their constitutional right to vote their subsidies in their provincial convocations; the crown, on the other hand, insisting on the immediate attendance of the clergy in parliament. The resistance of the clergy to the innovation of the "praemunientes" clause had so far prevailed in the reign of Edward II. that the crown consented to summon the clergy to parliament through their metropolitans, and a special form of provincial writ was for that purpose framed; but the clergy protested against this writ, and the struggle was maintained between the spirituality and the crown until 1337 (11 Edward III.), when the crown reverted to the ancient practice of commanding the metropolitans to call together their clergy in their provincial assemblies, where their subsidies were voted in the manner as accustomed before the "praemunientes" clause was introduced. The "praemunientes" clause, however, was continued in the parliamentary writs issued to the several bishops of both provinces, whilst the bishops were permitted to neglect at their pleasure the execution of the writs.

**Contest  
between  
spirituality  
and crown.**

The history of the convocation of the province of Canterbury, as at present constituted, is full of stirring incidents, and it resolves itself readily into five periods. The first period, by which is meant the first period which dates from an epoch of authentic history, is the period of its greatest freedom, but not of its greatest activity.

**Five**

**characteristic periods.** It extends from the reign of Edward I. (1283) to that of Henry VIII. The second period is the period of its greatest activity and of its greatest usefulness, and it extends from the twenty-fifth year of the reign of Henry VIII. to the reign of Charles II. The third period extends from the fifteenth year of the reign of Charles II. (1664) to the reign of George I. This was a period of turbulent activity and little usefulness, and the anarchy of the lower house of convocation during this period created a strong prejudice against the revival of convocation in the mind of the laity. The fourth period extends from the third year of the reign of George I. (1716) to the fifteenth year of the reign of Queen Victoria. This was a period of torpid inactivity, during which it was customary for convocation to be summoned and to meet *pro forma*, and to be continued and prorogued indefinitely. The fifth period may be considered to have commenced in the fifteenth year of the reign of Queen Victoria (1852).

During the first of the five periods above mentioned, it would appear from the records preserved at Lambeth and at York that the metropolitans frequently convened congregations (so called) of their clergy without the authority of a royal writ, which were constituted precisely as the convocations were constituted, when the metropolitans were commanded to call their clergy together pursuant to a writ from the crown. As soon, however, as King Henry VIII. had obtained from the clergy their acknowledgment of the supremacy of the crown in all ecclesiastical causes, he constrained the spirituality to declare, by what has been termed the Act of Submission on behalf of the clergy, that the convocation "is, always has been, and ought to be summoned by authority of a royal writ"; and this declaration was embodied in a statute of the realm (25 Henry VIII. c. 19), which further enacted that the convocation "should thenceforth make no provincial canons, constitutions or ordinances without the royal assent and licence." The spirituality was thus more closely incorporated than heretofore in the body politic of the realm, seeing that no deliberations on its part can take place unless the crown has previously granted its licence for such deliberations. It had been already provided during this period by 8 Henry VI. c. 1, that the prelates and other clergy, with their servants and attendants, when called to the convocation pursuant to the king's writ, should enjoy the same liberty and defence in coming, tarrying and returning as the magnates and the commons of the realm enjoy when summoned to the king's parliament.

The second period, which dates from 1533 to 1664, has been distinguished by four important assemblies of the spirituality of the realm in pursuance of a royal writ—the two first of which occurred in the reign of Edward VI., the third in the reign of Queen Elizabeth, and the fourth in the reign of Charles II. The two earliest of these convocations were summoned to complete the work of the reformation of the Church of England, which had been begun by Henry VIII.; the third was called together to reconstruct that work, which had been marred on the accession of Mary (the consort of Philip II. of Spain), whilst the fourth was summoned to re-establish the Church of England, the framework of which had been demolished during the great rebellion. On all of these occasions the convocations worked hand in hand with the parliament of the realm under a licence and with the assent of the crown. Meanwhile the convocation of 1603 had framed a body of canons for the governance of the clergy. Another convocation requires a passing notice, in which certain canons were drawn up in 1640, but by reason of an irregularity in the proceedings of this convocation (chiefly, on the ground that its sessions were continued for some time after the parliament of the realm had been dissolved), its canons are not held to have any binding obligation on the clergy. The convocations had up to this time maintained their liberty of voting the subsidies of the clergy in the form of "benevolences" separate and apart from the "aids" granted by the laity in parliament, and one of the objections taken to the proceedings of the convocation of 1640 was that it had continued to sit and to vote its subsidies to the crown after the parliament itself had been dissolved. It is not, therefore, surprising on the restoration of the monarchy in 1661 that the spirituality was not anxious to retain the liberty of taxing itself apart from the laity, seeing that its ancient liberty was likely to prove of questionable advantage to it. It voted, however, a benevolence to the crown on the occasion of its first assembling in 1661 after the restoration of King Charles II., and it continued so to do until 1664, when an arrangement was made between Archbishop Sheldon and Lord Chancellor Hyde, under which the spirituality silently waived its long-asserted right of voting its own subsidies to the crown, and submitted itself thenceforth to be assessed to the "aids" directly granted to the crown by parliament. An act was accordingly passed by the parliament in the following year 1665, entitled An act to grant a Royal Aid unto the King's Majesty, to which aid the clergy were assessed by the commissioners named in the statute without any objection being raised on their part or

**Sheldonian compact.**

behalf,<sup>1</sup> there being a proviso that in so contributing the clergy should be relieved of the liability to pay two subsidies out of four, which had been voted by them in the convocation of a previous year. In consequence of this practical renunciation of their separate *status*, as regards their liability to taxation, the clergy have assumed and enjoyed in common with the laity the right of voting at the election of members of the House of Commons, in virtue of their ecclesiastical freeholds.

The most important and the last work of the convocation during this second period of its activity was the revision of the Book of Common Prayer which was completed in the latter part of 1661.

The Revolution in 1688 is the most important epoch in the third period of the history of the synodical proceedings of the spirituality, when the convocation of Canterbury, having met in 1689 in pursuance of a royal writ, obtained a licence under the great seal,

**Third period.** to prepare certain alterations in the liturgy and in the canons, and to deliberate on the reformation of the ecclesiastical courts. A feeling,

however, of panic seems to have come over the Lower House, which took up a position of violent antagonism to the Upper House. This circumstance led to the prorogation of the convocation and to its subsequent discharge without any practical fruit resulting from the king's licence. Ten years elapsed during which the convocation was prorogued from time to time without any meeting of its members for business being allowed. The next convocation which was permitted to meet for business, in 1700, was marked by great turbulence and insubordination on the part of the members of the Lower House, who refused to recognize the authority of the archbishop to prorogue their sessions. This controversy was kept up until the discharge of the convocation took place concurrently with the dissolution of the parliament in the autumn of that year. The proceedings of the Lower House in this convocation were disfigured by excesses which were clearly violations of the constitutional order of the convocation. The Lower House refused to take notice of the archbishop's schedule of prorogation, and adjourned itself by its own authority, and upon the demise of the crown it disputed the fact of its sessions having expired, and as parliament was to continue for a short time, prayed that its sessions might be continued as a part of the parliament under the "praemunientes" clause. The next convocation was summoned in the first year of Queen Anne, when the Lower House, under the leadership of Dean Aldrich, its prolocutor, challenged the right of the archbishop to prorogue it, and

**Claim of Lower House to sit independently.** presented a petition to the queen, praying her majesty to call the question into her own presence. The question was thereupon examined by the queen's council, when the right of the president to prorogue both houses of convocation by a schedule of prorogation was held to be proved, and further, that it could not be altered except by an act of parliament. During

the remaining years of the reign of Queen Anne the two Houses of convocation were engaged either in internecine strife, or in censuring sermons or books, as teaching latitudinarian or heretical doctrines; and, when it had been assembled concurrently with parliament on the accession of King George I., a great breach was before long created between the two houses by the Bangorian controversy. Dr Hoadly, bishop of Bangor, having preached a sermon before the king, in the Royal Chapel at St James's Palace in 1717, against the principles and practice of the nonjurors, which had been printed by the king's command, the Lower House, which was offended by the sermon and had also been offended

**Bangorian controversy.** by a treatise on the same subject published by Dr Hoadly in the previous year, lost no time in representing the sermon to the Upper House, and in calling for its condemnation. A controversy thereupon arose between the two houses which was kept up with untiring energy by the Lower House,

until the convocation was prorogued in 1717 in pursuance of a royal writ; from which time until 1861 no licence from the crown was granted to convocation to proceed to business. During this period, which may be regarded as the fourth distinguishing period in the history

**Fourth period.** of the convocations of the Church of England, it was usual for a few members of the convocation to meet when first summoned with every new parliament, in pursuance of the royal writ, for the Lower House to elect a prolocutor, and for both houses to vote an address to the crown, after which

the convocation was prorogued from time to time, pursuant to royal writs, and ultimately discharged when the parliament was dissolved. There were, however, several occasions between 1717 and 1741 when the convocation of the province of Canterbury transacted certain matters, by way of consultation, which did not require any licence from the crown, and there was a short period in its session of 1741 when there was a probability of its being allowed to resume its deliberative functions, as the Lower House had consented to obey the president's schedule of prorogation; but the Lower House having declined to receive a

communication from the Upper House, the convocation was forthwith prorogued, from which time until the middle of the 19th century the convocation was not permitted by the crown to enjoy any opportunity even for consultation. The spirituality at last aroused itself from its long repose in 1852, and on this occasion the Upper House took the lead. The active spirit of the movement was Samuel Wilberforce, bishop of Oxford, but the ***Fifth period.*** master mind was Henry Phillpotts, bishop of Exeter. On the convocation assembling several petitions were presented to both houses, praying them to take steps to procure from the crown the necessary licence for their meeting for the despatch of business, and an address to the Upper House was brought up from the Lower House, calling the attention of the Upper House to the reasonableness of the prayer of the various petitions. After some discussion the Upper House, influenced mainly by the argument of Henry, bishop of Exeter, consented to receive the address of the Lower House, and the convocation was thereupon prorogued, shortly after which it was discharged concurrently with the dissolution of parliament. On the assembling of the next convocation of the province of Canterbury, no royal writ of exoneration having been sent by the crown to the metropolitan, the sessions of the convocation were continued for several days; and from this time forth convocation may be considered to have resumed its action as a consultative body, whilst it has also been permitted on more than one occasion to exercise its functions as a deliberative body. In 1865, under licence from the crown, the Convocations of Canterbury and York framed new canons in place of the 36th, 37th, 38th and 40th canons of 1603, and amended the 62nd and 102nd canons in 1888. In 1872 convocation was empowered by letters of business from the crown to frame resolutions on the subject of public worship, which resolutions were afterwards incorporated in the Act of Uniformity Amendment Act 1872.

As a deliberative body, convocation has done much useful work, but it suffers considerably from its unrepresentative nature. The non-beneficed clergy still remain without the franchise, but the establishment of Houses of Laymen (see [LAYMEN, HOUSES OF](#)) for both provinces has, to a certain extent, secured the co-operation of the lay element. Several attempts have been made to promote legislation to enable the convocations to reform their constitutions and to enable them to unite for special purposes; in 1905 a bill was introduced into the House of Lords. It did not, however, get beyond a first reading. In 1896 a departure was made in holding joint sessions of both convocations, in conjunction with the two Houses of Laymen, for consultative purposes. This body is now termed the Representative Church Council, and it adopted a Constitution in November 1905. All formal business is transacted in the separate convocations. It is usual for convocation to meet three times a year.

The order of convening the convocation of the province of Canterbury is as follows. A writ issues from the crown, addressed to the metropolitan archbishop of Canterbury, commanding him "by reason of certain difficult and urgent affairs concerning us, the security and defence of our Church of England, and the peace and tranquillity, public good and defence of our kingdom, and our subjects of the same, to call together with all convenient speed, and in lawful manner, the several bishops of the province of Canterbury, and deans of the cathedral churches, and also the archdeacons, chapters and colleges, and the whole clergy of every diocese of the said province, to appear before the said metropolitan in the cathedral church of St Paul, London, on a certain day, or elsewhere, as shall seem most expedient, to treat of, agree to and conclude upon the premises and other things, which to them shall then at the same place be more clearly explained on our behalf." In case the metropolitane see of Canterbury should be vacant, the writ of the crown is addressed to the dean and chapter of the metropolitane church of Canterbury in similar terms, as being the guardians of the spiritualities of the see during a vacancy. Thereupon the metropolitan, or, as the case may be, the dean and chapter of the metropolitane church, issue a mandate to the bishop of London, as dean of the province, and if the bishopric of London should be vacant, then to the bishop of Winchester as subdean, which embodies the royal writ, and directs the bishop to cause all the bishops of the province to be cited, and through them the deans of the cathedral and collegiate churches, and the archdeacons and other dignitaries of churches, and each chapter by one, and the clergy of each diocese by two sufficient proctors, to appear before the metropolitan or his commissary, or, as the case may be, before the dean and chapter of the metropolitane church or their commissary, in the chapter-house of the cathedral church of St Paul, London, if that place be named in the mandate, or elsewhere, with continuation and prorogation of days next following, if that should be necessary, to treat upon arduous and weighty affairs, which shall concern the state and welfare, public good and defence of this kingdom and the subjects thereof, to be then and there seriously laid before them, and to give their good counsel and assistance on the said affairs, and to consent to such things as shall happen to be wholesomely ordered and appointed by their common advisement, for the honour of God and the good of the church.

The provincial dean, or the subdean, as the case may be, thereupon issues a citation to the several bishops of the province, which embodies the mandate of the metropolitan or of the dean and chapter of the metropolitan church, as the case may be, and admonishes them to appear, and to cite and admonish their clergy, as specified in the metropolitan mandate, to appear at the time and place mentioned in the mandate. The bishops thereupon either summon directly the clergy of their respective dioceses to appear before them or their commissaries to elect two proctors, or they send a citation to their archdeacons, according to the custom of the diocese, directing them to summon the clergy of their respective archdeaconries to elect a proctor. The practice of each diocese in this matter is the law of the convocation, and the practice varies indefinitely as regards the election of proctors to represent the beneficed clergy. As regards the deans, the bishops send special writs to them to appear in person, and to cause their chapters to appear severally by one proctor. Writs also go to every archdeacon, and on the day named in the royal writ, which is always the day next following that named in the writ to summon the parliament, the convocation assembles in the place named in the archbishop's mandate. Thereupon, after the Litany has been sung or said, and a Latin sermon preached by a preacher appointed by the metropolitan, the clergy are praeconized or summoned by name to appear before the metropolitan or his commissary; after which the clergy of the Lower House are directed to withdraw and elect a prolocutor to be presented to the metropolitan for his approbation. The convocation thus constituted resolves itself at its next meeting into two houses, and it is in a fit state to proceed to business.

The constitution of the convocation of the province of York differs slightly from that of the convocation of the province of Canterbury, as each archdeaconry is represented by two proctors, precisely as in parliament formerly under the *Praemunientes* clause.

There are some anomalies in the diocesan returns of the two convocations, but in all such matters the *consuetudo* of the diocese is the governing rule.

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(T. T.; T. A. I.)

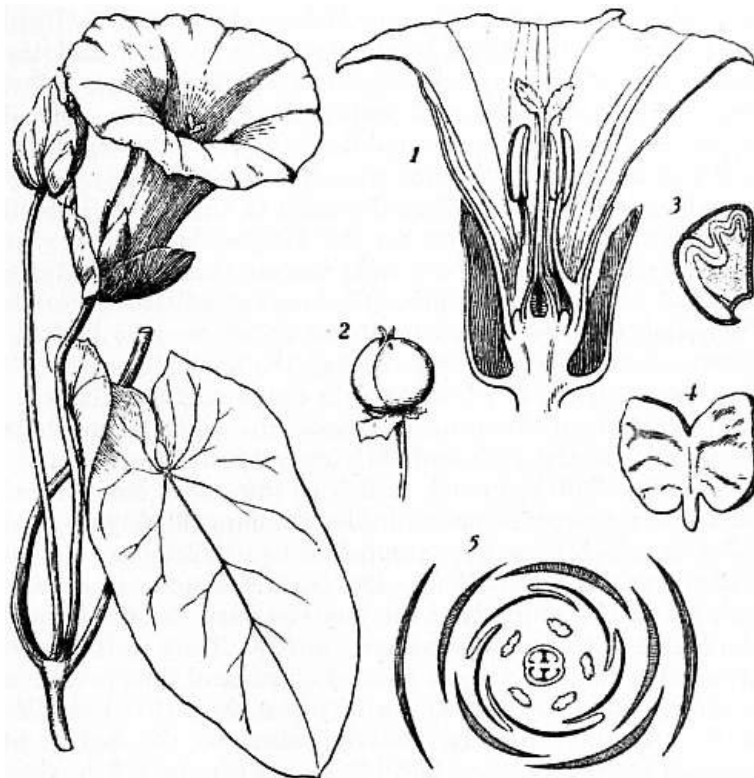
<sup>1</sup> It had always been the practice, when the clergy voted their subsidies in their convocation, for parliament to authorize the collection of each subsidy by the same commissioners who collected the parliamentary aid.

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**CONVOLVULACEAE**, a botanical natural order belonging to the series Tubiflorae of the sympetalous group of Dicotyledons. It contains about 40 genera with more than 1000 species, and is found in all parts of the world except the coldest, but is especially well developed in tropical Asia and tropical America. The most characteristic members of the order are twining plants with generally smooth heart-shaped leaves and large showy white or purple flowers, as, for instance, the greater bindweed of English hedges, *Calystegia sepium*, and many species of the genus *Ipomaea*, the largest of the order, including the "convolvulus major" of gardens, and morning glory. The creeping or trailing type is a common one, as in the English bindweed (*Convolvulus arvensis*), which has also a tendency to climb, and *Calystegia Soldanella*, the sea-bindweed, the long creeping stem of which forms a sand-binder on English seashores; a widespread and efficient tropical sand-binder is *Ipomaea Pes-Caprae*. One of the commonest tropical weeds, *Evolvulus alsinoides*, has slender, long-trailing stems with small leaves and flowers. In hot dry districts such as Arabia and north-east tropical Africa, genera have been developed with a low, much-branched, dense, shrubby habit, with small hairy leaves and very small flowers. An exceptional type in the order is represented by *Humbertia*, a native of Madagascar, which forms a large tree. The dodder (*q.v.*) is a genus (*Cuscuta*) of leafless parasites with slender thread-like twining stems. The flowers stand singly in the leaf-axils or form few or many flowered cymose inflorescences; the flowers are sometimes crowded into small heads. The bracts are usually scale-like, but sometimes foliaceous, as for instance in *Calystegia*, where they are large and envelop the calyx.

The parts of the flower are in fives in calyx, corolla and stamens, followed by two carpels which unite to form a superior ovary. The sepals, which are generally free, show much variation in size, shape and covering, and afford valuable characters for the distinction of genera or sub-genera. The corolla is generally funnel-shaped, more rarely bell-shaped or tubular; the outer face is often marked out in longitudinal areas, five well-defined areas tapering from base to apex, and marked with longitudinal striae corresponding to the middle of the petals, and alternating with five non-striated weaker triangular areas; in the bud the latter are folded inwards, the stronger areas being exposed and showing a twist to the right. The slender filaments of the stamens vary widely, often in the same flower; the anthers are linear to ovate in shape, attached at the back to the filament, and open lengthwise. Some importance attaches to the form of the pollen grains; the two principal forms are ellipsoidal with longitudinal bands forming the *Convolvulus*-type, and a spherical form with a spiny surface known as the *Ipomaea*-type. The ovary is generally two-chambered, with two inverted ovules standing side by side at the inner angle of each chamber. The style is simple or branched, and the stigma is linear, capitate or globose in form; these variations afford means for distinguishing the different genera. The fruit is usually a capsule opening by valves; the seeds, where four are developed, are each shaped like the quadrant of a sphere; the seed-coat is smooth, or sometimes warty or hairy; the embryo is large with generally broad, folded, notched or bilobed cotyledons surrounded by a horny endosperm. *Cuscuta* has a thread-like, spirally twisted embryo with no trace of cotyledons.





*Convolvulus sepium*, slightly reduced.

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| 1. Flower cut vertically.              | 4. Embryo taken out of seed.                 |
| 2. Fruit, slightly reduced.            | 5. Horizontal plan of arrangement of flower. |
| 3. Seed cut lengthwise showing embryo. |  |

The large showy flowers are visited by insects for the honey which is secreted by a ring-like disk below the ovary; large-flowered species of *Ipomaea* with narrow tubes are adapted for the visits of honey-seeking birds.

The largest genus, *Ipomaea*, has about 400 species distributed throughout the warmer parts of the earth. *Convolvulus* has about 150 to 200 species, mainly in temperate climates; the genus is principally developed in the Mediterranean area and western Asia. *Cuscuta* contains nearly 100 species in the warmer and temperate regions; two are native in Britain.

The tubers of *Ipomaea Batatas* are rich in starch and sugar, and, as the "sweet potato," form one of the most widely distributed foods in the warmer parts of the earth. Several members of the order are used medicinally for the strong purging properties of the milky juice (latex) which they contain; scammony is the dried latex from the underground stem of *Convolvulus Scammonia*, a native of the Levant, while jalap is the product of the tubercles of *Exogonium Purga*, a native of Mexico. Species of *Ipomaea* (morning glory), *Convolvulus* and *Calystegia* are cultivated as ornamental plants. *Convolvulus arvensis* (bindweed) is a pest in fields and gardens on account of its wide-spreading underground stem, and many of the dodders (*Cuscuta*) cause damage to crops.

**CONVOY** (through the Fr. from late Lat. *conviare*, to go along with, from Lat. *cum*, with, and *via*, way; "convey" has the same ultimate origin [see [CONVEYANCE](#)], neither word being connected, as has sometimes been supposed, with Lat. *convehere*, to carry together), a verb and noun now almost exclusively used in military and naval parlance. As a verb it signifies in the first instance to accompany or to escort; and in the 17th century we even hear of cavalry "convoying" infantry, but its meaning was soon complicated by the growing use of the word "convey" in the sense of "to carry," and as the usual task of an escort was that of accompanying and protecting vehicles containing supplies, the noun "convoy" (Fr. *convoi*) was introduced and has thenceforward in land warfare meant a train of vehicles containing stores for the use of troops and its guard or escort. Sometimes even the word is found in the meaning of the train of vehicles without implying that there is an escort, so far has the original meaning become obscured; but the idea of military protection is always present, whether this protection is given by a separate escort or provided by the weapons of the

drivers themselves.

In naval warfare the term is used to describe a method adopted for defending merchant ships against capture. It was usually applied to the vessels to be protected—as for example “the Baltic convoy,” or “Captain Montray’s convoy.” Until the 17th century the English term was “to waft” and the warship employed to guard the traders on their way was called “a wafter.” The practice of sailing in convoy for mutual protection was common in the middle ages, when all ships were more or less armed and the war vessel was not entirely differentiated from the trader. Thus the ships of the great German confederation of cities known as the Hanseatic League were required to sail in convoy. So were the six trading squadrons which sailed yearly from Venice. The masters of all the vessels were required to obey the authority of an officer who had the general command. In the 16th century the Spanish trade with America was compelled by law to sail in convoys (*flotas*), in order to avoid the danger of capture by pirates to which single ships were exposed. In the 17th and 18th centuries the use of convoy was universal. Dutch, French or British ships were collected at a rendezvous, and were accompanied by warships till they reached the point at which they were compelled to separate in order to go to their various destinations. The main danger was near the enemy’s ports. An example of the way the duty was discharged may be found in the Newfoundland convoy. They sailed from England under the direction of a naval officer and the protection of his ships, commonly a forty- or fifty-gun ship with a smaller vessel in attendance. The convoy sailed to the banks of Newfoundland. When they had filled up with stock fish, they were escorted across the Atlantic by the same officer. He accompanied those of them bound to the Mediterranean to the port of Leghorn, and, when they had unloaded and reloaded, saw them home. All cases were not so simple. The ships engaged in the East and West India trade, for instance, sailed together. In the Channel they were protected by the main strength of the fleet. When beyond the Scilly Islands they were left to the care of a smaller force, and continued together till in the neighbourhood of Madeira, when they separated. Convoys were subject to attack in two forms, by strong squadrons which overpowered the guard, and by privateers, corsairs and isolated cruisers. This latter peril was much increased in the case of British commerce by the reluctance of the merchant captains to obey the naval officers. They were very much inclined to separate from the convoy as they approached their destination in the hope of forestalling rivals. As a natural consequence they were frequently captured by hostile privateers. French naval officers had authority and large powers of punishment over merchant skippers. The British naval officers had not. In 1803-34, on the renewal of the war with France, the British government saw the necessity for regulating convoy more strictly than had hitherto been the case. It therefore passed “an act for the better protection of the trade of the United Kingdom during the present hostilities with France.” By this act (the 43rd Geo. III. Cap. 57) all vessels not exempted by special licence were required to sail in convoy and to conform to strict regulations, under penalties of £1000 (or, when the goods included government stores, of £1500) and the loss of all claim to insurance in case of capture.

(D. H.)

The object of convoying is to attach an official public character to the convoyed ships, *i.e.* a sort of assimilation of them to the escorting ship or ships of war. Thus European states and jurists hold that the declaration of the commander of the convoy, that there is no contraband of war on board the convoyed ships, pledges the national good faith, and must be assumed to be correct in the same way as it is assumed that the convoy itself is carrying no contraband of war. Great Britain has never taken this view. Down to 1907 she had maintained that it is materially impossible for any neutral state to exercise the necessary supervision to secure absolute accuracy of the ship’s papers. Number 29, however, of the instructions given by the government to the British plenipotentiaries at the Hague Conference of 1907 stated that “H.M. government would ... be glad to see the right of search limited in every practicable way, *e.g.* by the adoption of a system of consular certificates declaring the absence of contraband from the cargo...” As the greater includes the smaller, we may assume that, if a consular certificate might suffice to exempt from the exercise of search, the state guarantee of a convoy would certainly suffice. The London Convention on the Laws and Customs of Naval War has laid down the rules as to convoys in the following terms:

Neutral vessels under national convoy are exempt from search. The commander of a convoy gives, in writing, at the request of the commander of a belligerent warship, all information as to the character of the vessels and their cargoes, which could be obtained by search.—Art. 61.

If the commander of the belligerent warship has reason to suspect that the confidence of the commander of the convoy has been abused, he communicates his suspicions to him. In

such a case it is for the commander of the convoy alone to investigate the matter. He must record the result of such investigation in a report, of which a copy is handed to the officer of the warship. If, in the opinion of the commander of the convoy, the facts shown in the report justify the capture of one or more vessels, the protection of the convoy must be withdrawn from such vessels.—Art. 62.

(T. BA.)

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**CONVULSIONS**, the pathological condition of body associated with abnormal, violent and spasmodic contractions and relaxations of the muscles, taking the form of a fit. Convulsions may be a symptom resulting from various diseases, but the term is commonly restricted to the infantile variety, occurring in association with teething, or other causes which upset the child's nervous system. The treatment (plunging into a hot bath, or administration of chloroform) must be prompt, as convulsions are responsible for a large part of infant mortality.

The name "Convulsionaries" (Fr. *Convulsionnaires*) was given to certain Jansenist fanatics in France in the 18th century, owing to the convulsions, regarded by them as proofs of divine inspiration, which were the result of their religious ecstasies (see [JANSENISM](#)). The term "Convulsionists" is sometimes applied to them, as also, more loosely, to other religious enthusiasts who exhibit the same symptoms.

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**CONWAY, HENRY SEYMOUR** (1721-1795), English field marshal and statesman, was the second son of Francis Seymour, of Ragley, Warwickshire, who took the name of Conway on succeeding to the estates of the earl of Conway in 1699 and was created Baron Conway in 1703 (see [SEYMOUR](#) or [ST MAUR](#)). Henry Seymour Conway's elder brother, Francis, 2nd Baron Conway, was created marquess of Hertford in 1793; his mother was a sister of Sir Robert Walpole's wife, and he was therefore first cousin to Horace Walpole, with whom he was on terms of intimate friendship throughout his life. Having entered the army at an early age, Conway was elected to the Irish parliament in 1741 as member for Antrim, which he continued to represent for twenty years; in the same year he became a member of the English House of Commons, sitting for Higham Ferrers in Northamptonshire, and he remained in parliament, representing successively a number of different constituencies, almost without interruption for more than forty years. Meantime he saw much service in the army abroad, where he served with conspicuous bravery and not without distinction. In 1745 he became aide-de-camp to the duke of Cumberland in Germany, and was present at Fontenoy; in the following year he had command of a regiment at Culloden. In 1755 he went to Ireland as secretary to the lord-lieutenant, a position which he held for one year only; and on his return to England he received a court appointment, having already been promoted major-general. In 1757 he was associated with Sir John Mordaunt in command of an abortive expedition against Rochfort, the complete failure of which brought Conway into discredit and involved him in a pamphlet controversy. In 1759 he became lieutenant-general, and served under Prince Ferdinand of Brunswick in the campaigns of 1761-1763. Returning to England he took part in the debates in parliament on the Wilkes case, in which he opposed the views of the court, speaking strongly against the legality of general warrants. His conduct in this matter highly incensed the king, who insisted on Conway being deprived of his military command as well as of his appointment in the royal household. His dismissal along with other officers was the occasion of another paper controversy in which Conway was defended by Horace Walpole, and gave rise to much constitutional dispute as to the right of the king to remove military officers for their conduct in parliament—a right that was tacitly abandoned by the Crown when the Rockingham ministry of 1765 reinstated the officers who had been removed.

In this ministry Conway took office as secretary of state, with the leadership of the House of Commons. In the dispute with the American colonies his sympathies were with the latter, and in 1766 he carried the repeal of the Stamp Act. When in July of that year Rockingham gave place to Chatham, Conway retained his office; and when Chatham became

incapacitated by illness he tamely acquiesced in Townshend's reversal of the American policy which he himself had so actively furthered in the previous administration. In January 1768, offended by the growing influence of the Bedford faction which joined the government, Conway resigned the seals of office, though he was persuaded by the king to remain a member of the cabinet and "Minister of the House of Commons." When, however, Lord North became premier in 1770, Conway resigned from the cabinet and was appointed to the command of the royal regiment of horse guards; and in 1772 he became governor of Jersey, the island being twice invaded by the French during his tenure of command. In 1780 and 1781 he took an active part in opposition to Lord North's American policy, and it was largely as the result of his motion on the 22nd of February in the latter year, demanding the cessation of the war against the colonies, when the ministerial majority was reduced to one, that Lord North resigned office. In the Rockingham government that followed General Conway became commander-in-chief with a seat in the cabinet; and he retained office under Shelburne when Rockingham died a few months later. On Pitt's elevation to the premiership, Conway supported Fox in opposition; but after the dissolution of parliament in 1784 he retired from political life. He was made field marshal in 1793, and died at Henley-on-Thames on the 9th of July 1795. Conway married in 1747 Caroline, daughter of General Campbell (afterwards duke of Argyll), and widow of the earl of Aylesbury. He had one daughter, Anne, who married John Darner, son of Lord Milton, and who inherited a life interest in Strawberry Hill under the will of Horace Walpole.

Conway was personally one of the most popular men of his day. He was handsome, conciliatory and agreeable, and a man of refined taste and untarnished honour. As a soldier he was a dashing officer, but a poor general. He was weak, vacillating and ineffective as a politician, lacking in judgment and decision, and without any great parliamentary talent. In his later years he dabbled in literature and the drama, and interested himself in arboriculture in his retirement at Henley-on-Thames.

See Horace Walpole, *Letters*, edited by P. Cunningham (9 vols., London, 1857), many of the letters being addressed to Conway; *Memoirs of the Last Ten years of the Reign of George II.* (2 vols., London, 1822); *Memoirs of the Reign of George III.*, edited by Sir D. le Marchant (4 vols., London, 1845); *Journal of the Reign of George III., 1771-1783* (2 vols., London, 1859). See also the duke of Buckingham and Chandos, *Memoirs of the Court and Cabinets of George III.* (4 vols., London, 1853). Much information about Conway will also be found in the biographies of his leading contemporaries, Rockingham, Shelburne, Chatham, Pitt and Fox.

(R. J. M.)

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**CONWAY, HUGH**, the nom-de-plume of FREDERICK JOHN FARGUS (1847-1885), English novelist, who was born at Bristol on the 26th of December 1847, the son of an auctioneer. He was intended for his father's business, but at the age of thirteen joined the training-ship "Conway" in the Mersey. In deference to his father's wishes, however, he gave up the idea of becoming a sailor, and returned to Bristol, where he was articled to a firm of accountants till on his father's death in 1868 he took over the family business. While a clerk he had written the words for various songs, adopting the nom-de-plume Hugh Conway in memory of his days on the training-ship. Mr Arrowsmith, the Bristol printer and publisher, took an interest in his work, and Fargus's first short story appeared in *Arrowsmith's Miscellany*. In 1883 Fargus published through Arrowsmith his first long story, *Called Back*, of which over 350,000 copies were sold within four years. A dramatic version of this book was produced in London in 1884, and in this year Fargus published another story, *Dark Days*. Ordered to the Riviera for his health, he caught typhoid fever, and died at Monte Carlo on the 15th of May 1885. Several other books from his pen appeared posthumously, notably *A Family Affair*.

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**CONWAY, MONCURE DANIEL** (1832-1907), American clergyman and author, was born of an old Virginia family in Stafford county, Virginia, on the 17th of March 1832. He graduated at Dickinson College in 1849, studied law for a year, and then became a

Methodist minister in his native state. In 1852, owing largely to the influence of Ralph Waldo Emerson, his religious and political views underwent a radical change, and he entered the Harvard Divinity School, where he graduated in 1854. Here he fell under the influence of "transcendentalism," and became an outspoken abolitionist. On his return to Virginia this fact and his rumoured connexion with the attempt to rescue the fugitive slave, Anthony Burns, in Boston aroused the bitter hostility of his old neighbours and friends, and in consequence he left the state. In 1854-1856 he was pastor of a Unitarian church at Washington, D.C., but his anti-slavery views brought about his dismissal. From 1856 to 1861 he was a Unitarian minister in Cincinnati, Ohio, where, also, he edited a short-lived liberal periodical called *The Dial*. Subsequently he was an editor of the *Commonwealth* in Boston, Mass., and wrote *The Rejected Stone* (1861) and *The Golden Hour* (1862), both powerful pleas for emancipation. In 1862-1863, during the Civil War, he lectured in England in behalf of the North. From 1863 to 1884 he was the minister of the South Place chapel, Finsbury, London; and during this time wrote frequently for the London press. In 1884 he returned to the United States to devote himself to literary work. In addition to those above mentioned, his publications include *Tracts for To-day* (1858), *The Natural History of the Devil* (1859), *Testimonies Concerning Slavery* (1864), *The Earthward Pilgrimage* (1870), *Republican Superstitions* (1872), *Idols and Ideals* (1871), *Demonology and Devil Lore* (2 vols., 1878), *A Necklace of Stories* (1879), *Thomas Carlyle* (1881), *The Wandering Jew* (1881), *Emerson at Home and Abroad* (1882), *Pine and Palm* (2 vols., 1887), *Life and Papers of Edmund Randolph* (1888), *The Life of Thomas Paine* with an unpublished sketch of Paine by William Cobbett (2 vols., 1892), *Solomon and Solomonic Literature* (1899), his *Autobiography* (2 vols., 1900), and *My Pilgrimage to the Wise Men of the East* (1906). Conway died on the 15th of November 1907.

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**CONWAY, SIR WILLIAM MARTIN** (1856- ), English art critic and mountaineer, son of the Rev. William Conway, afterwards canon of Westminster, was born at Rochester, and was educated at Repton and at Trinity College, Cambridge. He became interested in early printing and engraving, and in 1880 made a tour of the principal libraries of Europe in pursuit of his studies, the result appearing in 1884 as a *History of the Woodcutters of the Netherlands in the Fifteenth Century*. His later works on art included *Early Flemish Artists* (1887); *The Literary Remains of Albrecht Dürer* (1889); *The Dawn of Art in the Ancient World* (1891), dealing with Chaldaean, Assyrian and Egyptian art; *Early Tuscan Artists* (1902). From 1884 to 1887 he was professor of art at University College, Liverpool; and in 1901-1904 he was Slade professor of the fine arts at Cambridge. He was knighted in 1895. Sir Martin Conway early became a member of the Alpine Club, of which he was president from 1902 to 1904. In 1892 he beat the climbing record by ascending to a height of 23,000 ft. in the Himalayas in the course of an exploring and mountaineering expedition undertaken under the auspices of the Royal Society, the Royal Geographical Society and the British Association. In 1896-1897 he explored the interior of Spitsbergen, and in the next year he explored and surveyed the Bolivian Andes, climbing Sorata (21,500 ft.) and Illimani (21,200 ft.). He also ascended Aconcagua (23,080 ft.) and explored Tierra del Fuego. At the Paris exhibition of 1900 he received the gold medal for mountain surveys, and the founder's medal of the Royal Geographical Society in 1905. His expeditions are described in his *Climbing and Exploration in the Kara-Koram Himalayas* (1894), *The Alps from End to End* (1895), *The First Crossing of Spitsbergen* (1897), *The Bolivian Andes* (1901), &c.; *No Man's Land, a History of Spitsbergen from ... 1596 ...* was published in 1906.

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**CONWAY** (*Conwy*, or *Aberconwy*), a municipal borough in the Arfon parliamentary division of Carnarvonshire, N. Wales, 14 m. by the London & North-Western railway from Bangor, and 225 m. N.W. from London. Pop. (1901) 4681. The town is enclosed by a high wall, roughly triangular, about 1 m. round, with twenty-one dilapidated round towers, pierced by three principal gateways with two strong towers. The castle in the south-east angle, built in 1284 by Edward I., was inhabited, in 1389, by Richard II., who here agreed to

abdicate. Held for Charles I. by Archbishop Williams, it was taken by General Mytton in 1646. Dismantled by the new proprietor, Earl Conway, it remains a ruin. It is oblong, with eight massive towers, and has, within, a hall 130 ft. in length, known as Llewelyn's. The parliamentary borough of Conway, returning, with five other towns, one member, extends over to the right bank of the stream Conwy (Conway). In 1885 the mayor of Conway was made a constable. Llandudno with Great and Little Orme's Heads are at some 4 m. distance. Two bridges, a tubular for the railway (40 ft. shorter than that of the Menai) and a suspension, designed by Stephenson (1846-1848) and Telford (1822-1826) respectively, cross the stream. St Mary's church is Gothic; the Elizabethan Plâs Mawr is the *locale* of the Royal Cambrian Academy of Art. There are still some fragments of the 1185 Cistercian Abbey. There are golf links here and at Llandudno. The Conwy stream, on which a steamboat runs from Deganwy (2 m. below Conway town) to Trefriw, opposite Llanrwst, in summer, has some coasting trade in sulphur and slates. It is about 30 m. long, its valley (a haunt of artists) containing the towns last mentioned and Bettws y coed. Its pearls are mentioned in Drayton's *Polyolbion* and Spenser's *Faerie Queene*. Pearl fisheries existed at Conway for many centuries, dating back to the Roman occupation. Tacitus, *Agricola*, 12, says of Britain "gignit et Oceanus margarita, sed subfusca ac liventia," as are those found today. Diganhwy (Dyganwy, Deganwy) is mentioned in the *Mabinogion* (*Geraint and Enid*), if the reading is sound; it is certainly mentioned in the *Annales Cambriae* (years 812-822) and in the *Black Book of Caerfyrddin* (Carmarthen), xxiii. 1. Caer-hyn, 4½ m. from Conway, is on the highroad from London to Holyhead, and is the *Conovium* of the Romans. The site of the camp can still be traced, consisting of a square, strengthened by four parallel walls, extending to a distance from the main work. The camp is on a height, with the Conwy in front and a wood on each flank. At the foot of the hill, near the stream, was a Roman bath, with walls, pavement and pillars. Camden's *Britannia* mentions tiles, with marks of the 10th or Antoninus's legion, as being found here, perhaps mistakenly. *Gleini nadroedd* (possibly amulets) and *vitrum* have been found here. In Bwlch y ddwy faen ("two rock ravine"), on the way to Aber, are the remains of a Roman road and antiquities.

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**CONYBEARE, WILLIAM DANIEL** (1787-1857), dean of Llandaff, one of the most distinguished of English geologists, who was born in London on the 7th of June 1787, was a grandson of John Conybeare, bishop of Bristol (1692-1755), a notable preacher and divine, and son of Dr William Conybeare, rector of Bishopsgate. Educated first at Westminster school, he went in 1805 to Christ Church, Oxford, where in 1808 he took his degree of B.A., with a first in classics and second in mathematics, and proceeded to M.A. three years later. Having entered holy orders he became in 1814 curate of Wardington, near Banbury, and he accepted also a lectureship at Brislington near Bristol. During this period he was one of the founders of the Bristol Philosophical Institution (1822). He was rector of Sully in Glamorganshire from 1823 to 1836, and vicar of Axminster from 1836 to 1844. He was appointed Bampton lecturer in 1839, and was instituted to the deanery of Llandaff in 1845. Attracted to the study of geology by the lectures of Dr John Kidd (*q.v.*) he pursued the subject with ardour. As soon as he had left college he made extended journeys in Britain and on the continent, and he became one of the early members of the Geological Society. Both Buckland and Sedgwick acknowledged their indebtedness to him for instruction received when they first began to devote attention to geology. To the *Transactions of the Geological Society* as well as to the *Annals of Philosophy* and *Philosophical Magazine* he contributed many geological memoirs. In 1821 he distinguished himself by the description of a skeleton of the *Plesiosaurus*, discovered by Mary Anning, and his account has been confirmed in all main points by subsequent researches. Among his most important memoirs is that on the south-western coal district of England, written in conjunction with Dr Buckland, and published in 1824. He wrote also on the valley of the Thames, on Elie de Beaumont's theory of mountain-chains, and on the great landslip which occurred near Lyme Regis in 1839 when he was vicar of Axminster. His principal work, however, is the *Outlines of the Geology of England and Wales* (1822), being a second edition of the small work issued by William Phillips (*q.v.*) and written in co-operation with that author. The original contributions of Conybeare formed the principal portion of this edition, of which only Part I., dealing with the Carboniferous and newer strata, was published. It affords evidence throughout of the extensive and accurate knowledge possessed by Conybeare; and it exercised a marked influence on the progress of geology in this country. He was a fellow of the Royal Society

and a corresponding member of the Institute of France. In 1844 he was awarded the Wollaston medal by the Geological Society of London. The loss of his eldest son, W. J. Conybeare, preyed on his mind and hastened his end. He died at Itchenstoke, near Portsmouth, a few months after his son, on the 12th of August 1857. (Obituary in *Gent. Mag.* Sept. 1857, p. 335.)

His elder brother JOHN JOSIAS CONYBEARE (1779-1824), also educated at Christ Church, Oxford, and an accomplished scholar, became vicar of Batheaston, and was professor of Anglo-Saxon and afterwards of poetry at Oxford. He likewise was an ardent student of geology and communicated several important papers to the *Annals of Philosophy* and the *Transactions of the Geological Society* of London. (Obituary in *Ann. Phil.* vol. viii., Sept. 1824, p. 162.)

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**CONYBEARE, WILLIAM JOHN** (1815-1857), English divine, son of Dean W. D. Conybeare, was born on the 1st of August 1815, and was educated at Westminster and at Trinity College, Cambridge, where he was elected fellow in 1837. From 1842 to 1848 he was principal of the Liverpool Collegiate Institution, which he left for the vicarage of Axminster. He published *Essays, Ecclesiastical and Social*, in 1856, and a novel, *Perversion, or the Causes and Consequences of Infidelity*, but is best known as the joint author (with J. S. Howson) of *The Life and Epistles of St Paul* (1851). He died at Weybridge in 1857.

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**COODE, SIR JOHN** (1816-1892), English engineer, was born at Bodmin, Cornwall, on the 11th of November 1816, the son of a solicitor. After considerable experience as an engineer in the west of England he came to London, and from 1844-1847 had a consulting practice in Westminster. In the latter year he was appointed resident engineer in charge of the extensive national harbour works at Portland then in progress. In 1856 he was appointed engineer-in-chief of this undertaking, and this post he retained till the completion of the works in 1872. His services at Portland were rewarded with a knighthood. He was now recognized as the leading authority on harbour construction, and his advice was sought by many of the colonial governments, especially by those of South Africa and Australia, and by the Indian government. After the Portland harbour his best-known work is the harbour of Colombo, Ceylon. He was made a K.C.M.G. in 1886. From 1884 till his death he was a member of the Suez Canal Commission, and from 1889-1891 president of the Institution of Civil Engineers. He died at Brighton on the 2nd of March 1892.

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**COOK, ALBERT STANBURROUGH** (1853- ), American scholar, was born on the 6th of March 1853 in Montville, Morris county, New Jersey. He graduated at Rutgers College in 1872, and also studied at Göttingen and Leipzig (1877-1878), and, after spending the years 1879-1881 as associate in English at Johns Hopkins University, in London, and under Sievers at Jena, he became in 1882 professor of English in the University of California, and in 1889 professor of English language and literature in Yale University. He re-organized the teaching of English in the state of California, and edited many texts for reading in secondary schools; but he is best known for his work in Old English and in poetics. He translated, edited, and revised Sievers' *Old English Grammar* (1885), edited *Judith* (1888), *The Christ of Cynewulf* (1900), *Asser's Life of King Alfred* (1905), and *The Dream of the Rood* (1905), and prepared *A First Book in Old English Grammar* (1894). He also edited, with annotations, *Sidney's Defense of Poesie* (1890); *Shelley's Defense of Poetry* (1891); *Newman's Poetry* (1891); *Addison's Criticisms on Paradise Lost* (1892); *The Art of Poetry* (1892), being the essays of Horace, Vida and Boileau; and *Leigh Hunt's What is Poetry* (1893); and published *Higher Study of English* (1906).

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**COOK, EDWARD DUTTON** (1829-1883), English dramatic critic and author, was born in London on the 30th of January 1829, the son of a solicitor. He was educated at King's College school, London, and, after four years in his father's office, obtained a situation in the London office of a railway company, at first utilizing only his spare time in literary work, but eventually devoting himself entirely to literature. He was dramatic critic of the *Pall Mall Gazette* from 1867 to 1875, and of the *World* from 1875 till his death. He also wrote freely on art topics, and was the author of several novels. He died in London on the 11th of September 1883.

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**COOK, ELIZA** (1818-1889), English author, was born on the 24th of December 1818, in Southwark, being the daughter of a local tradesman. She was self-taught, and began when a girl to write poetry for the *Weekly Dispatch* and *New Monthly*. In 1838 she published *Melaia and other Poems*, and from 1849 to 1854 conducted a paper for family reading called *Eliza Cook's Journal*. She also published *Jottings from my Journal* (1860), and *New Echoes* (1864); and in 1863 she was given a civil list pension of £100 a year. As the author of a single poem, "The Old Armchair," Eliza Cook's name was for a generation after 1838 a household word both in England and in America, her kindly domestic sentiment making her a great favourite with the working-class and middle-class public. She died at Wimbledon on the 23rd of September 1889.

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**COOK, JAMES** (1728-1779), English naval captain and explorer, was born on the 28th of October 1728, at Marton village, Cleveland, Yorkshire, where his father was first an agricultural labourer and then a farm bailiff. At twelve years of age he was apprenticed to a haberdasher at Staithes, near Whitby, and afterwards to Messrs Walker, shipowners, of Whitby, whom he served for years in the Norway, Baltic and Newcastle trades.

In 1755, having risen to be a mate, Cook joined the royal navy, and after four years' service was, on the recommendation of Sir Hugh Palliser, his commander, appointed master successively of the sloop "Grampus," of the "Garland" and of the "Solebay," in the last of which he served in the St Lawrence. He was employed also in sounding and surveying the river, and he published a chart of the channel from Quebec to the sea. In 1762 he was present at the recapture of Newfoundland, and was employed in surveying portions of this coast (especially Placentia Harbour); in 1763, on Palliser becoming governor of Newfoundland, Cook was appointed "marine surveyor of the coast of Newfoundland and Labrador"; this office he held till 1767; and the volumes of sailing directions he now brought out (1766-1768) showed remarkable abilities. At the same time he began to make his reputation as a mathematician and astronomer by his observation of the solar eclipse of the 5th of August 1766, at one of the Burgeo Islands, near Cape Ray, and by his account of the same in the *Philosophical Transactions* (vol. lvii. pp. 215-216).

In 1768 Cook was appointed to conduct an expedition, suggested by the revival of geographical interest now noticeable, and resolved on by the English admiralty at the instance of the Royal Society, for observing the impending transit of Venus, and prosecuting geographical researches in the South Pacific Ocean. For these purposes he received a commission as lieutenant (May 25th), and set sail in the "Endeavour," of 370 tons, accompanied by several men of science, including Sir Joseph Banks (August 25th). On the 13th of April 1769, he reached Tahiti, where he observed the transit on the 3rd of June. From Tahiti he sailed in quest of the great continent then supposed to exist in the South Pacific, explored the Society Islands, and thence struck to New Zealand, whose coasts he



circumnavigated and examined with great care for six months, charting them for the first time with fair accuracy, and especially observing the channel ("Cook Strait") which divided the North and South Islands. His attempts to penetrate to the interior, however, were thwarted by native hostility. From New Zealand he proceeded to "New Holland" or Australia, and surveyed with the same minuteness and accuracy the whole east coast. New South Wales he named after a supposed resemblance to Glamorganshire; Botany Bay, sighted on the 28th of April 1770, was so called by the naturalists of the expedition. On account of the hostility of the natives his discoveries here also were confined to the coast, of which he took possession for Great Britain. From Australia Cook sailed to Batavia, satisfying himself upon the way that (as Torres had first shown in 1607) New Guinea was in no way an outlying part of the greater land mass to the south.

Arriving in England, by way of the Cape of Good Hope, on the 12th of June, Cook was made a commander, and soon after was appointed to command another expedition for examining and determining once for all the question of the supposed great southern continent. With the "Resolution" of 462 tons, the "Adventure" (Captain Furneaux) of 330 tons, and 193 men, he sailed from Plymouth on the 13th of July 1772; he touched at the Cape of Good Hope, and striking thence south-east (November 22nd) passed the Antarctic Circle (January 16th, 1773), repassed the same, and made his way to New Zealand (March 26th) without discovering land. From New Zealand he resumed his "search for a continent," working up and down across the South Pacific, and penetrating to 67° 31' and again to 71° 10' S., with imminent risk of destruction from floating ice, but with the satisfaction of disproving the possibility of the disputed continent in the seas south-eastward of New Zealand. He then made for Easter Island, whose exact position he determined, for the first time, with accuracy; noticing and describing the gigantic statues which Roggewein, the first discoverer of the island, had made known. In the same manner he accomplished a better determination and examination of the Marquesas, as well as of the Tonga or Friendly Islands, than had yet been made; and after a stay at Tahiti to rest and refit, crossed the central Pacific to the "New Hebrides," as he renamed Quiros's "Southern Land of the Holy Spirit" (a name preserved in the modern island of *Espiritu Santo*), called by Bougainville the "Great Cyclades" (*Grandes Cyclades*), whose position, extent, divisions and character were now verified as never before. Next followed the wholly new discoveries of New Caledonia, Norfolk Island, and the Isle of Pines. Another visit to New Zealand, and yet another examination of the far southern Pacific, which was crossed from west to east through the whole of its extent, from south Australia to Tierra del Fuego, were now undertaken by Cook before he finally closed his work in refutation of the Antarctic continent, as previously understood, on this side of the world. The voyage closed with a rapid survey of the "Land of Fire," the rounding of Cape Horn, the rediscovery of the island now named Southern Georgia, the discovery of Sandwich Land, the crossing of the South Atlantic (here also exploding the great *Terra Australis* delusion), and visits to the Cape of Good Hope, St Helena, Ascension, Fernando Noronha and the Azores. The voyage (reckoning only from the Cape of Good Hope and back to the same) had covered considerably more than 20,000 leagues, nearly three times the equatorial circumference of the earth; it left the main outlines of the southern portions of the globe substantially as they are known to-day; and it showed a possibility of keeping a number of men for years at sea without a heavy toll of lives. Cook only lost one man out of 118 in more than 1000 days; he had conquered scurvy.

The discoverer reached Plymouth on the 25th of July 1775, and his achievements were promptly, if meanly, rewarded. He was immediately raised to the rank of post-captain, appointed a captain in Greenwich hospital, and soon afterwards unanimously elected a member of the Royal Society, from which he received the Copley gold medal for the best experimental paper which had appeared during the year.

Cook's third and last voyage was primarily to settle the question of the north-west passage, practically abandoned since before the middle of the 17th century, but now taken up again, as a matter of scientific interest, by the British government. The explorer, who had volunteered for this service, was instructed to sail first into the Pacific through the chain of the newly discovered islands which he had recently visited, and on reaching New Albion to proceed northward as far as latitude 65° and endeavour to find a passage to the Atlantic. Several ships were at the same time fitted out to attempt a passage on the other side from the Atlantic to the Pacific. Sailing from the Nore on the 25th of June 1776 (Plymouth, July 12), with the "Resolution" and "Discovery," and touching at the Cape of Good Hope, which he left on the 30th of November, Cook next made Tasmania and thence passed on to New Zealand and the Tonga and Society Islands, discovering on his way several of the larger members of the Hervey or Cook Archipelago, especially Mangaia and Aitutaki (March 30th-April 4th, 1777); some smaller isles of this group he had already sighted on his second

voyage, September 23rd, 1773. From Tahiti, as he moved north towards the main object of his expedition, he made a far more important discovery, or rather rediscovery, that of the Hawaiian or Sandwich Islands, the greatest and most remarkable of the Polynesian archipelagos (early February 1778). These had perhaps first been seen by the Spanish navigator Gaetano in 1555; but their existence had been kept a close secret by Spain at the time, and had long been forgotten. Striking the west American coast in 44° 55' N. on the 7th of March following, he made an almost continuous survey of the same up to Bering Straits and beyond, as far as 70° 41', where he found the passage barred by a wall, or rather continent, of ice, rising 12 ft. above water, and stretching as far as the eye could reach. The farthest point visible on the American shore (in the extreme north-west of Alaska) he called Icy Cape. On his way towards Bering Straits he discovered and named King George's ("Nootka") and Prince William's Sound, as well as Cape Prince of Wales, the westernmost extremity of North America, never yet seen by English navigators, but well known to Russian explorers, who probably first sighted it in 1648; he also penetrated into the bay afterwards known as Cook's Inlet or River, which at first seemed to promise a passage to the Arctic Seas, to the south-east of the Alaska peninsula. Cook next visited the Asiatic shores of Bering Straits (the extreme north-east of Siberia); returning to America, he explored Norton Sound, north of the Yukon; touched at (Aleutian) Unalaska, where he met with some Russian-American settlers; and thence made his way back to the Hawaiian group, which he had christened after his friend and patron Lord Sandwich, then head of the British admiralty (January 17th, 1779). Here he visited Maui and Hawaii itself, whose size and importance he now first realized, and in one of whose bays (Kealakekua) he met his death early in the morning of the 14th of February 1779. During the night of the 13th, one of the "Discovery's" boats was stolen by the natives; and Cook, in order to recover it, made trial of his favourite expedient of seizing the king's person until reparation should be made. Having landed on the following day with some marines, a scuffle ensued which compelled the party to retreat to their boats. Cook was the last to retire; and as he was nearing the shore he received a blow from behind which felled him to the ground. He rose immediately, and vigorously resisted the crowds that pressed upon him, but was soon overpowered.

Had Cook returned from his third voyage, there is ground for believing King George would have made him a baronet. Distinguished honours were paid to his memory, both at home and by foreign courts, and a pension was settled upon his widow. But in his life a very inadequate share of official reward was dealt out to the man who not only may be placed first among British maritime discoverers, but also gave his country her title, and so her colonies, in Australasia. As a commander, an observer and a practical physician, his merits were equally great. Reference has been made to his survey work and to his victory over scurvy; it must not be forgotten that along with a commanding personal presence, and with sagacity, decision and perseverance quite extraordinary, went other qualities not less useful to his work. He won the affection of those who served under him by sympathy, kindness and unselfish care of others as noteworthy as his gifts of intellect.

See the *Account of a Voyage round the World in 1769-1771*, by Lieut. James Cook, in vols. ii. and iii. of Hawkesworth's *Voyages* (1773); the *Voyage towards the South Pole and round the World ... in ... 1772-1775*, written by James Cook ... (1777); a *Voyage to the Pacific Ocean ... in 1776-1780*, vols. i. and ii. written by Cook (1784); also the *Narrative of the Voyages round the World performed by Captain James Cook*, by A. Kippis, D.D., F.R.S. (1788), long the standard life of the navigator, but now superseded by Arthur Kitson's *Captain James Cook, the Circumnavigator* (1907).

(C. R. B.)

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**COOK, THOMAS** (1808-1892), English travelling agent, was born at Melbourne in Derbyshire on the 22nd of November 1808. Beginning work at the age of ten, he was successively a gardener's help and a wood-turner at Melbourne, and a printer at Loughborough. At the age of twenty he became a Bible-reader and village missionary for the county of Rutland; but in 1832, on his marriage, combined his wood-turning business with that occupation. In 1836 he became a total abstainer, and subsequently became actively associated with the temperance movement, and printed at his own expense various publications in its interest, notably the *Children's Temperance Magazine* (1840), the first of its kind to appear in England. In June 1841 a large meeting was to be held at Loughborough in connexion with this movement, and Cook was struck with the idea of getting the Midland

Counties Railway Company to run a special train from Leicester to the meeting. The company consented, and on the 5th of July there were carried 570 passengers from Leicester to Loughborough and back at a shilling a head. This is believed to be the first publicly-advertised excursion train ever run in England—private “specials,” reserved for members of institutes and similar bodies, were already in use. The event caused great excitement, and Cook received so many applications to organize similar parties that he henceforward deserted wood-turning, while continuing his printing and publishing. The summers of the next three years were occupied with excursions like the first; but in 1845 Cook advertised a pleasure-trip on a more extensive scale, from Leicester to Liverpool and back, with opportunities for visiting the Isle of Man, Dublin and Welsh coast. A *Handbook of the Trip to Liverpool* was supplied for the use of travellers. In the previous year Cook had entered into a permanent arrangement with the Midland Railway Company to place trains at his disposal, for which he should provide the passengers. A trip to Scotland followed, and the excursionists were received in Glasgow with music and salute of guns.

The next great impetus to popular travel was given by the Great Exhibition of 1851, which Cook helped 165,000 visitors to attend. On the occasion of the Paris exhibition of 1855 there was a Cook's excursion from Leicester to Calais and back for £1:10s. The following year saw the first grand circular tour in Europe. This part of Cook's activity largely increased after 1863, when the Scottish railway managers broke off their engagements with him, and left him free for more distant enterprise. Switzerland was opened up in 1863, and Italy in 1864. Up to this time “Cook's tourists” had been personally conducted, but now he began to be an agent for the sale of English and foreign tickets, the holders of which travelled independently. Switzerland was the first foreign country accessible under these conditions, and in 1865 nearly the whole of Europe was included in the scheme. Its extension to the United States followed in 1866. For the benefit of visitors to the Paris exhibition, Cook made a fresh departure and leased a hotel there. In the same year began his system of “hotel-coupons,” providing accommodation at a fixed charge. The year 1869 was marked by an extension of Cook's tours to Palestine, followed by further developments of travel in the East, his son, John Mason Cook, (1834-1899), being appointed in 1870 agent of the khedivial government for passenger traffic on the Nile. The Franco-German War of 1870-1871 was expected to damage the tourist system, but, as a matter of fact, encouraged it, through the demand for combination, international tickets enabling travellers to reach the south of Europe without crossing the belligerent countries. At the termination of the war a party of American freemasons visited Paris under J. M. Cook's guidance, and became the precursors of the present vast American tourist traffic. At the beginning of 1872 J. M. Cook entered into formal partnership with his father, and the firm first took the name of Thomas Cook & Son. In 1882, on the outbreak of Arabi Pasha's rebellion, Thomas Cook & Son were commissioned to convey Sir Garnet Wolseley and his suite to Egypt, and to transport the wounded and sick up the Nile by water, for which they received the thanks of the war office. The firm was again employed in 1884 to convey General Gordon to the Sudan, and the whole of the men (18,000) and stores necessary for the expedition afterwards sent to relieve him. In 1889 Thomas Cook & Son acquired the exclusive right of carrying the mails, specie, soldiers and officials of the Egyptian government along the Nile. In 1891 the firm celebrated its jubilee, and on the 19th of July of the following year Thomas Cook died. He had been afflicted with blindness in his declining years. His son, J. M. Cook, died in 1899, leaving three sons, all actively engaged in the business.

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**COOK** or **HERVEY ISLANDS**, an archipelago in the Pacific Ocean, lying mainly between 155° and 160° E., and about 20° S.; a dependency of the British colony of New Zealand. It comprises nine partly volcanic, partly coralline, islands, the more important of which are Rarotonga, hilly, fertile and well watered, with several cones 300 to 400 ft. high, above which towers the majestic Rarotonga volcano (2920 ft.), the culminating point of the archipelago; Mangaia (Mangia); Aitutaki, with luxuriant cocoa-nut palm groves; Atui (Vatui); Mitiero; Mauki; Fenuaiti; and the two Hervey Islets, which give an alternative name to the group. The total land area is 111 sq. m. Owing to its healthy, equable climate, the archipelago is well suited for European settlement; but the dangerous fringing coral reefs render it difficult of access, and it suffers also from the absence of good harbours. The natives, who are of Polynesian stock and speech, have legends of their emigration from Samoa. They say their ancestors found black people on the islands, and the strongly

Melanesian type which is found, especially on Mangaia, supports the statement. The Cook Islanders were formerly man-hunters and cannibals, but they now are nearly all Protestants, wear European dress and live in stone houses. The total population is about 6200. Since 1890 the islands have enjoyed a general legislature and an executive council of which the *Arikis* ("kings" and "queens") are members. But all enactments are subject to the approval of the British resident at Rarotonga, and a British protectorate, proclaimed in 1888, was followed by the annexation of the whole archipelago by the governor of New Zealand, by proclamation of June 10th, 1901. The archipelago was discovered by Captain Cook in 1777, and in 1823 became the scene of the remarkable missionary labours of John Williams, of the London Missionary Society. The chief products of the group are coconuts, fruits, coffee and copra. Lime-juice and hats are made.

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**COOKE, GEORGE FREDERICK** (1756-1811), English actor, was born in London, and made his first appearance on the stage in Brentford at the age of twenty as Dumont in *Jane Shore*. His first London appearance was at the Haymarket in 1778, but it was not until 1794 in Dublin, as Othello, that he attained high rank in his profession. In 1801 he appeared in London as Richard III., Iago, Shylock and Sir Giles Overreach, and became the rival of Kemble, with whom, however, and with Mrs Siddons, he acted from 1803. His intemperate habits unfortunately grew more and more notorious, and on at least one occasion the curtain had to be rung down owing to the audience hissing his drunken condition. He visited the United States in 1810, and died in New York on the 26th of September 1811. A monument to his memory was erected in St Paul's churchyard there by Edmund Kean.

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**COOKE, JAY** (1821-1905), American financier, was born at Sandusky, Ohio, on the 10th of August 1821, the son of Eleutheros Cooke (1787-1864), a pioneer Ohio lawyer, and Whig member of Congress from that state in 1831-1833. Being destined for a commercial career, Jay Cooke received a preliminary training in a trading house in St Louis, and in the booking office of a transportation company in Philadelphia, and at the age of eighteen entered the Philadelphia house of E.W. Clark & Company, one of the largest private banking firms in the country. He showed such aptitude for business that three years later he was admitted to membership in the firm, and before he was thirty he was also a partner in the New York and St Louis branches of the Clarks. In 1858 he retired from the firm, and for the next three years he devoted himself to reorganizing some of the abandoned Pennsylvania railways and canals and placing them again in operation. On the 1st of January 1861 he opened in Philadelphia the private banking house of Jay Cooke & Company, and soon achieved signal success in floating at par a war loan of \$3,000,000 for the state of Pennsylvania, whose credit had become notoriously bad. In the early months of the Civil War Cooke co-operated with the secretary of the treasury, Salmon P. Chase, in securing loans from the leading bankers in the Northern cities, and his own firm was so successful in distributing treasury notes that Chase engaged him as special agent for the sale of the \$500,000,000 of so-called "five-twenty" bonds authorized by the act of the 25th of February 1862. To dispose of these bonds the treasury department had already tried every regular means at its command and had failed. Cooke secured the influence of the American press, appointed 2500 sub-agents, and before the machinery he set in motion could be stopped he had sold \$11,000,000 more of bonds than had been authorized, an excess which Congress immediately sanctioned. At the same time he used all his influence in favour of the establishment of national banks, and organized a national bank at Washington and another at Philadelphia almost as soon as such institutions were authorized by Congress. In the early months of 1865, when the needs of the government were pressing, and the sale of the new "seven-thirty" notes by the national banks had been very disappointing, Cooke's services were again secured. He sent agents into the remotest villages and hamlets, and even into the isolated mining camps of the West, and caused the rural newspapers to praise the loan. As a result, between February and July 1865 he had disposed of three series of the notes, reaching a total of \$830,000,000. Through these efforts the Union soldiers were well supplied and well paid while dealing the final

blows of the war; and, later, with money in their pockets, they were disbanded without difficulty.

After the war Cooke became interested in the development of the North-west, and in 1870 his firm undertook to finance the construction of the Northern Pacific railway. In advancing the money for the work, the firm over-estimated the possibilities of its capital, and at the approach of the financial crisis of 1873 it was forced to suspend. By 1880 Cooke had discharged all his obligations, and through an investment in a silver mine in Utah had again become wealthy. He died at Ogontz, Pennsylvania, on the 18th of February 1905. Cooke was noted for his piety, and gave regularly a tenth of his income for religious and charitable purposes. His handsome estate at Ogontz, which he had been compelled to give up during his bankruptcy, he later repurchased and converted into a school for girls.

See E. P. Oberholtzer, *Jay Cooke, Financier of the Civil War* (Philadelphia, 1907).

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**COOKE, ROSE TERRY** (1827-1892), American writer, *née* Terry, was born at West Hartford, Connecticut, on the 17th of February 1827. She published in 1860 a volume of *Poems*, but after her marriage in 1873 to Rollin H. Cooke she was best known for her fresh and humorous stories, though in 1888 she published more verse in her *Complete Poems*. The chief volumes of fiction dealing mainly with New England country life, produced by Rose Terry Cooke, were *Happy Dodd* (1878), *Somebody's Neighbors* (1881), *Root-bound* (1885), *The Sphinx's Children* (1886), *Steadfast* (1889) and *Huckleberries* (1891). She died at Pittsfield, Massachusetts, on the 18th of July 1892.

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**COOKERY** (Lat. *coquus*, a cook), the art of preparing and dressing food of all sorts for human consumption, of converting the raw materials, by the application of heat or otherwise, into a digestible and pleasing condition, and generally ministering to the satisfaction of the appetite and the delight of the palate. We may take it that some form of cookery has existed from the earliest times, and its progress has been from the simple to the elaborate, dominated partly by the foods accessible to man, partly by the stage of civilization he has attained, and partly by the appliances at his command for the purpose either of treating the food, or of consuming it when served.

The developed art of cookery is necessarily a late addition—if it may be considered to be included at all—to the list of “fine arts.” Originally it is a purely industrial and useful art. Man, says a French writer, was born a roaster, and “*pour être cuisinier, il a besoin de le devenir.*” The ancients were great eaters, but strangers to the subtler refinements of the palate. The gods were supposed to love the smell of fried meat, while their nectar and ambrosia represented an ideal, which, though preserved as a phrase, would hardly satisfy a modern epicure. The ancients were poorly provided with pots and pans, except of a simple order, or with the appurtenances of a kitchen, and they were sadly to seek in the requisites of a modern table. So long as men ate with their hands no dainty confection was suitable; the viands were set forth in a straightforward style fit for their requirements. “Plain cooking,” which, after all, can never become obsolete, was the only sort. Oddities, no doubt, were the luxuries; and we can see to-day in the ethnological accounts of contemporary savages and backward civilizations, a fair representation of the cookeries of the ancients. The luxuries of the Chinese are, in their way, a survival of long ages of a cookery which to western civilization is grotesque. Even if it is an historic impertinence, it is impossible for the countries of western civilization to regard the fine flower of their own evolution as other than the highest pitch of progress. *Autres temps, autres mœurs.* To the Chinaman French cooking may possibly be as grotesque as to an Englishman the Chinaman’s hundred-year-old buried egg, black and tasteless. The history of comparative cookery is bound up with the physical possibilities of each country and its products; and if we attempt to mark out stages in the evolution of cookery as a fine art, it is necessarily as understood by the so-called civilized peoples of the West in their culmination at the present day.

It is obvious that opportunity has dominated its history, for the art of cookery is to some extent the product of an increased refinement of taste, consequent on culture and increase of wealth. To this extent it is a decadent art, ministering to the luxury of man, and to his progressive inclination to be pampered and have his appetite tickled. It is thus only remotely connected with the mere necessities of nutrition (*q.v.*), or the science of dietetics (*q.v.*). Mere hunger, though the best sauce, will not produce cookery, which is the art of sauces. For centuries its elaboration consisted mainly of a progressive variety of foods, the richest and rarest being sought out; and their nature depended on what was most difficult to obtain. The Greeks learnt by contact with Asia to increase the sumptuous character of their banquets, but we know little enough of their ideas of gastronomy. Athens was the centre of luxury. According to our chief authority Athenaeus, Archestratus of Gela, the friend of the son of Pericles, the guide of Epicurus, and author of the *Heduphagetica*, was a great traveller, and took pains to get information as to how the delicacies of the table were prepared in different parts. His lost work was versified by Ennius. Other connoisseurs seem to have been Numenius of Heraclea, Hegemon of Thasos, Philogenes of Leucas, Simonaclides of Chios, and Tyndarides of Sicyon. The Romans, emerging from their pristine simplicity, borrowed from the Greeks their achievements in gastronomic pleasure. We read of this or that Roman gourmet, such as Lucullus, his extravagances and his luxury. The name of the connoisseur Apicius, after whom a work of the time of Heliogabalus is called, comes down to us in association with a manual of cookery. And from Macrobius and Petronius we can gather very interesting glimpses of the Roman idea of a menu. In the later empire, tradition still centred round the Roman cookery favoured by the geographical position of Italy; while the customs and natural products of the remoter parts of Europe gradually begin to assert themselves as the middle ages progress.

It is, however, not till the Renaissance, and then too with Italy as the starting-point, that the history of modern cookery really begins. Meanwhile cookery may be studied rather in the architecture of kitchens, and the development of their appurtenances and personnel, than in any increase in the subtleties of the art; the ideal was inevitably gross; the end was feeding—inextricably associated in all ages with cooking, but as distinct from its *fine fleur* as gluttony from gastronomy.

Montaigne's references to the revival of cookery in France by Catherine de' Medici indicate that the new attention paid to the art was really novel. She brought Italian cooks to Paris and introduced there a cultured simplicity which was unknown in France before. It is to the Italians apparently that later developments are originally due. It is clearly established, for instance (says Abraham Hayward in his *Art of Dining*), that the Italians introduced ices into France. Fricandeaus were invented by the *chef* of Leo X. And Coryate in his *Crudities*, writing in the time of James I., says that he was called "furcifer" (evidently in contemptuous jest) by his friends, from his using those "Italian neatnesses called forks." The use of the fork and spoon marked an epoch in the progress of dining, and consequently of cookery.

Under Louis XIV. further advances were made. His *maître d'hôtel*, Béchamel, is famous for his sauce; and Vatel, the great Condé's cook, was a celebrated artist, of whose suicide in despair at the tardy arrival of the fish which he had ordered, Madame de Sévigné relates a moving story. The prince de Soubise, immortalized by his onion sauce, also had a famous chef.

In England the names of certain cookery-books may be noted, such as Sir J. Elliott's (1539), Abraham Veale's (1575), and the *Widdowe's Treasure* (1625). The *Accomplisht Cook*, by Robert May, appeared in 1665, and from its preface we learn that the author (who speaks disparagingly of French cookery, but more gratefully of Italian and Spanish) was the son of a cook, and had studied abroad and under his father (c. 1610) at Lady Dormer's, and he speaks of that time as "the days wherein were produced the triumphs and trophies of cookery." From his description they consisted of most fantastic and elaborately built up dishes, intended to amuse and startle, no less than to satisfy the appetite and palate.

Louis XV. was a great gourmet; and his reign saw many developments in the culinary art. The mayonnaise (originally *mahonnaise*) is ascribed to the duc de Richelieu. Such dishes as "*potage à la Xavier*," "*cailles à la Mirepoix*," "*chartreuses à la Mauconseil*," "*poulets à la Villeroy*," "*potage à la Condé*," "*gigot à la Mailly*," owe their titles to celebrities of the day, and the Pompadour gave her name to various others. The Jesuits Brunoy and Bougeant, who wrote a preface to a contemporary treatise on cookery (1739), described the modern art as "more simple, more appropriate, and more cunning, than that of old days," giving the ingredients the same union as painters give to colours, and harmonizing all the tastes. The very phrase "*cordons bleu*" (strictly applied only to a woman cook) arose from an enthusiastic recognition of female merit by the king himself. Madame du Barry, piqued at his opinion that

only a man could cook to perfection, had a dinner prepared for him by a *cuisinière* with such success that the delighted monarch demanded that the artist should be named, in order that so precious a *cuisinier* might be engaged for the royal household. "*Allons donc, la France!*" retorted the ex-grisette, "have I caught you at last? It is no *cuisinier* at all, but a *cuisinière*, and I demand a recompense for her worthy both of her and of your majesty. Your royal bounty has made my negro, Zamore, governor of Luciennes, and I cannot accept less than a *cordons bleu*" (the Royal Order of the *Saint Esprit*) "for my *cuisinière*."

The French Revolution was temporarily a blow to Parisian cookery, as to everything else of the *ancien régime*. "Not a single turbot in the market," was the lament of Grimod de la Reynière, the great gourmet, and author of the *Manuel des amphitryons* (1808). But while it fell heavily on the class of noble amphitryons it had one remarkable effect on the art which was epoch-making. It is from that time that we notice the rise of the Parisian restaurants. To 1770 is ascribed the first of these, the *Champ d'oiseau* in the rue des Poulies. In 1789 there were a hundred. In 1804 (when the *Almanach des gourmands*, the first sustained effort at investing gastronomy with the dignity of an art, was started) there were between 500 and 600. And in 1814, to such an extent had the restaurants attracted the culinary talent of Paris, that the allied monarchs, on arriving there, had to contract with the two brothers Véry for the supply of their table. Among the great gastronomic names of Napoleon's day was that of his chancellor Cambacérès, of whose dinners many stories are told. Robert (the eponym of the *sauce Robert*), Rechaud and Mérillion were at this period esteemed the Raphael, Michelangelo and Rubens of cookery; while A. Beauvilliers (author of *Art des cuisines*) and Carême (author of the *Maître d'hôtel français*, and chef at different times to the Tsar Alexander I., Talleyrand, George IV. and Baron Rothschild) were no less celebrated.<sup>1</sup> Perhaps the greatest name of all in the history of the literature of cookery is that of Anthelme Brillat-Savarin (1755-1826), the French judge and author of the *Physiologie du goût* (1825), the classic of gastronomy.

In England Louis Eustache Ude, Charles Elmé Francatelli, and Alexis Soyer carried on the tradition, all being not only cooks but authors of treatises on the art. The *Original* (1835) of Thomas Walker, the Lambeth police magistrate, is another work which has inspired later pens. Like the *Physiologie du goût*, it is no mere cookery-book, but a compound of observation and philosophy. Among simple hand-books, Mrs Glasse's, Dr Kitchener's and Mrs Rundell's were standard English works in the 18th and early 19th centuries; and in France the *Cuisinière de la campagne* (1818) went through edition after edition. An interesting old English work is Dr Pegge's *Forme of Cury* (1780), which includes some historical reflections on the subject. "We have some good families in England," he says, "of the name of Cook or Coke.... Depend upon it, they all originally sprang from real professional cooks, and they need not be ashamed of their extraction any more than Porters, Butlers, &c." He points out that cooks in early days were of some importance; William the Conqueror bestowed land on his *coquorum praepositus* and *coquus regius*; and Domesday Book records the bestowal of a manor on Robert Argyllon, by the service of a dish called "de la Groute" on the king's coronation day.

At the present time, whatever the local varieties of cooking, and the difference of national custom, French cooking is admittedly the ideal of the culinary art, directly we leave the plain roast and boiled. And the spread of cosmopolitan hotels and restaurants over England, America and the European continent, has largely accustomed the whole civilized world to the Parisian type. The improvements in the appliances and appurtenances of the kitchen have made the whole world kin in the arts of dining, but the French chef remains the typical master of his craft. Schools of cookery have been added to the educational machine. The literature of the subject has passed beyond enumeration.

It is unnecessary here to pursue so vast a practical subject into detail; but the following notes on broiling, roasting, baking, boiling, stewing and frying may be useful.

*Broiling.*—The earliest method of cooking was probably burying seeds and flesh in hot ashes, a kind of broiling on all the surfaces at the same time, which when properly done is the most delicate kind of cooking. Broiling is now done over a clear fire extending at least 2 in. beyond the edges of the gridiron, which should slightly incline towards the cook. It is usual to rub the bars with a piece of suet for meat, and chalk for fish, to prevent the thing broiled from being marked with the bars of the gridiron. In this kind of cookery the object is to coagulate as quickly as possible all the albumen on the surface, and seal up the pores of the meat so as to keep in all the juices and flavour. It is, therefore, necessary thoroughly to warm the gridiron before putting on the meat, or the heat of the fire is conducted away while the juices and flavour of the meat run into the fire. Broiling is a simple kind of cookery, and one well suited to invalids and persons of delicate appetites. There is no other way in

which small quantities of meat can be so well and so quickly cooked. Broiling cannot be well done in front of an open fire, because one side of the meat is exposed to a current of cold air. A pair of tongs should be used instead of a fork for turning all broiled meat and fish.

*Roasting.*—Two conditions are necessary for good roasting—a clear bright fire and frequent basting. Next to boiling or stewing it is the most economical method of cooking. The meat at first should be placed close to a brisk fire for five minutes to coagulate the albumen. It should then be drawn back a short distance and roasted slowly. If a meat screen be used, it should be placed before the fire to be moderately heated before the meat is put to roast. The centre of gravity of the fire should be a little above the centre of gravity of the joint. No kitchen can be complete without an open range, for it is almost impossible to have a properly roasted joint in closed kitcheners. The heat radiated from a good open fire quickly coagulates the albumen on the surface, and thus to a large extent prevents that which is fluid in the interior from solidifying. The connective tissue which unites the fibres is gradually converted into gelatin, and rendered easily soluble. The fibrin and albumen appear to undergo a higher oxidation and are more readily dissolved. The fat cells are gradually broken, and the liquid fat unites to a small extent with the chloride of sodium and the tribasic phosphate of sodium contained in the serum of the blood. It is easily seen that roasting by coagulating the external albumen keeps together the most valuable parts of the meat, till they have gradually and slowly undergone the desired change. This surface coagulation is not sufficient to prevent the free access of the oxygen of the surrounding air. The empyreumatic oils generated on the surface are neither wholesome nor agreeable, and these are perhaps better removed by roasting than any other method except broiling. The chief object is to retain as much as possible all the sapid juicy properties of the meat, so that at the first cut the gravy flows out of a rich reddish colour, and this can only be accomplished by a quick coagulation of the surface albumen. The time for roasting varies slightly with the kind of meat and the size of the joint. As a rule beef and mutton require a quarter of an hour to the pound; veal and pork about 17 minutes to the pound. To tell whether the joint is done, press the fleshy part with a spoon; if the meat yield easily it is done.

*Baking* meat is in many respects objectionable, and should never be done if any other method is available. The gradual disuse of open grates for roasting has led to a practice of first baking and then browning before the fire. This method completely reverses the true order of cooking by beginning with the lowest temperature and finishing with the highest. Baked meat has never the delicate flavour of roast meat, nor is it so digestible. The vapours given off by the charring of the surface cannot freely escape, and the meat is cooked in an atmosphere charged with empyreumatic oil. A brick or earthenware oven is preferable to iron, because the porous nature of the bricks absorbs a good deal of the vapour. When potatoes are baked with meat, they should always be first parboiled, because they take a longer time to bake, and the moisture rising from the potatoes retards the process of baking, and makes the meat sodden. A baked meat pie, though not always very digestible, is far less objectionable than plain baked meat. In the case of a meat pie the surfaces of the meat are protected by a bad conductor of heat from that charring of the surface which generates empyreumatic vapours, and the fat and gravy, gradually rising in temperature, assist the cooking, and such cooking more nearly resembles stewing than baking. The process may go on for a long time after the removal of the meat from the oven, if surrounded with flannel, or some bad conductor of heat. The Cornish pasty is the best example of this kind of cooking. Meat, fish, game, parboiled vegetables, apples or anything that fancy suggests, are surrounded with a thick flour and water crust and slowly baked. When removed from the oven, and packed in layers of flannel, the pasty will keep hot for hours. When baked dishes contain eggs, it should be remembered that the albumen becomes harder and more insoluble, according to the time occupied in cooking. About the same time is required for baking as roasting.

*Boiling* is one of the easiest methods of cooking, but a successful result depends on a number of conditions which, though they appear trifling, are nevertheless necessary. The fire must be watched so as properly to regulate the heat. The saucepan should be scrupulously clean and have a closely-fitting lid, and be large enough to hold sufficient water to well cover and surround the meat, and all scum should be removed as it comes to the surface; the addition of small quantities of cold water will assist the rising of the scum. For all cooking purposes clean rain water is to be preferred. Among cooks a great difference of opinion exists as to whether meat should be put into cold water and gradually brought to the boiling point, or should be put into boiling water. This, like many other unsettled questions in cookery, is best decided by careful scientific experiment and observation. If a piece of meat be put into water at a temperature of 60°, and gradually raised to 212°, the meat is undergoing a gradual loss of its soluble and nutritious properties, which are dissolved in the water. From the surface to the interior the albumen is partially dissolved out of the meat, the fibres become hard and stringy, and the thinner the piece of meat the greater the loss of all



those sapid constituents which make boiled meat savoury, juicy and palatable. To put meat into cold water is clearly the best method for making soups and broth; it is the French method of preparing the *pot au feu*; but the meat at the end of the operation has lost much of that juicy sapid property which makes boiled meat so acceptable. The practice of soaking fresh meat in cold water before cooking is for the same reasons highly objectionable; if necessary, wipe it with a clean cloth. But in the case of salted, smoked and dried meats soaking for several hours is indispensable, and the water should be occasionally changed. The other method of boiling meat has the authority of Baron Liebig, who recommends putting the meat into water when in a state of ebullition, and after five minutes the saucepan is to be drawn aside, and the contents kept at a temperature of 162° (50° below boiling). The effect of boiling water is to coagulate the albumen on the surface of the meat, which prevents, but not entirely, the juices from passing into the water, and meat thus boiled has more flavour and has lost much less in weight. To obtain well-flavoured boiled meat the idea of soups or broth must be a secondary consideration. It is, however, impossible to cook a piece of meat in water without extracting some of its juices and nutriment, and the liquor should in both cases be made into a soup.

*Stewing.*—When meat is slowly cooked in a close vessel it is said to be stewed; this method is generally adopted in the preparation of made dishes. Different kinds of meat may be used, or only one kind according to taste. The better the meat the better the stew; but by carefully stewing the coarsest and roughest parts will become soft, tender and digestible, which would not be possible by any other kind of cooking. Odd pieces of meat and trimmings and bones can often be purchased cheaply, and may be turned into good food by stewing. Bones, although containing little meat, contain from 39 to 49% of gelatin. The large bones should be broken into small pieces, and allowed to simmer till every piece is white and dry. Gelatin is largely used both in the form of jellies and soups. Lean meat, free from blood, is best for stewing, and, when cut into convenient pieces, it should be slightly browned in a little butter or dripping. Constant attention is necessary during this process, to prevent burning. The meat should be covered with soft water or, better, a little stock, and set aside to simmer for four or five hours, according to the nature of the material. When vegetables are used, these should also be slightly browned and added at intervals, so as not materially to lower the temperature. Stews may be thickened by the addition of pearl barley, sago, rice, potatoes, oatmeal, flour, &c., and flavoured with herbs and condiments according to taste. Although stewing is usually done in a stewpan or saucepan with a close-fitting cover, a good stone jar, with a well-fitting lid, is preferable in the homes of working people. This is better than a metal saucepan, and can be more easily kept clean; it retains the heat longer, and can be placed in the oven or covered with hot ashes. The common red jar is not suitable; it does not stand the heat so well as a grey jar; and the red glaze inside often gives way in the presence of salt. The lid of a vessel used for stewing should be removed as little as possible. An occasional shake will prevent the meat from sticking. At the end of the operation all the fat should be carefully removed.

*Frying.*—Lard, oil, butter, or dripping may be used for frying. There are two methods of frying—the dry method, as in frying a pancake, and the wet method, as when the thing fried is immersed in a bath of hot fat. In the former case a frying pan is used, in the other a frying kettle or stewpan. It is usual for most things to have a wire frying basket; the things to be fried are placed in the basket and immersed at the proper temperature in the hot fat. The fat should gradually rise in temperature over a slow fire till it attains nearly 400° Fahr. Great care is required to fry properly. If the temperature is too low the things immersed in the fat are not fried, but soddened; if, on the other hand, the temperature is too high, they are charred. The temperature of the fat varies slightly with the nature of things to be fried. Fish, cutlets, croquets, rissoles and fritters are well fried at a temperature of 380° Fahr. Potatoes, chops and white bait are better fried at a temperature of 400° Fahr. Care must be taken not to lower the temperature too much by introducing too many things. The most successful frying is when the fat rises two or three degrees during the frying. Fried things should be of a golden brown colour, crisp and free from fat. When fat or oil has been used for fish it must be kept for fish. It is customary first to use fat for croquets, rissoles, fritters and other delicate things, and then to take it for fish. Everything fried in fat should be placed on bibulous paper to absorb any fat on the surfaces.

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1 See Lady S. O. Morgan's *France*, 1829-1830, ii. 414, for an account of a dinner by Carême.

54 m. W. by N. of Belfast, on branches of the Great Northern and the Northern Counties (Midland) railways. Pop. of urban district (1901) 3531. It consists principally of a single street of great length, and lies in a pleasant, well-wooded district, near the Ballinderry river. It has important manufactures of linen, and some agricultural trade. It was founded in 1609, the landlord, Allan Cook, giving name to it. The mansion of Killymoon Castle, in the vicinity, is a notable example of the work of a celebrated architect, John Nash (c. 1800).

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**COOKTOWN**, a seaport of Banks county, Queensland, Australia, at the mouth of the Endeavour river, about 1050 m. direct N.N.W. of Brisbane. It is visited by the ocean steamers of several lines, and is the centre of a very extensive *bêche-de-mer* and pearl fishery. Tin and gold are worked in the district, in which also good coffee and rice are grown. Cooktown is the port of the Palmer gold-fields, and a railway runs to Laura on the gold-fields, 67 m. W. by S. of Cooktown. It is the chief port of Queensland for the New Guinea trade; and is also the seat of a Roman Catholic vicariate apostolic whose bishop has jurisdiction over the whole of Queensland north of lat. 18° 50'. In 1770 Captain Cook here beached his ship the "Endeavour," to repair the damage caused by her striking a reef in the neighbourhood of the estuary, which he could only clear by throwing his guns overboard. Cooktown became a municipality in 1876. The population of the town and district in 1901 was 1936.

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**COOKWORTHY, WILLIAM** (1705-1780), English potter, famous for his discovery of the existence of china-clay and china-stone in Cornwall, and as the first manufacturer of a porcelain similar in nature to the Chinese, from English materials, was born at Kingsbridge, Devon, of Quaker parents who were in humble circumstances. At the age of fourteen he was apprenticed to a London apothecary named Bevans, and he afterwards returned to the neighbourhood of his birthplace, and carried on business at Plymouth with the co-operation of his master, under the title of Bevans & Cookworthy. The manufacture of porcelain was at the time attracting great attention in England, and while the factories at Bow, Chelsea, Worcester and Derby were introducing the artificial glassy porcelain, Cookworthy, following the accounts of Père d'Entrecolles, spent many years in searching for English materials similar to those used by the Chinese. From 1745 onwards he seems to have travelled over the greater portion of Cornwall and Devon in search of these minerals, and he finally located them in the parish of St Stephen's near to St Austell. With a certain amount of financial assistance from Mr Thomas Pitt of Boconnoc (afterwards Lord Camelford) he established the Plymouth China Factory at least as early as 1768. The factory was removed to Bristol about 1770, and the business was afterwards sold to Richard Champion and others and became the well-known Bristol Porcelain Manufactory. Apart from its historic interest there is little to be said for the Plymouth porcelain. Technically it was often imperfect, and its artistic treatment was never of a high order. But Cookworthy deserves to be remembered for his discovery of those abundant supplies of English clay and rocks which form the foundation of English porcelain and fine earthenware (see [CERAMICS](#)).

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**COOLGARDIE**, a municipal town in Western Australia, 310 m. by rail E. by N. of Perth, and 528 m. by rail N.E. of Albany. Pop. (1901) 4249. Its gold-fields were discovered in 1891 and are among the richest in the colony. Lignite, copper, graphite and silver are also found. Toorak and Montana are small residential suburbs. A remarkable engineering work by which a full supply of water was brought to the town from Fremantle (a distance exceeding 330 m. direct) was completed in 1903.

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**COOLIE**, or COOLY (from Koli or Kuli, an aboriginal race of western India; or perhaps from Tamil *kūli*, hire, *i.e.* one hired), a term generally applied to Asiatic labourers belonging to the unskilled class as opposed to the artisan, and employed in a special sense to designate those natives of India and China who leave their country under contracts of service to work as labourers abroad. After the abolition of slavery much difficulty was found in obtaining cheap labour for tropical plantations. The emancipated black was unwilling to engage in field labour, while the white man was physically incapable of so doing. Recourse was had to the overpeopled empires of China and India, as the most likely sources from which to obtain that supply of workers upon which the very existence of some colonies, notably in the West Indies, depended.

The first public recognition of the coolie traffic was in 1844, when the British colony of Guiana made provision for the encouragement of Chinese immigration. About the same time both Peru and Cuba began to look to China as likely to furnish an efficient substitute for the negro bondsman. Agents armed with consular commissions from Peru appeared in Chinese ports, where they collected and sent away shiploads of coolies. Each one was bound to serve the Peruvian planter to whom he might be assigned for seven or eight years, at fixed wages, generally about 17s. a month, food, clothes and lodging being provided. From 1847 to 1854 coolie emigration went on briskly without attracting much notice, but it gradually came to light that circumstances of great cruelty attended the trade. The transport ships were badly equipped and overcrowded, and many coolies died before the end of the voyage. On arrival in Cuba or Peru the survivors were sold by auction in the open market to the highest bidders, who held them virtually as slaves for seven years instead of for life. Particularly terrible was the lot of those who, contrary to their agreements, had been sent to labour in the foul guano pits of the Chinchas islands, where they were forced to toil in gangs, each under the charge of an overseer armed with a cowhide lash. In 1860 it was calculated that of the four thousand coolies who had been fraudulently consigned to the guano pits of Peru not one had survived. The greater number of them had committed suicide. In 1854 the British governor of Hong-Kong issued a proclamation forbidding British subjects or vessels to engage in the transport of coolies to the Chinchas. Technically this was *ultra vires* on his part, but his policy was confirmed by the Chinese Passengers' Act 1855, which put an end to the more abominable phase of the traffic. After that no British ship was allowed to sail on more than a week's voyage with more than twenty coolies on board, unless her master had complied with certain very stringent regulations.

The consequence of this was that the business of shipping coolies for Peru was transferred to the Portuguese settlement of Macao. There the Peruvian and Cuban "labour-agents" established depôts, which they unblushingly called "barracoons," the very term used in the West African slave trade. In these places coolies were "received," or in plain words, imprisoned and kept under close guard until a sufficient number were collected for export. Some of these were decoyed by fraudulent promises of profitable employment. Others were kidnapped by piratical junks hired to scour the neighbouring coasts. Many were bought from leaders of turbulent native factions, only too glad to sell the prisoners they captured whilst waging their internecine wars. The procurador or registrar-general of Macao went through the form of certifying the contracts; but his inspection was practically useless. After the war of 1856-1857 this masked slave trade pushed its agencies into Whampoa and Canton. In April 1859, however, the whole mercantile community of the latter port rose up in indignation against it, and transmitted such strong representations to the British embassy in China, that steps were taken to mitigate the evil. New regulations were from time to time passed by the Portuguese authorities for the purpose of minimizing the horrors of the Macao trade. They seem, however, to have been systematically evaded, and to have been practically inoperative. At Canton and Hong-Kong the coolie trade was put under various regulations, which in the latter port worked well only when the profits of "head-money" were ruined. In March 1866 the representatives of the governments of France, England and China drew up a convention for the regulation of the Canton trade, which had an unfortunate effect. It left head-money, the source of most of the abuses, comparatively untouched. It enacted that every coolie must at the end of a five years' engagement have his return passage-money paid to him. The West Indian colonies at once objected to this. They wanted permanent not temporary settlers. They could not afford to burden the coolie's expensive contract with return passage-money, so they declined to accept emigrants on these terms. Thus a

legalized coolie trade between the West Indies and China was extinguished. Thereafter the coolie supply for British colonies was drawn exclusively from India, until 1904, when an exception was made in the case of the Transvaal. Under a convention drawn up in that year between the United Kingdom and China over fifty thousand indentured Chinese labourers were engaged on three years' contracts to work in the Witwatersrand gold mines (see [TRANSVAAL](#)). To the Malay states and other parts of eastern Asia there is an extensive yearly migration of Chinese coolies. This migration, however, is not under contract. From Amoy alone some seventy-five thousand coolies yearly migrate to Singapore and the Straits Settlements, whence they are drafted for labour purposes in every direction.

It is scarcely possible to say when the Indian coolie trade began. Before the end of the 18th century Tamil labourers from southern India were wont to emigrate to the Straits Settlements, and they also flocked to Tenasserim from the other side of the Bay of Bengal after the conquest had produced a demand for labour. The first regularly recorded attempt at organizing coolie emigration from India took place in 1834, when forty coolies were exported to Mauritius; but it was not until 1836 that the Indian government decided to put the trade under official regulations. In 1837 an emigration law was passed for all the territories of the East India Company, providing that a permit must be obtained from government for every shipment of coolies, that all contracts should terminate in five years, that a return passage should be guaranteed, that the terms of his contract should be carefully explained to each coolie, and that the emigrant ship should only carry one coolie for every ton and a half of burden. Then as now the Indian government watched the deportation of labour from their dominions with jealous and anxious care, and when in 1838 it was found that upwards of twenty-five thousand natives had, up to that year, gone from all parts of India to Mauritius, the government became somewhat alarmed at the dimensions which the traffic was assuming. Brougham and the anti-slavery party denounced the trade as a revival of slavery, and the Bengal government suspended it in order to investigate its alleged abuses. The nature of these may be guessed when it is said that the inquiry condemned the fraudulent methods of recruiting then in vogue, and the brutal treatment which coolies often received from ship captains and masters. In 1842 steps were taken formally to reopen the coolie trade with Mauritius, and in 1844 emigration to the West Indies was sanctioned by the Indian government. In 1847 Ceylon was separated from India, and her labour supply was cut off; but this accident was soon remedied, the Ceylon government adopting protective regulations for the coolies.

Emigration of coolies under contract to labour outside India is now regulated by the Emigration Act of 1883 and the rules issued under its provisions, the only exceptions being in respect of emigrants to Ceylon and the Straits Settlements and adjoining states, or those engaged by the British government for employment in east and central Africa. By section 8 of this act natives of India are permitted to emigrate under labour contracts only to such countries as have satisfied the government of India that sufficient provision is made for the protection of the emigrants. A country which is duly empowered under the act to receive emigrants may appoint an agent, residing in India, who is responsible for the due observance of the provisions of the law. These agents are under the general supervision of the protector of emigrants. As emigrants have to be recruited at great distances from the port of embarkation, recruiters are appointed by the agents and licensed by the protector. The conduct of these subordinates is minutely regulated. Every precaution is taken to let the emigrant know the exact terms on which he is hired, and to ensure good treatment in the interval between registration and embarkation. Coolies are shipped for the most part from Calcutta and Madras, but of recent years large numbers bound for Mombasa and the Seychelles left from Bombay and Karachi. Both the coolies themselves and the depôt are medically inspected. Only those physically fit are allowed to embark. The vessels for their conveyance are licensed and inspected by the local government. The terms on which emigrants are recruited are settled beforehand by convention with the colonies concerned, and are embodied in ordinances passed by the local legislatures. They vary in detail, but their main provisions relate to the rights and obligations of the emigrants, including the grant of a return passage on the expiry of a specified period, usually ten years. The British colonies to which coolies were exported in the decade 1891-1901 were British Guiana, Trinidad, St Lucia, Jamaica, Mauritius, the Seychelles Islands, Fiji, East Africa and Natal; the only non-British country was Dutch Guiana. Emigration to the French colonies, including Réunion has been forbidden by the government of India since 1886, but there still remain in those colonies some of the former emigrants, and the questions of their treatment and repatriation have frequently formed the subject of representations to the French authorities.

**Indian coolies.**

**Modern regulations.**

The number of Indian coolies resident in the various British colonies in 1900 was 625,000, of which the largest numbers were 265,000 in Mauritius and 125,000 in British Guiana.

**The British colonies.**

There were still 13,800 in Réunion. The regulations governing coolie labour in British Guiana may be taken as typical for the British colonies generally. They are contained in the Labour Ordinance of 1873, which was amended by the ordinances of 1875, 1876, 1886 and 1887. Under these ordinances an immigration agent-general is appointed, to whom medical officers and recruiting agents are responsible, and the emigrants are allotted by him to the separate estates. They regulate the hours of work, the rate of wages, and the general treatment of the coolies, the nature of house and hospital accommodation, the terms of re-enlistment and the conditions of marriage amongst the coolies themselves. The coolies returning from the British colonies to India in 1901 possessed average savings of £19.

**British East and South Africa.**

During the construction of the Uganda railway large numbers of coolies were recruited in the Punjab and exported from Karachi to Mombasa. During the decade 1891-1901 the number of these emigrants was 33,000; but on the completion of the line the emigration practically stopped, while in 1901-1902 there were over 6000 emigrants who returned to India. Some, however, settled in East Africa. Coolies are also exported for government employment in Nyasaland. In Natal the Indian population had by 1904 reached over 100,000 and slightly outnumbered the whites. Many of the coolies had become permanent residents in the colony (see [NATAL](#)).

**Assam, Ceylon and Burma.**

According to the census of 1901 there were 775,844 foreigners in Assam, of whom no fewer than 645,000 or 83% were brought into the province as garden coolies. The recruiting of these coolies is regulated by Act VI. of 1901, which provides that a labour agreement may be entered into for four years, and includes a penal clause, under which a coolie deserting or refusing to work may be punished with imprisonment. The coolies can also give an agreement under Act XIII. of 1859, by which they are only liable to civil action for breach of contract. The latter are called non-act coolies. This system of immigration has made tea-planting the most important industry in Assam, and has greatly increased the prosperity of the province. Migration to Ceylon and Burma takes place chiefly from the Madras ports, and is of a seasonal and temporary character. The tea estates and pearl fisheries of Ceylon, and the town work and harvesting in Burma attract large numbers of Tamil labourers. The respective numbers embarking in 1901 were 117,000 for Ceylon, 84,000 for Burma and 27,000 for the Straits Settlements. In Ceylon there is no system of recruitment like that for the Assam tea-gardens. The coolies come in gangs, each under its own headman, with whom the planter deals exclusively, leaving him to make his own arrangements with the individual coolies. The coolies are mostly carried in small sailing vessels from the ports of Madura and Tanjore, and the number who permanently settle in Ceylon is not very great.

See E. Jenkins, *The Coolie; his Rights and Wrongs* (1871); J. L. A. Hope, *In Quest of Coolies* (1872); and C. B. Grose, *The Labour Ordinances* (Georgetown, 1890).

(C. L.)

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**COOMA**, a town of Beresford county, New South Wales, Australia, 264 m. by rail S.S.W. of Sydney. Pop. (1901) 1938. The town is the centre of a pastoral district and has a large trade in furs, while at Bushy Hill, a mile from the town, is a small gold-field. Cooma, which is pleasantly situated at an elevation of 2657 ft., is the tourist centre for visitors to the Yarrangobilly Caves and Mount Kosciusko and its observatory. The caves are distant 65 m. from the town, situated in the side of a hill, overlooking the Yarrangobilly river; they are seven in number and of remarkable beauty and extent.

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**COOPER, ABRAHAM** (1787-1868), English animal and battle painter, the son of a tobacconist, was born in London. At the age of thirteen he became an employé at Astley's

amphitheatre, and was afterwards groom in the service of Sir Henry Meux. When he was twenty-two, wishing to possess a portrait of a favourite horse under his care, he bought a manual of painting, learned something of the use of oil-colours, and painted the picture on a canvas hung against the stable wall. His master bought it and encouraged him to continue in his efforts. He accordingly began to copy prints of horses, and was introduced to Benjamin Marshall, the animal painter, who took him into his studio, and seems to have introduced him to the *Sporting Magazine*, an illustrated periodical to which he was himself a contributor. In 1814 he exhibited his "Tam O'Shanter," and in 1816 he won a prize of £100 for his "Battle of Ligny." In 1817 he exhibited his "Battle of Marston Moor" and was made associate of the Academy, and in 1820 he was elected Academician. Cooper, although ill educated, was a clever and conscientious artist; his colouring was somewhat flat and dead, but he was a master of equine portraiture and anatomy, and had some antiquarian knowledge. He had a special fondness for Cavalier and Roundhead pictures.

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**COOPER, ALEXANDER** (d. 1660), English miniature painter. His works are of great rarity, and the chief are a series representing the king and queen of Bohemia and their children, in the possession of the German emperor; some very remarkable portraits belonging to the queen of Holland, and others in the possession of the king of Sweden and in various Swedish galleries. He was the brother of Samuel Cooper, but whether senior or junior to him is not known, although, according to certain Swedish authorities, he is stated, upon very slight evidence, to have been born in 1605, four years before his more famous brother. He came to Sweden in 1646, and the Swedish documents declare that he was a Jew, and that his full name was Abraham Alexander Cooper. He had previously been residing in Holland, but on reaching Sweden entered the service of Queen Christina, and continued to be her miniature painter until 1654, when she resigned the crown. Two years later, Cooper was in Denmark, carrying out some commissions for Christian IV., but in 1657 was back again in Stockholm, where he died in the early part of 1660. The date of his birth is not known, but he is believed to have been born in London.

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For full information regarding his career, and for various documents bearing his signature, see *The History of Portrait Miniatures*, by G. C. Williamson, chap. vi. page 78, and an article in the *Nineteenth Century* for October 1905.

(G. C. W.)

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**COOPER, SIR ASTLEY PASTON** (1768-1841), English surgeon, was born at the village of Brooke in Norfolk on the 23rd of August 1768. His father, Dr Samuel Cooper, was a clergyman of the Church of England; his mother was the author of several novels. At the age of sixteen he was sent to London and placed under Henry Cline (1750-1827), surgeon to St Thomas's hospital. From the first he devoted himself to the study of anatomy, and had the privilege of attending the lectures of John Hunter. In 1789 he was appointed demonstrator of anatomy at St Thomas's hospital, where in 1791 he became joint lecturer with Cline in anatomy and surgery, and in 1800 he was appointed surgeon to Guy's hospital, on the death of his uncle, William Cooper. In 1802 he received the Copley medal for two papers read before the Royal Society of London on the destruction of the *membrana tympani*; and in 1805 he was elected a fellow of that society. In the same year he took an active part in the formation of the Medico-Chirurgical Society, and published in the first volume of its *Transactions* an account of an attempt to tie the common carotid artery for aneurism. In 1804 he brought out the first, and in 1807 the second, part of his great work on hernia, which added so largely to his reputation that in 1813 his annual professional income rose to £21,000 sterling. In the same year he was appointed professor of comparative anatomy to the Royal College of Surgeons and was very popular as a lecturer. In 1817 he performed his famous operation of tying the abdominal aorta for aneurism; and in 1820 he removed a wen from the head of George IV., and about six months afterwards received a baronetcy, which, as he had no son, was to descend to his nephew and adopted son, Astley Cooper. He served as president of the Royal College of Surgeons in 1827 and again in 1836, and he was elected

a vice-president of the Royal Society in 1830. He died on the 12th of February 1841 in London, and was interred, by his own desire, beneath the chapel of Guy's hospital. A statue by E. H. Baily was erected in St Paul's.

His chief works are *Anatomy and Surgical Treatment of Hernia* (1804-1807); *Dislocations and Fractures* (1822); *Lectures on Surgery* (1824-1827); *Illustrations of Diseases of the Breast* (1829); *Anatomy of the Thymus Gland* (1832); *Anatomy of the Breast* (1840).

See *Life of Sir A. Cooper*, by B. B. Cooper (1843).

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**COOPER, CHARLES HENRY** (1808-1866), English antiquary, was born at Great Marlow, on the 20th of March 1808, being descended from a family formerly settled at Bray, Berkshire. He received his education at a private school in Reading. In 1826 he fixed his residence at Cambridge, and in 1836 was elected coroner of the borough. Four years later he was admitted a solicitor, and in course of time he acquired an extensive practice, but his taste and inclination ultimately led him to devote almost the whole of his time to literary research, and especially the elucidation of the history of the university of Cambridge. In 1849 he resigned the office of borough coroner on being elected to the town-clerkship, which he retained till his death on the 21st of March 1866. His earliest production, *A New Guide to the University and Town of Cambridge*, was published anonymously in 1831. *The Annals of Cambridge* followed (1842-1853) containing a chronological history of the university and town from the earliest period to 1853. His most important work, the *Athenae Cantabrigienses* (1858, 1861), a companion work to the famous *Athenae Oxonienses* of Anthony à Wood, contains biographical memoirs of the authors and other men of eminence who were educated at the university of Cambridge from 1500 to 1609. Cooper's other works are *The Memorials of Cambridge*, (1858-1866) and a *Memoir of Margaret, Countess of Richmond and Derby* (1874). He was a constant contributor to *Notes and Queries*, the *Gentleman's Magazine* and other antiquarian publications, and left an immense collection of MS. materials for a biographical history of Great Britain and Ireland.

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**COOPER, JAMES FENIMORE** (1789-1851), American novelist, was born at Burlington, New Jersey, on the 15th of September 1789. Reared in the wild country round Otsego Lake, N.Y., on the yet unsettled estates of his father, a judge and member of Congress, he was sent to school at Albany and at New Haven, and entered Yale College in his fourteenth year, remaining for some time the youngest student on the rolls. Three years afterwards he joined the United States navy; but after making a voyage or two in a merchant vessel, to perfect himself in seamanship, and obtaining his lieutenancy, he married and resigned his commission (1811). He settled in Westchester county, N.Y., the "Neutral Ground" of his earliest American romance, and produced anonymously (1820) his first book, *Precaution*, a novel of the fashionable school. This was followed (1821) by *The Spy*, which was very successful at the date of issue; *The Pioneers* (1823), the first of the "Leatherstocking" series; and *The Pilot* (1824), a bold and dashing sea-story. The next was *Lionel Lincoln* (1825), a feeble and unattractive work; and this was succeeded in 1826 by the famous *Last of the Mohicans*, a book that is often quoted as its author's masterpiece. Quitting America for Europe he published at Paris *The Prairie* (1826), the best of his books in nearly all respects, and *The Red Rover*, (1828), by no means his worst.

At this period the unequal and uncertain talent of Cooper would seem to have been at its best. These excellent novels were, however, succeeded by one very inferior, *The Wept of Wish-ton-Wish* (1829); by *The Notions of a Travelling Bachelor* (1828), an uninteresting book; and by *The Waterwitch* (1830), one of the poorest of his many sea-stories. In 1830 he entered the lists as a party writer, defending in a series of letters to the *National*, a Parisian journal, the United States against a string of charges brought against them by the *Revue Britannique*; and for the rest of his life he continued skirmishing in print, sometimes for the national interest, sometimes for that of the individual, and not infrequently for both at once. This opportunity of making a political confession of faith appears not only to have fortified

him in his own convictions, but to have inspired him with the idea of imposing them on the public through the medium of his art. His next three novels, *The Bravo* (1831), *The Heidenmauer* (1832) and *The Headsman: or the Abbaye of Vignerons* (1833), were designed to exalt the people at the expense of the aristocracy. Of these the first is by no means a bad story, but the others are among the dullest ever written; all were widely read on both sides of the Atlantic.

In 1833 Cooper returned to America, and immediately published *A Letter to my Countrymen*, in which he gave his own version of the controversy he had been engaged in, and passed some sharp censure on his compatriots for their share in it. This attack he followed up with *The Monikins* (1835) and *The American Democrat* (1835); with several sets of notes on his travels and experiences in Europe, among which may be remarked his *England* (1837), in three volumes, a burst of vanity and ill-temper; and with *Homeward Bound*, and *Home as Found* (1838), noticeable as containing a highly idealized portrait of himself. All these books tended to increase the ill-feeling between author and public; the Whig press was virulent and scandalous in its comments, and Cooper plunged into a series of actions for libel. Victorious in all of them, he returned to his old occupation with something of his old vigour and success. A *History of the Navy of the United States* (1839), supplemented (1846) by a set of *Lives of Distinguished American Naval Officers*, was succeeded by *The Pathfinder* (1840), a good "Leatherstocking" novel; by *Mercedes of Castile* (1840); *The Deerslayer* (1841); by *The Two Admirals* and by *Wing and Wing* (1842); by *Wyandotte*, *The History of a Pocket Handkerchief*, and *Ned Myers* (1843); and by *Afloat and Ashore, or the Adventures of Miles Wallingford* (1844). From pure fiction, however, he turned again to the combination of art and controversy in which he had achieved distinction, and in the two *Littlepage Manuscripts* (1845-1846) he fought with a great deal of vigour. His next novel was *The Crater, or Vulcan's Peak* (1847), in which he attempted to introduce supernatural machinery with indifferent success; and this was succeeded by *Oak Openings* and *Jack Tier* (1848), the latter a curious *refacimento* of *The Red Rover*; by *The Sea Lions* (1849); and finally by *The Ways of the Hour* (1850), another novel with a purpose, and his last book. He died of dropsy on the 14th of September 1851 at Cooperstown, New York. His daughter, Susan Fenimore Cooper (1813-1894), was known as an author and philanthropist.

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Cooper was certainly one of the most popular authors that have ever written. His stories have been translated into nearly all the languages of Europe and into some of those of Asia. Balzac admired him greatly, but with discrimination; Victor Hugo pronounced him greater than the great master of modern romance, and this verdict was echoed by a multitude of inferior readers, who were satisfied with no title for their favourite less than that of "the American Scott." As a satirist and observer he is simply the "Cooper who's written six volumes to prove he's as good as a Lord" of Lowell's clever portrait; his enormous vanity and his irritability find vent in a sort of dull violence, which is exceedingly tiresome. It is only as a novelist that he deserves consideration. His qualities are not those of the great masters of fiction; but he had an inexhaustible imagination, some faculty for simple combination of incident, a homely tragic force which is very genuine and effective, and up to a certain point a fine narrative power. His literary training was inadequate; his vocabulary is limited and his style awkward and pretentious; and he had a fondness for moralizing tritely and obviously, which mars his best passages. In point of conception, each of his three-and-thirty novels is either absolutely good or is possessed of a certain amount of merit; but hitches occur in all, so that every one of them is remarkable rather in its episodes than as a whole. Nothing can be more vividly told than the escape of the Yankee man-of-war through the shoals and from the English cruisers in *The Pilot*, but there are few things flatter in the range of fiction than the other incidents of the novel. It is therefore with some show of reason that *The Last of the Mohicans*, which as a chain of brilliantly narrated episodes is certainly the least faulty in this matter of sustained excellence of execution, should be held to be the best of his works.

The personages of his drama are rather to be accounted as so much painted cloth and cardboard, than as anything approaching the nature of men and women. As a creator of aught but romantic incident, indeed, Cooper's claims to renown must rest on the fine figure of the Leatherstocking, and, in a less degree, on that of his friend and companion, the Big Serpent. The latter has many and obvious merits, not the least of which is the pathos shed about him in his last incarnation as the Indian John of *The Pioneers*. Natty Bumppo, however, is a creation of no common unity and consistency. There are lapses and flaws, and Natty is made to say things which only Cooper, in his most verbosely didactic vein, could have uttered. But on the whole the impression left is good and true. In the dignity and simplicity of the old backwoodsman there is something almost Hebraic. With his naïve vanity and strong reverent piety, his valiant wariness, his discriminating cruelty, his fine natural sense



of right and wrong, his rough limpid honesty, his kindly humour, his picturesque dialect, and his rare skill in woodcraft, he has all the breadth and roundness of a type and all the eccentricities and peculiarities of a portrait.

See *James Fenimore Cooper* (Boston, 1883), by Thomas R. Lounsbury in the "American Men of Letters" series; Griswold, *Prose Writers of America* (Philadelphia, 1847); J. R. Lowell, *Fable for Critics*; M. A. de Wolfe Howe, *American Bookmen* (New York, 1898); and the introduction by Mowbray Morris to Macmillan's uniform edition of Cooper's novels (London, 1900).

(W. E. H.)

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**COOPER, PETER** (1791-1883), American manufacturer, inventor and philanthropist, was born in New York city on the 12th of February 1791. His grandfathers and his father served in the War of American Independence. He received practically no schooling, but worked with his father at hat-making in New York city, at brewing in Peekskill, at brick-making in Catskill, and again at brewing in Newburgh. At seventeen he was apprenticed to a coach-builder in New York city. On coming of age he got employment at Hempstead, Long Island, making machines for shearing cloth; three years afterwards he set up in this business for himself, having bought the sole right to manufacture such machinery in the state of New York. Business prospered during the War of 1812, but fell off after the peace. He turned his shop into a furniture factory; soon sold this and for a short time was engaged in the grocery business on the site of the present Bible House, opposite Cooper Union; and then invested in a glue and isinglass factory, situated for twenty-one years in Manhattan (where the Park Avenue Hotel was built later) and then in Brooklyn. About 1828 he built the Canton Iron Works in Baltimore, Maryland, the foundation of his great fortune. The Baltimore & Ohio railway was to cross his property, and, after various inventions aiming to do away with the locomotive crank and thus save two-fifths of the steam, in 1830 he designed and constructed (largely after plans made two years before) the first steam locomotive built in America; though only a small model it proved the practicability of using steam power for working that line. The "Tom Thumb," as Cooper called the locomotive, was about the size of a modern hand-car; as the natural draft was far from sufficient, Cooper devised a blowing apparatus. Selling his Baltimore works, he built, in 1836, in partnership with his brother Thomas, a rolling mill in New York; in 1845 he removed it to Trenton, New Jersey, where iron structural beams were first made in 1854 and the Bessemer process first tried in America in 1856; and at Philippsburg, New Jersey, he built the largest blast furnace in the country at that time. He built other foundries at Ringwood, New Jersey, and at Durham, Pennsylvania; bought iron mines in northern New Jersey, and carried the ore thence by railways to his mills. Actively interested with Cyrus Field in the laying of the first Atlantic cable, he was president of the New York, Newfoundland & London Telegraph Company, and his frequent cash advances made the success of the company possible; he was president of the North American Telegraph Company also, which controlled more than one-half of the telegraph lines of the United States. For his work in advancing the iron trade he received the Bessemer gold medal from the Iron and Steel Institute of Great Britain in 1879. He took a prominent part in educational affairs, strongly opposed the Roman Catholic claims for public funds for parochial schools, and conducted the campaign of the Free School Society to its successful issue in 1842, when a state law was passed forbidding the support from public funds of any "religious sectarian doctrine." He is probably best known, however, as the founder of the Cooper Union (*q.v.*). Cooper was an early advocate of the emancipation and the enlistment in the Union army of Southern negroes, and he upheld the administration of Lincoln. Though he had been a hard-money Democrat, he joined the Greenback party after the Civil War, and in 1876 was its candidate for the presidency, but received only 81,740 out of the 8,412,833 votes cast. He died in New York city on the 4th of April 1883. He published *The Political and Financial Opinions of Peter Cooper, with an Autobiography of his Early Life* (1877), and *Ideas for a Science of Good Government, in Addresses, Letters and Articles on a Strictly National Currency, Tariff and Civil Service* (1883).

There is a brief biography by R. W. Raymond, *Peter Cooper* (Boston, 1900).

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**COOPER, SAMUEL** (1609-1672), English miniature painter. This artist was undoubtedly the greatest painter of miniatures who ever lived. He is believed to have been born in London, and was a nephew of John Hoskins, the miniature painter, by whom he was educated. He lived in Henrietta St., Covent Garden, and frequented the Covent Garden Coffee-House. Pepys, who makes many references to him, tells us he was an excellent musician, playing well upon the lute, and also a good linguist, speaking French with ease. According to other contemporary writers, he was a short, stout man, of a ruddy countenance. He married one Christiana, whose portrait is at Welbeck Abbey, and he had one daughter. In 1668 he was instructed by Pepys to paint a portrait of Mrs Pepys, for which he charged £30. He is known to have painted also the portrait of John Aubrey, which was presented in 1691 to the Ashmolean Museum, as we learn from his correspondence with John Ray, the naturalist. Evelyn refers to him in 1662, when, on the occasion of the visit that the diarist paid to the king, Cooper was drawing the royal face and head for the new coinage.

Magnificent examples of his work are to be found at Windsor Castle, Belvoir Castle, Montague House, Welbeck Abbey, Ham House, the Rijks Museum at Amsterdam and in the collection of Mr J. Pierpont Morgan. His largest miniature is in the possession of the duke of Richmond and Gordon at Goodwood. A piece of the artist's handwriting is to be seen at the back of one of his miniatures in the Welbeck Abbey collection, and one of his drawings in black chalk is in the University Gallery at Oxford. His own portrait of himself is in the collection of Mr J. Pierpont Morgan.

The date of his death has been handed down by a record in the diary of Mary Beale, the miniature painter; and in some letters from Mr Charles Manners, addressed to Lord Roos, dated 1672, now amongst the duke of Rutland's papers at Belvoir, the writer refers to Cooper's serious illness on the 4th of May, and to his doubt as to whether the artist would ever recover. Mary Beale's reference to his decease is in the following words: "Sunday, May 5, 1672—Mr Samuel Cooper, the most famous limner of the world for a face, dyed."

For a fuller account see the *History of Portrait Miniatures*, by G. C. Williamson, vol. i. p. 64.

(G. C. W.)

**COOPER (OR COUPER), THOMAS** (c. 1517-1594), English bishop and writer, was born in Oxford, where he was educated at Magdalen College. He became master of Magdalen College school, and afterwards practised as a physician in Oxford. His literary career began in 1548, when he compiled, or rather edited, a Latin dictionary *Bibliotheca Eliotae*, and in 1549 he published a continuation of Thomas Lanquet's *Chronicle of the World*. This work, known as *Cooper's Chronicle*, covers the period from A.D. 17 to the time of writing, and was reprinted in 1560 and 1565. In 1565 appeared the first edition of his greatest work, *Thesaurus Linguae Romanae et Britannicae*, and this was followed by three other editions. Queen Elizabeth was greatly pleased with the *Thesaurus*, generally known as *Cooper's Dictionary*; and its author, who had been ordained about 1559, was made dean of Christ Church, Oxford, in 1567. Two years later he became dean of Gloucester, in 1571 bishop of Lincoln and in 1584 bishop of Winchester. Cooper was a stout controversialist; he defended the practice and precept of the Church of England against the Roman Catholics on the one hand and against the Martin Marprelate writings and the Puritans on the other. He took some part, the exact extent of which is disputed, in the persecution of religious recusants in his diocese, and died at Winchester on the 29th of April 1594.

*Cooper's Admonition against Martin Marprelate* was reprinted in 1847, and his *Answer in Defence of the Truth against the Apology of Private Mass* in 1850.

**COOPER, THOMAS** (1759-1840), American educationalist and political philosopher, was born in London, England, on the 22nd of October 1759, and educated at Oxford. Threatened

with prosecution at home because of his active sympathy with the French Revolution, he emigrated to America about 1793, and began the practice of law in Northumberland county, Pennsylvania. He was president-judge of the Fourth District of Pennsylvania in 1806-1811. Like his friend Joseph Priestley, who was then living in Northumberland, he sympathized with the Anti-Federalists, and took part in the agitation against the Sedition Act, and for a newspaper attack in 1799 on President John Adams, Cooper was convicted, fined and imprisoned for libel. Like Priestley, Cooper was very highly esteemed by Thomas Jefferson, who secured for him the appointment as first professor of natural science and law in the University of Virginia—a position which Cooper was forced to resign under the fierce attack made on him by the Virginia clergy. After filling the chair of chemistry in Dickinson College, Carlisle, Pa. (1811-1814), and in the University of Pennsylvania (1818-1819), he became professor of chemistry in South Carolina College, at Columbia, in 1819, and afterwards gave instruction in political economy also. In 1820 he became acting president of this institution, and was president from 1821 until 1833, when he resigned owing to the opposition within the state to his liberal religious views. In December 1834, owing to continued opposition, he resigned his professorship. He had been formally tried for infidelity in 1832. He was a born agitator: John Adams described him as “a learned, ingenious, scientific and talented madcap.” Before his college classes, in public lectures, and in numerous pamphlets, he constantly preached the doctrine of free trade, and tried to show that the protective system was especially burdensome to the South. His remedy was state action. Each state, he contended, was a sovereign power and was in duty bound to protest against the tyrannical acts of the Federal government. He exercised considerable influence in preparing the people of South Carolina for nullification and secession; in fact he preceded Calhoun in advocating a practical application of the state sovereignty principle. The last years of his life were spent in preparing an edition of the Statutes at Large of the state, which was completed by David James McCord (1797-1855) and published in ten volumes (1836-1841). Dr Cooper died in Columbia on the 11th of May 1840. As a philosopher he was a follower of Hartley, Erasmus Darwin, Priestley and Broussais; he was a physiological materialist, and a severe critic of Scotch metaphysics. Among his publications are *Political Essays* (1800); *An English Version of the Institutes of Justinian* (1812); *Lectures on the Elements of Political Economy* (1826); *A Treatise on the Law of Libel and the Liberty of the Press* (1830); and a translation of Broussais' *On Irritation and Insanity* (1831), with which were printed his own essays, “The Scripture Doctrine of Materialism,” “View of the Metaphysical and Physiological Arguments in favour of Materialism,” and “Outline of the Doctrine of the Association of Ideas.”

See I. Woodbridge Riley, *American Philosophy: the Early Schools* (New York, 1907).

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**COOPER, THOMAS** (1805-1892), English Chartist and writer, the son of a working dyer, was born at Leicester on the 20th of March 1805. After his father's death his mother began business as a dyer and fancy box-maker at Gainsborough. Young Cooper was apprenticed to a shoemaker. He had a passion for knowledge; studied Greek, Latin and Hebrew in his spare time; and in 1827 gave up cobbling to become a schoolmaster, and, later, a Methodist preacher. His affairs did not prosper, and after going to Lincoln, where he obtained work on a local newspaper, he came to London in 1839. Here he became assistant to a second-hand bookseller, but in 1840 he joined the staff of the *Leicestershire Mercury*. His support of the Chartist movement obliged him to resign his position, but he undertook to edit *The Midland Counties Illuminator*, a Chartist journal, in 1841. He became a leader of the extreme Chartist party, and for his action in urging on the strike of 1842 he was imprisoned in Stafford gaol for two years. Here he produced *The Purgatory of Suicides*, a political epic in ten books, embodying the radical ideas of the time. In his efforts to publish this work after his liberation he came under the notice of Benjamin Disraeli and Douglas Jerrold. Through Jerrold's help it appeared in 1845, and Cooper then turned his attention to lecturing upon historical and educational subjects. In 1856 he suddenly renounced the free-thinking doctrines which he had held for many years, and became a lecturer on Christian evidences. He died at Lincoln on the 15th of July 1892. Among his other works may be mentioned the *Bridge of History over the Gulf of Time* (1871) and the *Life of Thomas Cooper, written by Himself* (1872).

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**COOPER, THOMAS SIDNEY** (1803-1902), English painter, was born at Canterbury on the 20th of September 1803. In very early childhood he showed in many ways the strength of his artistic inclinations, but as the circumstances of his family did not admit of his receiving any systematic training, he began before he was twelve years old to work in the shop of a coach painter. A little later he obtained employment as a scene painter; and he alternated between these two occupations for about eight years. But the desire to become an artist continued to influence him, and all his spare moments were given up to drawing and painting from nature. At the age of twenty he went to London, drew for a while in the British Museum, and was admitted as a student of the Royal Academy. He then returned to Canterbury, where he was able to earn a living as a drawing-master and by the sale of sketches and drawings. In 1827 he settled in Brussels; but four years later he returned to London to live, and by showing his first picture at the Royal Academy (1833) began an unprecedentedly prolonged career as an exhibitor. Cooper's name is mainly associated with pictures of cattle or sheep, and the most notable of the many hundred he produced are: "A Summer's Noon" (1836), "A Drover's Halt on the Fells" (1838), "A Group in the Meadows" (1845), "The Half-past One o'Clock Charge at Waterloo" (1847), "The Shepherd's Sabbath" (1866), "The Monarch of the Meadows" (1873), "Separated but not Divorced" (1874), "Isaac's Substitute" (1880), "Pushing off for Tilbury Fort" (1884), "On a Farm in East Kent" (1889), "Return to the Farm, Milking Time" (1897). He was elected A.R.A. in 1845 and R.A. in 1867. He presented to his native place, in 1882, the Sidney Cooper Art Gallery, built on the site of the house in which he was born. He wrote his reminiscences, under the title of *My Life*, in 1890; and died on the 7th of February 1902.

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**COOPERAGE**, or **COPERAGE** (Flemish and Dutch *koop*, a trader, dealer), a system of traffic in spirituous liquors, tobacco and other articles amongst the fishermen in the North Sea. The practice began in the middle of the 19th century, when Flemish and Dutch *koopers* frequented the fishing fleets for the purpose of barter. Trading first in tobacco, they extended their operations, and soon became practically floating grog-shops.

The demoralizing nature of the traffic was brought to the public notice in 1881, and a convention was held at the Hague in 1882 to consider means of remedying the abuses. In 1887 Great Britain, Germany, Belgium, Denmark, France and the Netherlands signed an agreement to prevent the sale or purchase of spirituous liquors among fishermen at sea. In Great Britain an act (the North Sea Fisheries Act 1888) was passed to carry into effect the terms of the convention. The act (now repealed and replaced by the North Sea Fisheries Act 1893, with which it is identical but for some slight verbal modifications) imposes a fine not exceeding £50 or a term of imprisonment not exceeding three months for supplying, exchanging or otherwise selling spirits. It imposes a like penalty for purchasing spirits by exchange or otherwise, and requires every British vessel dealing in provisions or other articles to have a licence and to carry a special mark. In 1882 Mr E. J. Mather started a mission to deep sea fishermen, which sends out mission ships and supplies the fishermen with good clothing, literature, tobacco, &c., at a fair price. This mission, now the Royal National Mission to Deep Sea Fishermen, is registered by the Board of Trade.

See E. J. Mather, *Nor'ard of the Dogger* (1888), and publications of the Mission to Deep Sea Fishermen.

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**COOPERAGE** (from "cooper," a maker of casks, derived from such forms as Mid. Dutch *cuper*, Ger. *Küfer*, Lat. *cuparius*; the same root is seen in various Teut. words for a basket, such as Dutch *kuip* and Eng. "kipe" and "coop," but cooper is apparently not formed directly from "coop," which never means a "cask" but always a basket-cage for poultry, &c.), the art of making casks, barrels and other rounded vessels, the sides of which are composed of separate staves, held together by hoops surrounding them. The art is one of great antiquity; Pliny ascribes its invention to the inhabitants of the Alpine valleys. The trade is one in which there are numerous subdivisions, the chief of which are tight or wet and dry or slack cask

manufacture. To these may be added white cooperage, a department which embraces the construction of wooden tubs, pails, churns and other even-staved vessels. Of all departments, the manufacture of tight casks or barrels for holding liquids is that which demands the greatest care and skill since, in addition to being perfectly tight when filled with liquid, the vessels must bear the strain of transportation to great distances, and in many cases have to resist considerable internal pressure when they contain fermenting liquors. The staves are best made of well-seasoned oak. Since a cask is a double conoid, usually having its greatest diameter (technically the bulge or belly) at the centre, each stave must be properly curved to form a segment of the whole, and must be so cut as to have a suitable bilge or increase of width from the ends to the middle; it must also have its edges bevelled to such an angle that it will form tight joints with its neighbours. The staves being prepared, the next operation is to set up or raise the barrel. For this purpose as many staves as are necessary are arranged upright in a circular frame, and round their lower halves are fitted truss hoops which serve to keep them together for the permanent hooping. The upper ends are then drawn together by means of a rope which is passed round them and tightened by a windlass, and other truss hoops are dropped over them, the wood being steamed or heated to enable it to bend freely to shape. The two ends of the cask are next finished to receive the heads by forming the chime, or bevel on the extremity of the staves, and the croze or groove into which the heads fit. Finally the heads and permanent hoops are put in place. The heads, when made of two or more pieces, are jointed by wooden dowel pins, and after being cut to size are chamfered or bevelled round the edge to fit into the croze grooves. The hoops are generally of iron. The manufacture of slack casks proceeds on the same general lines, but is simpler in various respects, both because less accurate workmanship is required, and because softer woods, largely fir, may be employed. Machinery of the most elaborate and specialized character has been devised to perform most of the operations in making both slack and tight casks, and though it involves considerable capital outlay it effects so great an economy of time that it has largely superseded hand labour. (For an account of such machinery see L. H. Ransome, "Cask-making Machinery," *Proc. Inst. Civ. Eng.* vol. 115; also an article in *Engineering*, 1908, 85, p. 845.) Barrels without separate staves are made by bending a sheet of wood, sawn from a log in a continuous strip, into the required circular shape, the bulge at the centre being obtained by cutting out V gores from the ends. Barrels are also sometimes made of steel, either of the ordinary bulging form or consisting of straight-sided drums provided near the middle with rings on which they may be rolled. Immense numbers of casks of different shapes and sizes are employed in various industries. Tight barrels are a necessity to the wine and cider maker, brewer and distiller, and are largely used for the transport of oils and liquid chemicals, while slack barrels are utilized by the million for packing cement, alkali, china, fruit, fish and numerous other products.

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**CO-OPERATION**, a term used particularly both for a theory of life, and for a system of business, with the general sense of "working together" (*con*, with, and *opus*, work). In its narrowest usage it means a combination of individuals to economize by buying in common, or increase their profits by selling in common. In its widest usage it means the creed that life may best be ordered not by the competition of individuals, where each seeks the interest of himself and his family, but by mutual help; by each individual consciously striving for the good of the social body of which he forms part, and the social body in return caring for each individual: "each for all, and all for each" is its accepted motto. Thus it proposes to replace among rational and moral beings the struggle for existence by voluntary combination for life. More or less imperfectly embodying this theory, we have co-operation in the concrete, or "the co-operative movement," meaning those forms of voluntary association where individuals unite for mutual aid in the production of wealth, which they will devote to common purposes, or share among them upon principles of equity, reason and the common good, agreed upon beforehand. Not that a co-operative society can begin by saying absolutely what those principles in their purity would dictate. It begins with current prices, current rates of wages and interest, current hours of labour, and modifies them as soon as it can wherever they seem least conformable to equity, reason and the common good.

In the industrial world there is everywhere much working together for the production of wealth, but this is not included in co-operation if the shares of those concerned are determined by competition, *i.e.* by a struggle and the relative ability of each to secure a

large share. Nor do co-operators regard the association as truly voluntary, though it may depend on contract, if that contract be one of service only, without an opportunity for all concerned to share in the ultimate control. Co-operation in fact is essentially a democratic association. On the other hand, there is some working together for the production of wealth which without being competitive, or based on service, is not strictly voluntary: thus in primitive societies there is much customary help, combined with customary division of the produce; and in advanced societies we have state and municipal socialism. These are indeed sometimes included in co-operation, but at least they are not voluntary co-operation, since the individual has no choice but to take part in them; they depend on the power of the ruler to coerce the ruled, or of the majority to coerce the minority. In co-operation, meaning voluntary co-operation, there may also, it is true, be frequent overruling of the minority by the majority, but only so far as the minority have, when joining the association, voluntarily agreed to permit, and subject always to an effective ultimate right of secession.

Thus co-operation occupies the middle ground between competition and state or municipal socialism. In its technical sense, however, it does not cover the whole of this ground: it does not cover associations which are primarily for social, provident, or religious purposes, but only those closely connected with the production of wealth. We speak of co-operative societies for agriculture, for manufacturing, for retail, or wholesale distribution, for building or house-owning, for raising capital and so forth; while the great Friendly Societies (*q.v.*), though a part of co-operation as a theory of life, are not part of the co-operative movement. The line is somewhat hard to draw, and consequently is drawn somewhat arbitrarily. Thus while a society for building, or for the collective ownership of houses, is counted a co-operative society, a Building Society (as we ordinarily understand the term), though it be purely mutual in its basis, is not so counted in Great Britain, but is in the United States (see [BUILDING SOCIETIES](#)).

For the early history of the co-operative movement we have to look chiefly to Great Britain, and British co-operation acknowledges as its founder Robert Owen (*q.v.*). In every age and every country the origins of co-operation may no doubt be traced, where men have helped one another in the creation of wealth and agreed as brothers as to its division. In England long before the days of Owen there was much co-operation of miners and fishermen which, though scarcely obligatory on the individuals taking part in it, was largely regulated by custom. Coming to more purely voluntary associations, co-operative workshops are recorded, retail co-operation was practised in Scotland from the middle of the 18th century, while in England shops not unlike co-operative stores, but without the democratic element, were in one or two instances set up by benevolent individuals. It does not seem, however, that there was any theory of co-operation until Owen in England, and almost simultaneously Fourier (*q.v.*) in France, formulated their gospels, not identical, yet having much in common. Of these two Owen and his teaching are by far the more important.

The end of the 18th and the beginning of the 19th centuries were the culminating days of the industrial revolution, when the old organization of domestic industry had given way before the factory system, and the population of the factory districts was suffering a martyrdom, with ruin of body and degradation of character, from unbridled competition, long hours, women's and children's labour, pauper apprenticeship, great fluctuations of trade and employment, dearness and adulteration of provisions, the truck system and insanitary homes. Owen, having himself become a great employer of labour, after starting as a draper's assistant, saw that this was in every sense waste, and that as it paid the manufacturer to have the best machinery and not to overdrive it, but to tend it well and keep it in the best repair, so it would pay him, and abundantly pay the nation, to have the human machines well cared for, not overworked, and kept in the best condition. The popular individualistic philosophy of that day taught that the good of society would be achieved by each individual seeking in his business relations the interest of himself and his family; but Owen maintained that the well-being of the social body could only be served if each individual made that his conscious aim. For this reason he and his disciples were called Socialists. He taught further that a man's character depended mainly upon the circumstances which influenced his life; he emphasized environment, and all but denied heredity. At New Lanark, from 1799, he carried out these ideas among the workers in the cotton mills of which he was managing partner.<sup>1</sup> "For twenty-nine years," he wrote, "we did without the necessity for magistrates or lawyers; without a single legal punishment; without any known poors' rate; without intemperance or religious animosities. We reduced the hours of labour, well educated all the children from infancy, greatly improved the condition of the adults, diminished their daily labour, paid interest on capital, and cleared upwards of £300,000 of profit." So wonderful were the results upon the population, that New Lanark

became a show-place of world-wide renown, and was visited by many of the greatest and most exalted people of the period.

While thus using his own power Owen not only advocated legislation to limit the hours of factory labour, but appealed to the public authorities to establish industrial communities, where the poor might be set to work, and be managed paternally on the principles of New Lanark. So great was his repute, and so influential the royal and other personages who gave him their support, that this appeal might probably have been successful had not Owen, in reply to complaints as to his religious views—which were deistic—and that his system was not founded on religion, made a public attack upon all accepted religions.

Failing to get the required support from the Government and magistrates, he still sought it from wealthy believers in his teaching, and a number of “communities” (see [COMMUNISM](#)) were founded in England and Scotland, and in the United States. These were intended to be self-supporting, the land and other means of producing wealth being owned in common, and work and education being regulated on Owen’s principles. Owen well knew that most of them lacked the large amount of capital necessary, but his hand was forced by enthusiastic followers, and even the most hopeful of the experiments, that of Queenwood in Hampshire (1839-1844), was made prematurely and failed.

His connexion with New Lanark also came to an end, not from any want of success, but through differences with some of his partners who objected to such matters as dancing, military drill for the children, and the wearing of kilts, but above all feared lest Owen’s “infidelity” should undermine the people’s faith.

Thus it might have seemed that Owen’s life and fortune had been spent in vain, and resulted only in unsuccessful experiments; but this was far from being so. His teaching, and in particular his doctrines of circumstance, and of the conscious seeking after the social good, his belief in self-supporting communities, and his vision of a new moral and industrial world, had powerfully affected the working classes, indeed, all classes. Workmen in many parts of the country had formed groups with the ultimate object of founding self-supporting communities. If the government and the rich would not provide capital enough to start communities, the workers would start them themselves. Thus was the democratic basis given to co-operation. As a means they had been founding co-operative societies, which are sometimes called “union shops” to distinguish them from the later growth of societies of the Rochdale type. The members began by buying provisions wholesale and retailing them to themselves at current prices; the difference became capital, and as soon as possible one member was set to work to make boots and another clothes, and so forth, until ultimately the society should have capital enough to take land and form a community. Education also was prominent among their objects. These co-operative societies reached some 400 or 500 between 1828 and 1834, but the movement then collapsed. As the original enthusiasm died out, or members left the neighbourhood, or capital accumulated in the hands of the original shareholders, they almost all either failed or became private property. In those early days, moreover, the law gave no protection to the property of co-operative societies. This remained so until 1852, when the Christian Socialists (see [SOCIALISM](#)) among their many great services to the working classes secured such protection. In 1862 they secured also limited liability for the members.

Before 1844 a co-operative society had already been formed and failed at Rochdale in Lancashire, yet some ardent spirits planned to form another. Twenty-eight poor men, flannel weavers and such like, got together a capital of £28 by twopenny and threepenny subscriptions, and in December 1844 opened in Toad Lane, Rochdale, a little shop from which, speaking broadly, the whole of British co-operation, and very much of that of other lands, has grown. Their objects were those of other co-operative societies of the time, including the ultimate aim of a self-supporting community. In this last they never succeeded, nor indeed did they attempt it; but they did succeed in vastly improving the position of millions of the working classes by enabling them to obtain their provisions cheap and pure, to avoid the millstone of debt, to save money, to pass from retail to wholesale trade, and from distribution to manufacturing, building and house-owning, ship-owning and banking; above all to educate themselves, and to live with an ideal.

The Rochdale Equitable Pioneers began their trading in the smallest way, the members taking turns to serve in the shop; yet where so many other Union shops had failed Rochdale succeeded, and it has steadily grown to an institution with some 14,000 members, doing a trade of £300,000, owning shops and workshops, a library and reading-rooms, making large profits, and devoting a substantial part of them to education and to charitable purposes.

**Rochdale  
pioneers.**

What was the reason of this difference? Chiefly it would seem a different method of dealing with the profits. Earlier "Stores" had divided these according to the capital contributed by each member, or else equally among the members: the Rochdale Pioneers determined that, after paying 5% interest on the share capital, all profit should be allotted to the purchasing members in proportion to their purchases, and be capitalized in the name of the member entitled, until his shares amounted to £5. Thus each member found it his interest to purchase at the store and to introduce new purchasers. The ownership of the store remained always with the purchasers, and each came under the magic influence of a little capital saved.

Not only did Rochdale store grow amazingly, but its example spread far and near. New stores were founded on the "Rochdale plan" and old stores adopted it; soon they were numbered by hundreds. In spite of many failures there were in 1906 more than fourteen hundred such stores in the United Kingdom, with nearly two and a quarter million members, over £33,000,000 capital, and sales exceeding £63,000,000 in the year. The number of societies does not increase of late years, the tendency being rather for established societies to open branches, but all the other figures increase rapidly from year to year.

***Growth of co-operative stores.***

These workmen's Co-operative Stores, or Distributive Societies, flourish chiefly in the north and midlands of England and in Scotland, but are found more or less all over the country. They, and practically all other British co-operative societies, are registered under the Industrial and Provident Societies Act, which constitutes them corporate bodies, with limited liability, and fixes £200 as the maximum that any member may hold in the share capital. Their government is democratic, based on one vote each, for man or woman; and their members or shareholders, and their committee-men or directors, are almost exclusively the more provident of the working classes, or belong to the class just above. Store societies are of various sizes, from the small village shop to the greatest of them all, the Leeds Society, with nearly 30,000 members, sales exceeding a million and a half sterling, and an elaborate organization of branches and manufacturing departments. Their method, the "Rochdale system," is as follows, subject to occasional variations. Membership is open to all who pay a shilling entrance fee and sign for a £1 share, which can be paid up out of profit. For the most part members may at any time withdraw their shares in cash at par. A record of each member's purchases is kept by means of metal tokens or otherwise, and at the end of each quarter, after paying a limited interest (never more than 5%, and in very many societies less) on shares, and, in some societies, paying a proportion of profit to the employees, the surplus is divided to the members in proportion to their purchases: non-members also usually receiving half dividends on theirs. Thus the members in effect obtain their necessaries at cost price. The dividend on members' purchases averages about 2s. 6d. in the £. In many successful societies even more is paid, but the average is falling. Where dividend is high, prices are often fixed above those current in the neighbourhood, so that the members, in addition to saving the retailer's profit, use their Society as a sort of savings bank, where they put away a halfpenny or so for every shilling they spend. In addition to retailing, a store often manufactures bread, clothes, boots and millinery, sometimes farms land, or grinds corn; usually for its own members only, but occasionally for sale to other societies also. Their productions in this way exceed £5,000,000 a year. They also invest large and increasing sums in building cottages, to let or sell to their members; and they lend still more largely to their members, to enable them to buy cottages.

Outwardly these stores may look like mere shops, but they are really much more. First, they are managed with a view not to a proprietor's profit, but to cheap and good commodities. Secondly they have done an immense work for thrift and the material prosperity of the working classes, and as teachers of business and self-government. But further, they have a distinct social and economic aim, namely, to correct the present inequalities of wealth, and substitute for the competitive system an industry controlled by all in the common interest, and distributing on principles of equity and reason, mutually agreed on, the wealth produced. With this view they acknowledge the duties of fair pay and good conditions for their own employees, and of not buying goods made under bad conditions. The best societies further set aside a small proportion of their profits for educational purposes, including concerts, social gatherings, classes, lectures, reading-rooms and libraries, and often make grants to causes with which they sympathize. Their members are prominent in local government affairs; co-operative candidates are occasionally run for town councils, and often talked of for parliament. Though the societies are non-political, and have refused to join the labour representation movement, they are usually centres of "progressive" ideas. There are of course many defects, and of their two million members a large, and many fear an increasing, proportion, attracted by the prosperity of the societies,



think chiefly of what they themselves gain; but the government of the movement has, hitherto at least, been largely in the hands of men of ideas, who believe that stores are but a step to co-operative production, and on to the "co-operative commonwealth."

It is indeed only when we come to federations of co-operative societies, and above all to production, with its large number of employees, that the educational side of the movement and its power to promote industrial reform are most seen. The Co-operative Union, Limited, for instance, is a propagandist federation of all the chief co-operative societies in Great Britain, and some in Ireland. Its income of £10,000 a year is contributed by the Co-operative Societies. It looks after their legal and parliamentary interests, carries on much educational work by means of literature, lectures, classes, scholarships, summer meetings at the universities, and so on; organizes numerous local conferences for discussion, and once a year a great national co-operative congress, and exhibition of productions, in some chief centre of population. The Co-operative Wholesale Society, Limited, is a trading federation of the great majority of the English stores. Founded in 1863 on a small scale, it now counts its employees by thousands, its capital by millions, and its yearly sales by tens of millions. Besides its merchant trade, it manufactures to the value of £4,500,000, owning factories, warehouses and land in many districts. It imports largely, and runs its own steamships. It is also the bank of the co-operative societies, and the chief outlet for the always redundant capital of the well-established stores. The Scottish stores also have their Wholesale Society, not less important relatively. For many purposes these two are in partnership. In each of them the net profits are returned to the stores as a dividend on purchases, and thence to the whole body of members; but in the Scottish Wholesale a part is also paid to its employees as a dividend upon their wages. There are also a few local federations of stores, mostly for corn-milling and baking.

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Strongly contrasting with this production by associations of consumers, or "consumers' production," is the co-partnership, or labour co-partnership, branch of co-operation. Its simplest form is an association of producers formed to carry on their own industry. Originally such societies were intended to consist solely of the workers employed; the ideal was the "self-governing workshop," introduced from France by the Christian Socialists of 1850; but membership is now open to the distributive societies, which are the chief customers, and usually, to all sympathizers. Shares are transferable, not withdrawable. Profits first pay the agreed "wages of capital," usually 5%, and of what remains the main part goes to the employees as a dividend on their wages, and to the customers as a dividend on their purchases. In well-established societies the dividend on wages averages about 1s. on the £. This is not usually paid in cash, but credited to the employees as share capital, whereby all may become members. Besides other producers' associations, more or less co-operative, there are over a hundred co-partnership societies at work in England, against a dozen or fifteen in 1883. They are engaged in boot-making, printing, building, weaving, clothing, wood-working, metal-working, and so on. Some of them are very small, while others have businesses of £50,000 a year or more, the average being about £10,000. The majority show fair, sometimes large profits. Each is governed by a committee, which is elected by the members and appoints the manager. A minority of them sell in the open, *i.e.* the non-co-operative, market, and a few sell largely for export.

We constantly hear that co-operative production is a failure. There have no doubt been failures, especially of big experiments attempted among men totally unprepared. But many of the failures counted were not truly co-operative. At the present day consumers' production is successful beyond all question, while the net growth of producers' associations in the last twenty years has been marked both in number and importance. These two forms of production best illustrate the two rival theories which divide British co-operation, and between whose partisans the conflict has at times been sharp. The consumers' theory maintains that all profit on price is abstracted from the consumer, and must be returned to him; while to him should also belong all capital and control, subject to such regulations as the state and the trade unions enforce. This theory is fully exemplified in the English Wholesale Society, and in some of the smaller federations for production, which employ workmen, whether co-operators or not, for wages only, and admit no individual, but only co-operative societies, to membership. It is also exemplified by the great majority of the stores, though in their case the employee may become a member in his capacity as a consumer. The co-partnership theory, on the other hand, maintains that the workers actually employed in any industry, whether distributive or productive, should be partners with those who find the capital, and those who buy the produce, and should share with them the profit, responsibilities and control. The consumers' party contend that societies of producers make a profit out of the

**Co-partnership.**

**Rival theories.**

consumers, and thus are never truly co-operative, while as they multiply they must compete against each other. The co-partnership party answer that labour at least helps to make the profit, and that competition, as yet almost insignificant between their societies, can be avoided by federating them (a process long ago begun) for buying and selling in common, and for other common purposes, while leaving each the control and responsibility of its own internal affairs. They further advocate the eventual federation of the productive wing of co-operation with the distributive, for settling prices and all matters in which their interests might conflict. In this way they say the co-operative system may extend indefinitely without sacrificing either individual responsibility and freedom, or a general unity and control, so far as these are necessary to secure the common interest. On the other hand they hold that the opposing system tends more and more to centralization and bureaucracy, and divorces the individual workman from all personal interest in his work, and from any control over its conditions. They contend, moreover, and it is indeed admitted that, in spite of the great advantages which consumers' production has in its command of a market and of abundant capital, only a small part of industry can ever be carried on by associations of the persons who actually consume the produce. Outside this small part, therefore, voluntary co-operation is impossible except as some form of co-partnership.

On the working-out of these two principles depends the future of co-operation. The example of Scotland probably throws light on the problem. There co-operative production, amounting to some millions sterling, is nearly all carried on by federations of consumers' societies, including the Scottish Wholesale, which apply more or less successfully the co-partnership principle—*i.e.* their employees are admitted to share in profits, and may become members, whereby they are further admitted to share in capital and control. The type of organization hence resulting is very much the same as where a society of producers admits consumers' societies to membership, and sets aside a proportion of the profits to be returned to them as dividend upon their purchases. To this combined type, we have seen, English productive societies, started by producers, have come; and it would appear that those started by consumers must ultimately tend to it. However, in spite of honoured leaders of the early days, the consumers' party is at present greatly in the ascendant in English co-operation, and even in the Scottish federations it is almost strong enough to abolish co-partnership, and allow no one to share in capital, profit or control except in his capacity as a consumer.

An association of co-operative societies and individuals, called the Labour Co-partnership Association, exists to maintain the principle of co-partnership in co-operation, and also to promote its gradual adoption in ordinary businesses. Some progress in this latter direction is being made, there being a tendency to improve upon simple profit-sharing by capitalizing the workman's "bonus," whereby he becomes a shareholder, and the business is gradually modified in a co-operative direction. There are remarkable instances of such modification abroad, notably that of the great iron foundry and *Familistère* at Guise in France. The most noteworthy, among several, in England is that of the South Metropolitan Gas Company, where after eighteen years of the system 5000 odd employees had in 1907 more than £320,000 invested in the company; they also elect three of themselves directors of the company, this being one-third of the board. Unfortunately this example is, or at least was, marred by a feud with the trade unions, whereas there is friendship between trade unionism and co-partnership, as indeed between trade unionism and co-operation generally.

One of the most recent and promising developments of English co-operation is the tenants' co-partnership movement for the common ownership of groups of houses, which the society owning them lets out to its members. These societies are but few as yet, but they have sprung up rapidly and promise great usefulness and extension. Somewhat similar societies have long been a recognized branch of co-operation on the continent of Europe.

**Tenants' co-partnership societies.**

Such, then, are the history and present extent of co-operation in Great Britain. Turning abroad we find in almost all civilized countries, besides other forms of co-operation, important and growing movements roughly similar to those above described, but on the whole less identified with the working classes and less coloured by their social and economic ideals. In France, Germany, Switzerland, Italy and elsewhere, there are very important co-operative distributive movements looking to Rochdale as their prototype; and in the United States of America there are at least continual attempts to spread Rochdale co-operation. Of these foreign stores, however, many exhibit important modifications, such as unlimited liability, and selling at cost price, or between that and market prices. On the whole we may say that Rochdale Co-operation is the most extended

**The movement outside Britain.**

and the most typical. It, and the workshop movement springing from Fourier, and the socialist co-operation of Belgium and elsewhere, are certainly the forms which have most of the ideal of democratic equality and social reconstruction. Other forms look more to the money benefits accruing to the members, seeking to supplement the present order of society, rather than to bring in a new order. Among these other forms—separate in origin, in methods, and largely in spirit—the most important are credit co-operation, or people's banking, and agricultural co-operation, two forms until recently unknown in the British Islands.

Confusion has sometimes arisen from the fact that while Rochdale Co-operation sets itself against "credit," continental co-operation is more concerned with obtaining credit for its members than with anything else. But credit is used in two senses. The English workman employed for wages is against the credit which means spending them before they are earned: continental co-operation seeks by collective credit to put into the hands of working peasants, craftsmen and traders, the stock and the tools without which their labour is vain. Credit for consumption is the road to poverty; credit for production the road to well-being.

**Germany and credit co-operation.**

Just as with co-operation in labour and in purchase, so mutual help in obtaining credit may doubtless be traced in primitive forms far back into history. It was certainly more or less "in the air" in Germany and France about 1848 and even earlier; but the beginning of systematic organized credit co-operation may be definitely fixed in the year 1849, when Raiffeisen began his *Darlehnskasse*, or loan bank, in Rhenish Prussia. Curiously enough it had also a second and entirely independent origin. For in the following year Schulze-Delitzsch, in a distant part of the same kingdom, established his Credit Society based on an entirely different system. As this second system spread much more rapidly than the other and attained, as indeed it retains, much greater commercial magnitude, it came to be regarded as the beginning of credit co-operation, of which for a long time it was the only important form. These two remain the two distinct types in every land. Thus Germany, which has innumerable co-operative societies of every form and of great importance, is in particular the mother of credit co-operation.

In the famine years of 1846 and 1847 and for some years after, Friedrich Wilhelm Raiffeisen was a burgomaster in the barren Westerwald. The people were hopelessly ground down by debt to money-lenders for small doles of capital, advanced to purchase stock, or meet times of special difficulty. It occurred to Raiffeisen that by combining to borrow a moderate sum of money on their joint responsibility, and afterwards to lend it out among themselves in small sums at a slightly greater rate of interest, the peasants might obtain relief from their burden of usury, and at the same time get the capital necessary to make their labour productive. Accordingly in 1849 at the little town of Flammersfeld, he set up a "Loan Bank." Despite its success, it remained the only one of its kind for five years, when Raiffeisen founded a second. There was no third for eight years more: it was only in 1880 that they began really to spread, but now they are found in many lands and are counted by thousands.

**Raiffeisen loan banks.**

Such a bank is essentially an association of neighbours. Besides borrowing, it also receives savings deposits, which often produce a large part of, or even all, the capital it needs. Usually a few of the members are comparatively well to do people, who join to help their neighbours by increasing the society's credit. This Raiffeisen considered essential. They have no actual privilege, but by common consent they take a leading part. In the true Raiffeisen bank the liability of each member is unlimited, but limited liability has been introduced in some of its modifications. The Society confines its operations strictly to a small area, say a parish, where everyone knows everyone. Each borrower must specify the purpose for which he wants a loan, say to buy a cow or drain a field, or pay off a money-lender, and this is rigorously inquired into. Only members can borrow. Any member, however poor, can borrow for a profitable approved purpose, and no one, however rich, for any other. Practically all the members see that the money is applied as agreed; and, while the loan is often made for a long period, a year or two—even for ten or more—so as to repay itself out of the profit, power is reserved to call it in at short notice if misapplied. Loans are repayable by periodical instalments, but repayments must be made with absolute punctuality. No bills, mortgages or other securities are taken, except a note of hand either alone or with one or two sureties. There are two committees, one to lend and do the work of the society, and the other to supervise the first; and on both of these it is understood that the richer members are to be in a majority. No committeeman or officer receives any remuneration for his services, except that the accountant gets a small salary. Originally there were no shares, and when in 1889 the legislature ordained that there must be shares,

the Raiffeisen banks made theirs as small as possible, generally ten or twelve shillings. Nothing is paid on the shares as interest or dividend, all profit being voted once for all to the ordinary reserve and the indivisible reserve, the latter the backbone of the system. In every large district the Raiffeisen banks are federated in a Union, and these Unions culminate in a General Agency. As an intermediary among themselves, and between them and the money market, the banks have also a central bank with a capital of £500,000, and with ten provincial branches. A great deal of agricultural co-operation has arisen from these banks as centres, and with the money they have supplied.

Raiffeisen banks boast that neither member nor creditor has ever lost a penny by them, and while this is denied it seems at least near the truth. Their credit is so good that they can obtain money at very low rates, and as their expenses are trifling they can re-lend to their members at rates but little higher. In Germany they usually lend at about 5%. Only men of good character can obtain membership: thus, besides spreading prosperity, they have everywhere been great promoters of sobriety and good conduct. They were only intended to meet the needs of the peasants, especially of the very poorest, and for this purpose they have proved admirably suited.

Very different were the people among whom Schulze-Delitzsch established his form of co-operative credit; and very different the organization he adopted and the results which have flowed from it. In 1850 Franz Hermann Schulze was a judge in his native town of Delitzsch, almost at the middle point of the southern edge of Prussia, and established there his first *Vorschussverein*, or Advance-Union. He had been in England and knew something of our co-operative movement, but he scarcely seems to have derived any part of his inspiration from it. The people he desired to help were townsmen, especially the small craftsmen working on their own account, the joiners, shoemakers and so forth; and his ideal was to do this merely by stimulating their thrift.

In a Schulze-Delitzsch bank, a number of such men combine together to raise a capital of guarantee: to do this every member takes up one share and one only, which is of large value, say £30 or £50 or even much more, but can be paid up by small instalments. Thus every member is committed to a long course of saving. On the strength of this capital in course of formation, and the unlimited liability of the members, the bank is able to borrow, or to receive as savings and deposits from members and others, a much larger capital. The funds so constituted it lends out at the highest rates it can command, originally 12% or 14%, but now very much less, and varying, of course, with the market. It lends to members only, but to any amount, for any purpose and on any good and sufficient security, whether acceptance, promissory note, overdraft, discount, mortgage, pledge, surety or what not. The loans, however, are always for a short period, usually three months, renewable for another three months, and sometimes further than that. The committee of management are elected by the general meetings; they decide on all loans, and receive a salary, plus a commission on the business done. The council of supervision are also paid, or at least entitled to pay. The great objects which a bank keeps in view are security and a good return on capital. It is not confined to a small area, but works for as large and as varied a constituency as possible. With such a constitution the Schulze-Delitzsch banks grow big and accumulate a large capital of their own. On an average each bank has nearly 600 members and lends about £150,000 per annum, including loans renewed. Losses are sometimes made, but they are not heavy on the whole. All the profits are divided upon capital, or put to reserve, except some, usually small, sums given to charitable or educational purposes. Dividends average about 5%, but have been known to reach and even exceed 30%.

It may therefore justly be said that for co-operative institutions these banks smack too much of joint-stockism: they are in fact co-operative not much more than in the same sense that the Oldham cotton mills, and other "working-class limiteds," have sometimes been loosely called co-operative. They seem constituted to make the lender's interest supreme, but they have, nevertheless, conferred enormous benefits on the handicraftsmen, small traders, small cultivators and others who borrow from them. They have put capital within their reach at reasonable rates.

These banks also have their central point. In 1864 the German Co-operative Societies' Bank was founded to centralize the work of the local Schulze-Delitzsch banks and to bring the money market within their reach. It was not itself co-operative, and never confined its business to the co-operative banks. Beginning in a very small way, by 1903 it had attained a capital of a million and a half sterling and a yearly business of £154,000,000, of which £28,000,000 was specifically with co-operative credit societies. It was then amalgamated with another banking business, the *Dresdner Bank*, esteemed one of the most important and

**Schulze-Delitzsch banks.**

successful in Germany.

Thus these two types of credit co-operation agree in being founded on unlimited liability, but speaking broadly they are contrasted in that the Schulze-Delitzsch banks work primarily, though by no means solely, among townsmen, are based on share capital, work for profit, which they divide on shares, are conducted by paid directors, and confer their benefits not on the very poorest but rather, as their own friends say, on the middle classes: the Raiffeisen banks are designed for the peasantry, are not based upon share capital, neither divide, nor work for, profit, are conducted by unpaid directors, and confer their benefits especially on the very poor. The Schulze-Delitzsch type is strong in self-help, but tends to commercialism as it grows; the other needs the help of the well-to-do to back up the self-help of the poor, but it tends to altruism and the union of classes.

The world has 30,000 co-operative credit societies, not counting building societies; and though they are organized in many groups, especially in their native Germany, for local reasons, or because of some modification, or some compromise between the two systems, the two types really include them all. There is, however, a strong tendency to introduce limited liability into various offshoots of the one type and the other; even into the orthodox Schulze-Delitzsch banks themselves, when they grow big. From Germany co-operative banks have spread into almost all European countries—even at last to Ireland and England—and to America and Asia. In Germany there are some fifteen thousand local, and no less than sixty central, co-operative credit associations, which lend out £180,000,000 a year including renewals. In Italy, Austria and Hungary they are also strong. In 1896 it was estimated that £150,000,000 a year must be very well within the total amount lent by money co-operation on the continent of Europe; eight years later it could not well fall short of £250,000,000, and the amount keeps constantly increasing. Of this total only a small percentage represents loans by banks of the Raiffeisen type, which, though very numerous, often lend only a few hundred pounds each in the year.

Great controversy has prevailed as to the state subsidies given to co-operative credit. While governments are sometimes rather inclined to hinder co-operative distribution, they have shown a marked tendency to foster, whether for political or economic reasons, co-operative credit. The Prussian government in response to popular demand, vigorously supported by the agricultural interest, has founded and endowed with £2,500,000 of public money, the Central Co-operative Bank, whose object is to bring capital within the reach of the various groups of co-operative banks. The Schulze-Delitzsch Union was the only one to dispute the need of this, and though the bank has given a stimulus to the formation of co-operative societies, it still denies that this is a healthy propagation. Nevertheless, some even of the Schulze-Delitzsch societies resort to this state bank for money. It is under government administration and lends immense sums each year. In France the Bank of France has been compelled to lend £1,600,000 free of interest, and to give about £120,000 per annum out of its profits to assist agriculture; this money is being lent free to “regional” banks, and by them at about 3% to local societies. State help has also been given to the co-operative bank of the French workmen’s productive societies. In Austria and in many other countries a great deal of similar help has been given.

Closely connected with certain developments of credit, and deserving to rank as the third, if not the second, great subdivision of co-operation, is agricultural co-operation, a movement

***Denmark and  
agricultural  
co-operation.***

in the main of the last twenty years, but amounting now to a great force, almost everywhere except in Great Britain, and in some countries almost to a revolution. It is important to say agricultural co-operation and not co-operative agriculture, for in spite of some customary mutual help in farm work, in spite of several attempts, and some small successes, in co-operative farming, the actual cultivation is almost everywhere individualistic. The farmer or peasant cultivates alone, or with his family, or servants; when he co-operates with his fellows, it is to manufacture, or to market, the products of his farm, or more often to obtain the things he needs for his farming, to raise stock, to own expensive machinery in common, or insure against risks. By these means the small farmer, without sacrificing his own peculiar advantages, obtains most of the advantages of the big farmer, to the immense improvement of his position.

At almost every point agricultural and credit co-operation touch; yet the most perfect example of agricultural co-operation is not concerned with credit co-operation in any form. The farmers of Denmark practise co-operation in almost every variety, except for raising capital. The commercial banks have provided money to start dairies and other co-operative societies; so that, it would appear, the need of credit co-operation has not been felt.

The Danish farmer is almost always a freeholder: it is little more than a century since his ancestors were serfs. It is little more than a generation since a few men, turning to account the strong national feeling aroused by the defeat of 1864, started a great educational movement which has left its mark on all strata of Danish society. After the People's High School, technical schools arose in various places; and to these, and to the excellent continuation schools in the country districts, the Danes are beholden for the regeneration of their agriculture. From 1867 co-operative distributive societies on the Rochdale plan had been spreading in Denmark; but it was not till 1882 that co-operation in agriculture began, and the first co-operative dairy was formed; ten years later there were about a thousand such, a number which has slightly increased since. These dairies are productive societies in which the cow-owners are the shareholders, and all shareholders have equal rights and equal voting power, whether they own one cow or one hundred. Almost every village has its co-operative dairy, fitted to deal with the milk of from 400 to 1400, or even 2000 cows. They far exceed all the other dairies of Denmark. More than four-fifths of all the milk of Denmark is used in them, and they produce butter worth more than nine millions sterling. The profits are divided among those who supply the cream, in proportion to the value of their supplies—a method of dividing profits characteristic of agricultural co-operation. The village dairies are united in federations to export their produce.

Side by side with the dairies are other co-operative societies, quite independent but largely composed of the same members, for buying collectively fodder, manures and other agricultural or household requisites, for collecting and exporting eggs, slaughtering hogs and curing bacon, improving the breed of stock, for bee-keeping, fruit-growing and so forth. By means of these societies the country has been greatly enriched. The farmer not uncommonly belongs to ten co-operative societies, besides probably a farmers' club. The work of starting and administering the societies is seldom paid, and many farmers give much time to it gratuitously. They are in the main organized on the same principles as the dairies, but with variations; the largest egg export society, for instance, has over 30,000 members. It is not a federation of village societies, but a centralized body with many branches.

The growth of the bacon-curing societies has been remarkable. The first of them was not founded until 1887, but they spread rapidly, and in seven years there were twenty, killing more than half the country's then produce of hogs. The movement has greatly increased since then, and multiplied its output about fourfold. Co-operation in collecting, grading and exporting eggs only began in 1895, and in eight years 65,000 members had joined the various egg societies, and the value of eggs exported had reached £436,000. Taken as a whole, the effect of agricultural co-operation in Denmark has amounted to little less than a revolution. It has brought the results of science within the peasant's reach, and he has been quick to avail himself of them: it has transformed a great part of farm work into a factory industry, increased the yield of the soil, improved the material position of the peasants, and drawn rich and poor together. Denmark, once so poor, is now, except England, probably the richest country in Europe in proportion to its population. Besides Denmark, Germany, France, Italy, Belgium, Holland, Finland, Australia, New Zealand, the United States, Canada, Ireland and many other countries have important developments of agricultural co-operation. In Germany, where it is closely connected with credit co-operation, it seems to date from 1866 only, yet in forty years agricultural co-operative societies have come to number six thousand, without counting the agricultural banks, which exceed twice that number. There are dairies, societies to purchase farm requisites, societies of grape-growers, hop-growers and beetroot-growers, distilleries, labour societies, insurance societies, societies to own warehouses and granaries and to sell produce, to purchase land and resell it in small holdings, and even several societies which purchase land to cultivate it in common. The close connexion between credit-societies and other agricultural co-operation is exemplified in the Central Union of orthodox Raiffeisen credit societies at Neuwied. Through a central bank and a trading department allied to it, it has negotiated the joint purchase of coal, feeding-stuffs, manures, machinery and so forth to large amounts, as well as the difficult business of the combined sale of agricultural produce. Moreover, several local centres connected with this union have granaries and warehouses for the storage of agricultural produce, and negotiate joint sales, while within the union facilities have been found for selling the products of one district to members in another.

In Ireland stores have not hitherto flourished, though a few exist. Irish co-operation is agricultural, and dates from the foundation of one co-operative dairy in 1889. Thence has grown a movement already of great importance, still advancing and comprising from eighty to ninety thousand members, belonging to some hundreds of societies—dairies, agricultural supply societies, banks and so

forth, formed on the Danish model. To form a dairy the small working farmers of a district register a society and take up shares of £1 each, in proportion to the number of their cows. Each brings his milk to be separated, is paid for the butter-making material it contains, and receives back skim milk. If any profit is divided, it belongs nine-tenths to the suppliers of milk in proportion to the value of their supplies, and one-tenth to the dairy employees as dividend on wages in pursuance of the co-partnership principle. These dairies produce butter worth more than £1,000,000. Their rapid spread is due to their great influence in improving the quality of butter, and hence increasing the farmer's gains. The co-operative banks are of the Raiffeisen type, though a few have limited liability. They aim at providing the peasants with necessary capital ("the lucky money" they have christened it) and expelling the usurer. They are increasing rapidly. Among other objects of Irish co-operation are selling eggs, poultry, barley and pigs, joint-grazing, potato-spraying, scutching flax, bacon curing, home industries, and of course supplying farm requisites. The movement promises much further growth in magnitude and variety. The dairy societies have federated into an agency for reaching the English market, and the supply societies into an Irish Wholesale for purchasing to the best advantage. Besides the direct profits and economies of these societies, they have greatly benefited Ireland by teaching men of all classes, parties and religions to act together for peaceful progress; they have led to a wide diffusion of better agricultural knowledge, and to the establishment by government of the Agricultural Department. (See IRELAND.)

In France, which Englishmen are apt to speak of as preeminently the country of co-operative production, the agricultural is the most important branch of co-operation; and the source and mainstay of agricultural co-operation are the *Syndicats Agricoles*. These are not technically co-operative societies; they are rather trade unions, not indeed of wage-earners only, or mainly, but of cultivators. They cannot legally trade, being constituted for the study and protection of the general interests of the members, the spread of information, and so forth. Their principal object however, seems in many cases to be to combine their members for the purchase of all farm requisites and especially of chemical manures. This they do by collecting, sorting and passing on orders. They cannot usually manage selling in common without the intervention of a society specially registered for that object. Beginning only in 1893, their number long ago ran into thousands and their membership into hundreds of thousands, drawn from all classes of cultivators and landowners, great and little. Among much other good work they have led to the formation of a large number of strictly co-operative societies for all the purposes of agriculture, except cultivation in common. Thus there are two thousand agricultural banks, besides butter factories, distilleries, associations for threshing, for sale of fruit and vegetables, for wine-making, oil-pressing, and so on, amounting altogether to some hundreds. There are also societies, mostly of ancient date, engaged in making Gruyère cheese: a few years ago these numbered 2000, but they are dwindling. Lastly, there are some eight thousand mutual insurance societies organized as agricultural syndicates.

Everywhere the main features of this agricultural movement are similar to those we have seen in Denmark and Ireland; it is supplementary to individual cultivation; hardly ever does it appear as associations for cultivating in common, and, speaking with certain important exceptions, it has no very ideal aims, but seeks chiefly to give the farmer a better profit. In England there are a number of farms worked by stores, and several large associations for the supply of farm requisites; but the typical agricultural co-operation, based on small village societies and federations of such societies, has only recently been made known and begun to take root.

It is notable that while the *Syndicats agricoles* are almost exactly what Fourier, the Robert Owen of France, foresaw as the next stage of social development, the other great branch of French co-operation, the workshop movement of the *Associations ouvrières de production*, is

**France and co-operative production.**

directly due to his teaching, which led in 1848 to the starting of a large number of co-operative workshops. The suppression of association after the advent of Napoleon III. killed most of them, but with the return of liberty they revived and they have steadily increased ever since. They vary somewhat among themselves, but are in the main combinations of workmen

to carry on their industries with their own capital or that of their trade unions. Their chief difference from English co-partnership societies is that they very rarely admit to membership any persons not belonging to the trade. They are engaged in a great variety of industries, selling comparatively little to co-operative distributive societies, as English co-partnership societies do, but taking contracts from government departments and the municipalities, and supplying the general public. Complete statistics of their total trade are

not available, but it exceeds £2,000,000, and the separate societies seem to vary, like the majority of English co-partnership societies, from about £40,000 a year downwards, a few being larger but the great majority small. From about 140 societies in 1896 they have grown to between two and three times that number, and the increase continues with rapidity. More than two hundred of them are federated in the *Chambre consultative des associations ouvrières de production*, which looks after certain business interests of the societies, and also assists the formation of new ones by propaganda and advice. In Paris alone about a third of these societies are found.

It has been objected that their growth is artificial inasmuch as the government gives them certain advantages, such as preference over the private contractor at an equal price, exemption from the deposit of security, and special concessions as to payments on account. It also grants a subvention (recently about £7000 per annum), which was formerly all given to the societies in grants, but is now largely lent to them at not more than 2% interest through their own special bank. This bank was founded in 1893 to help the societies with loans and discounts, and was soon after endowed by a disciple of Fourier with £20,000. The societies have also benefited by other private beneficence and public help. As to the Government aid, it must be remembered that in France the state helps all forms of industry in ways unknown to us, and the French co-operative producers always declare that what is done for them is a trifle compared to what is done for other manufacturers. Moreover, they get many large contracts in open and unaided competition. In these societies the *auxiliaires*, or workers who are not members, are often numerous; but no society is now admitted to their federation which does not share profits with the *auxiliaires* and facilitate their admission to membership.

Consumers' co-operation, credit co-operation, agricultural co-operation, and workshop co-operation, as exemplified in Great Britain, Germany, Denmark and France, are found in most advanced countries, some in one and some in another, in forms roughly similar to those above described. Of co-operation for production it might have been said, a few years ago, that outside Great Britain it everywhere meant associations of producers. Except bakeries, there was but little consumers' production; that, however, seems now to be spreading in foreign countries also. The most important developments of co-operation not yet described are the socialist co-operation of Belgium, the co-operative building societies of the United States, the labour societies of Italy and Russia, the co-operation of German craftsmen to provide themselves with raw material, and the letting out of railway construction to temporary co-operative groups of workmen by the New Zealand and Victorian governments.

In Belgium co-operation is mostly socialist in the towns and Catholic in the country. In all the principal industrial centres are very important co-operative bakeries and distributive societies, owned by co-operative groups, numbering thousands of workmen of every calling. These *Maisons du peuple* are admitted to be well managed, even by those who dislike their politics. The socialist party look upon them chiefly as a means of organizing and educating the working classes for political and economic emancipation, and of providing funds for political warfare. Like the English stores, and allied societies, they are based on the consumer, but unlike them they pay no interest on share capital, though they do on deposits. A much larger part of the profit than in England is devoted to propaganda and common purposes, though a part is also paid to the consumers individually in the form of checks exchangeable for bread or other goods. The workers employed also receive a share of profit as a dividend on their wages, and elect their representatives on the committee of management. By means of these societies the party has a press, buildings, and the funds to fight elections and support members in parliament. In France, where the store movement has been of an individualistic, and often middle class, tendency, the socialists have lately imitated the example of Belgium, and seem to be winning more success than the older French stores.

In the United States there has long been much important agricultural co-operation, and there have been many much-advertised attempts to establish Rochdale co-operation, but there have so often been failures and even dishonesties that co-operation has had a bad odour in the country, and the developments come and go with such rapidity that it is difficult to speak with confidence of its stability. The branch of co-operation which has been a great success in the United States consists of the great co-operative building societies, but building societies are not considered part of the co-operative movement in Great Britain.

Co-operation of all kinds is greatly developed in Italy, but one form is specially notable. The *Società di lavoro* are co-operative labour gangs of great importance. They are counted by hundreds, and are found among navvies, builders, masons, carriers, stevedores, agricultural labourers and other workmen, and have carried out very great works in Italy



and in foreign countries. They have, for instance, drained lands in the Campagna and made a railway in Greece. They differ from productive societies markedly in that they have comparatively little to do with capital or material, but contract mainly for labour.

The Slavonic races seem to have a special aptitude for grouping together co-operatively: it is said that men meeting casually on a journey will do so for the brief time they are together. In countries like Servia we see this ancient, and more or less customary, loose and unstable co-operation meeting the modern contractual, permanent co-operation of banks and other registered societies. So in Russia, where so large a part in the national organization is played by the *Artel* (see [RUSSIA](#)), which may be a transitory co-operative group of workmen undertaking a particular piece of work, *e.g.* to build a house, or a permanent association like that of the bank porters combined together to guarantee one another's honesty.

While English and some other forms of co-operation have always repudiated state help, and probably rightly, so far as their own work is concerned, the state in almost all countries, and conspicuously in England, has in fact helped to the extent of providing special legislation, and waiving fees, so as to encourage the formation of co-operative societies. A second form of state help is very noticeable in the modern development of agriculture, as in Denmark, Canada, New Zealand, Ireland and very many countries, where the state has played a great part in performing or assisting functions which neither voluntary association nor individual enterprise could well perform alone; in providing technical education, expert advisers, exhibitions and prizes; in distributing information in all forms; in finding out markets, controlling railway rates, subsidizing steamboats, and even grading, branding, warehousing and freezing produce, and maintaining trade agents abroad. These things have not been done for co-operative societies alone, but for agriculture in general; but co-operation has chiefly benefited, and much has been done expressly to encourage the formation of associations of cultivators, and provincial and national federations of such associations; and government departments of agriculture are found acting through such bodies, and with their advice and assistance. The third and most questionable form of state help is by direct subventions, and we have seen how much has been done in this way for credit co-operation and particularly agricultural credit. Harm has undoubtedly been done in certain cases by forcing co-operative societies, whether from political motives or merely mistaken policy. Yet even as to money subventions, good authorities, while admitting the great dangers, remain convinced that the advantages overbalance them, self-help being evoked, and helped over initial difficulties which would otherwise be insuperable. Experience in fact shows that governments can do a very great deal, at least for agricultural co-operation, but only on condition that they encourage, and do not undermine, self-help and private initiative. Thus while voluntary association is sometimes advocated as a step towards, and sometimes on the other hand as a substitute for, and bulwark against, state socialism, we find in practice these two forces working each in its own sphere, and in ways complementary one to the other, while underlying and essential to both is the force of individual action and self-help.

We have now surveyed co-operation in its chief forms and in some of the countries where it is chiefly found. Some years ago it was roughly estimated that the members of one or other of its branches numbered six millions, representing with their families a population of 25,000,000 people. This must be much within the truth today. In no other country so much as in Great Britain do we find the tendency for all branches of co-operation to federate in one union and to help one another by mutual trade. Yet everywhere the instinct of co-operative societies is to federate with others—at least with others of their own particular shade; so that Wholesales and other federations are found more and more in many countries. Since 1895 the co-operators and co-operative societies of many far-distant lands—almost of the whole world—have been drawn together by the International Co-operative Alliance, a body which, without attempting to interfere in their differences, collects information from all, and distributes it to all, keeps them all in touch, and every few years calls their delegates together in congress, to discuss their problems, and to remember their common ideals.

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(A. Wi.\*)

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1 Holyoake, *History of Co-operation* (1906 edition), i. 34.

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**COOPERSTOWN**, a village and the county-seat of Otsego county, New York, U.S.A., where the Susquehanna river emerges from Otsego Lake; about 92 m. (by rail) W. of Albany. Pop. (1890) 2657; (1900) 2368; (1905) 2446; (1910) 2484. It is served by the Cooperstown & Charlotte Valley railway (owned and controlled by the Delaware & Hudson), and is on the line of the Oneonta & Mohawk Valley electric railway. The village lies in the midst of a hop-growing and dairying region, and has cheese factories and creameries. It has a public library, Thanksgiving hospital, a Y.M.C.A. hall, and the Diocesan orphanage (Protestant Episcopal). Cooperstown is a summer resort, Otsego Lake (9 m. long and with an average width of about 1 m.), the "Glimmerglass" of Cooper's novels, being one of the most picturesque of the New York lakes. Cooperstown occupies the site of an old Indian town. In 1785 the site became the property of Judge William Cooper, who in the following year founded there a village which took his name and was incorporated in 1807. Judge Cooper himself settled here with his family in 1790. His son, James Fenimore Cooper, who lived here for many years and is buried in the Episcopal cemetery here, made the region famous in his novels.

See J. Fenimore Cooper, *The Chronicles of Cooperstown* (Cooperstown, 1838).

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**COOPER UNION**, a unique educational and charitable institution "for the advancement of science and art" in New York city. It is housed in a brownstone building in Astor Place, between 3rd and 4th Avenues immediately N. of the Bowery, and was founded in 1857-1859 by Peter Cooper, and chartered in 1859. In a letter to the trustees accompanying the trust-deed to the property, Cooper said that he wished the endowment to be "for ever devoted to the advancement of science and art, in their application to the varied and useful purposes of life"; provided for a reading-room, a school of art for women, and an office in the Union, "where persons may apply ... for the services of young men and women of known character and qualifications to fill the various situations"; expressed the desire that students have monthly meetings held in due form, "as I believe it to be a very important part of the education of an American citizen to know how to preside with propriety over a deliberative assembly"; urged lectures and debates exclusive of theological and party questions; and required that no religious test should ever be made for admission to the Union. Cooper's most efficient assistant in the Union was Abram S. Hewitt. In 1900 Andrew Carnegie put the finances of the Union on a sure footing by gifts aggregating \$600,000. For the year 1907 its revenue was \$161,228 (including extraordinary receipts of \$25,565, from bequests, &c.), its expenditures \$161,390; at the same time its assets were \$3,870,520, of which \$1,070,877 was general endowment, building and equipment, and \$2,797,728 was special endowments

(\$205,000 being various endowments by Peter Cooper; \$340,000, the William Cooper Foundation; \$600,000, the Cooper-Hewitt Foundation; \$391,656, the John Halstead Bequest; \$217,820, the Hewitt Memorial Endowment). The work has been very successful, the instruction is excellent, and the interest of the pupils is eager. All courses are free. The reading-room and library contain full files of current journals and magazines; the library has the rare complete old and new series of patent office reports, and in 1907 had 45,760 volumes; in the same year there were 578,582 readers. There is an excellent museum for the arts of decoration. Apart from valuable lecture courses, the principal departments of the Union, with their attendance in 1907, were: a night school of science—a five-year course in general science (667) and in chemistry (154), a three-year course in electricity (114), and a night school of art (1333); a day school of technical science—four years in civil, mechanical or electrical engineering—(237); a woman's art school (282); a school of stenography and typewriting for women (55); a school of telegraphy for women (31); a class in elocution (96); and classes in oratory and debate (146). During the year 2505 was the highest number in attendance at any time, and then 3000 were on the waiting list.

In the great hall of the Union free lectures for the people are given throughout the winter; one course, the Hewitt lectures, in co-operation with Columbia University, "of a very high grade, corresponding more nearly to those given by the Lowell Institute in Boston"; six (in 1907) courses in co-operation with the Board of Education of New York city, which, upon Mayor Hewitt's suggestion, made an appropriation for this work in 1887-1888, and extended such lecture courses to different parts of the city, all under the direction (after 1890) of Henry M. Leipziger (b. 1854), and several courses dealing especially with social and political subjects, and including, besides lectures and recitals, public meetings for the discussion of current problems.

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**CO-OPTATION** (from Lat. *co-optare*; less correctly "co-option"), the election to vacancies on a legislative, administrative or other body by the votes of the existing members of the body, instead of by an outside constituency. Such bodies may be purely co-optative, as the Royal Academy, or may be elective with power to add to the numbers by co-optation, as municipal corporations in England.

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**COORG** (an anglicized corruption of *Kodagu*, said to be derived from the Kanarese *Kudu*, "steep," "hilly"), a province of India, administered by a commissioner, subordinate to the governor-general through the resident of Mysore, who is officially also chief commissioner of Coorg. It lies in the south of the peninsula, on the plateau of the Western Ghats, sloping inland towards Mysore. It is an attractive field of coffee cultivation, though the greater part is still under forest, but the prosperity of the industry has declined since 1891. The administrative headquarters are at Mercara (pop. 6732). Coorg is the smallest province in India, its area being only 1582 sq. m. Of this amount about 1000 sq. m. consist of ghat, reserved and other forests. Coorg was constituted a province not on account of its size, but on account of its isolation. It lies at the top of the Western Ghats, and is cut off by them from easy communication with the British districts of South Kanara and Malabar, which form its western and southern boundaries, while on its other sides it is surrounded by the native state of Mysore. It is a mountainous district, presenting throughout a series of wooded hills and deep valleys; the lowest elevations are 3000 ft. above sea-level. The loftiest peak, Tadiandamol, has an altitude of 5729 ft.; Pushpagiri, another peak, is 5626 ft. high. The principal river is the Cauvery, which rises on the eastern side of the Western Ghats, and with its tributaries drains the greater part of Coorg. Besides these there are several large streams that take their rise in Coorg. In the rainy season, which lasts during the continuance of the southwest monsoon, or from June to the end of September, the rivers flow with violence and great rapidity. In July and August the rainfall is excessive, and the month of November is often showery. The yearly rainfall may exceed 160 in.; in the dense jungle tract it reaches from 120 to 150; in the bamboo district in the west from 60 to 100 in. The climate, though humid, is on the whole healthy; it is believed to have been rendered hotter and drier

by the clearing of forest land. Coorg has an average temperature of about 60° F., the extremes being 52° and 82°. The hottest season is in April and May. In the direction of Mysore the whole country is thickly wooded; but to the westward the forests are more open. The flora of the jungle includes *Michelia* (Chumpak), *Mesua* (Ironwood), *Diospyros* (Ebony and other species), *Cedrela toona* (White cedar), *Chickrassia tubularis* (Red cedar), *Calophyllum angustifolium* (Poon spar), *Canarium strictum* (Black Dammar tree), *Artocarpus*, *Dipterocarpus*, *Garcinia*, *Euonymus*, *Cinnamomum iners*, *Myristica*, *Vaccinium*, *Myrtaceae*, *Melastomaceae*, *Rubus* (three species), and a rose. In the undergrowth are found cardamom, areca, plantain, canes, wild pepper, tree and other ferns, and arums. In the forest of the less thickly-wooded bamboo country in the west of Coorg the trees most common are the *Dalbergia latifolia* (Black wood), *Pterocarpus marsupium* (Kino tree), *Terminalia coriacea* (Mutti), *Lagerströmia parviflora* (Benteak), *Conocarpus lalifolius* (Dindul), *Bassia latifolia*, *Butea frondosa*, *Nauclea parviflora*, and several acacias, with which, in the eastern part of the district, teak and sandalwood occur. Among the fauna may be mentioned the elephant, tiger, tiger-cat, cheetah or hunting leopard, wild dog, elk, bison, wild boar, several species of deer, hares, monkeys, the buceros and various other birds, the cobra di capello, and a few alligators. The most interesting antiquities of Coorg are the earth redoubts or war-trenches (*kadangas*), which are from 15 to 25 ft. high, and provided with a ditch 10 ft. deep by 8 or 10 ft. wide. Their linear extent is reckoned at between 500 and 600 m. They are mentioned in inscriptions of the 9th and 10th centuries. The exports of Coorg are mainly rice, coffee and cardamoms; and the only important manufacture is a kind of coarse blanket. Fruits of many descriptions, especially oranges, are produced in abundance, and are of excellent quality.

In 1901 the population was 180,607, showing an increase of 4.4% in the decade. Of the various tribes inhabiting Coorg, the Coorgs proper, or Kodagas, and the Yeravas, or Eravas, both special to the country, are the most numerous. The Kodagas (36,091) are a light-coloured race of unknown origin. They constitute a highland clan, free from the trammels of caste, and they have the manly bearing and independent spirit natural in men who have been from time immemorial the lords of the soil. Their religion consists of ancestor- and demon-worship, with a certain admixture of Brahman cults. The men are by tradition warriors and hunters, and while they will plough the fields and reap the rice, they leave all menial work to the women and servants. They speak Kodagu, a dialect of Hala Kannada or old Kanarese, midway between that and Malayālam. It has been asserted that the institution of polyandry was prevalent among them, according to which the brothers of a family had their wives in common. But if this institution ever existed it no longer does so. The Yeravas (14,586) are a race of an altogether inferior type, dark-skinned and thick-lipped, resembling the Australian aborigines who possibly, according to one theory, may have sprung from the same Dravidian stock (see [AUSTRALIA: Aborigines](#)). Though now nominally free, they were, before the establishment of British rule, the hereditary praedial slaves of the Kodagas. Some of them live a primitive life in the jungle, but the majority earn a livelihood as coolies. They are demon-worshippers, their favourite deity being Karingali (black Kali). Their language, a dialect of Malayālam, is peculiar to them. Among the other tribes or castes special to Coorg are the Heggades (1503 in 1901), cultivators from Malabar; the Ayiri (898), who constitute the artisan caste; the Medas (584), who are basket- and mat-makers, and act as drummers at feasts; the Binepatta (98), originally wandering musicians from Malabar, now agriculturists; the Kavadi (49), cultivators from Yedenālnād; all these speak the Coorg language, wear the Coorg dress, and conform, more or less, to Coorg customs. Other tribes are not special to Coorg. Of these the Holeyas (27,000) are the most numerous. They are divided into four sections: Badagas from Mysore, Kembattis and Māringis from Malabar, Kukkas from S. Kanara. They were formerly the slaves of the Kodagas and now act as their menials. The Lingayats (8700) are rather a religious sect than a tribe. Of the Tulu (farmer) class the Gaudas (11,900), who live principally along the western boundary, are the most important; they speak Tulu and wear the Coorg dress. Other castes and tribes are the Tiyas (1500) and Nayars (1400), immigrants from Malayālam; the Vellala (1300), who are Tamils; the Mahrattas (2400) and Brahmans (1100). Of the Mussulmans the most numerous are the Moplahs (6700) and the Shaikhs (4400), both chiefly traders. Of native Christians there are upwards of 3000. The official language of Coorg, which is that spoken by 45% of the population, is Kanarese (Kannada), the Coorg language (Kodagu) coming next. The Coorg dress is very picturesque, its characteristics being a long coat (Kupasa), of dark-coloured cloth, reaching below the knees, folded across and confined at the waist by a red or blue girdle. The sleeves are cut off below the elbow, showing the arms of a white shirt. The head-dress is a red kerchief, or a peculiar large, flat turban, covering the back of the neck. The Coorg also carries a short knife, with an ivory or silver hilt, fastened with silver chains and stuck into the girdle. A large, broad-bladed waist knife, akin to the *kukri* of the Gurkhas,

worn at the back, point upwards, was formerly a formidable weapon in hand-to-hand fighting, but is now used only for exhibitions of strength and skill on festive occasions.

The chief crops are rice and coffee. Some abandoned coffee land has been planted with tea as an experiment. The cultivation of cinchona has proved unprofitable. There is no railway. There are no colleges, but twenty-four scholarships are given to maintain Coorg students at colleges in Madras and Mysore. There are secondary schools at Mercara and Virarajendrapet.

The early accounts of Coorg are purely legendary, and it was not till the 9th and 10th centuries that its history became the subject of authentic record. At this period, according to inscriptions, the country was ruled by the Gangas of Talakād, under whom the Changalvas, kings of Changa-nād, styled later kings of Nanjarayapatna or Nanjarajapatna, held the east and part of the north of Coorg, together with the Hunsur *talūk* in Mysore. After the overthrow, in the 11th century, of the Ganga power by the Cholas, the Changalvas became tributary to the latter. When the Cholas in their turn were driven from the Mysore country by the Hoysalas, in the 12th century, the Changalvas held out for independence; but after a severe struggle they were subdued and became vassals of the Hoysala kings. In the 14th century, after the fall of the Hoysala rule, they passed under the supremacy of the Vijayanagar empire. During this period, at the beginning of the 16th century, Nanja Raja founded the new Changalva capital Nanjarajapatna. In 1589 Piriya Raja or Rudragana rebuilt Singapatna and renamed it Piriapatna (Periapatam). The power of the Vijayanagar empire had, however, been broken in 1565 by the Mahommedans; in 1610 the Vijayanagar viceroy of Seringapatam was ousted by the raja of Mysore, who in 1644 captured Piriapatna. Vira Raja, the last of the Changalva kings, fell in the defence of his capital, after putting to death his wives and children.

Coorg, however, was not absorbed in Mysore, which was hard pressed by other enemies, and a prince of the Ikkeri or Bednur family (perhaps related to the Changalvas) succeeded in bringing the whole country under his sway, his descendants continuing to be rajas of Coorg till 1834. The capital was removed in 1681 by Muddu Raja to Madikeri or Mercara. In 1770 a disputed succession led to the intervention of Hyder Ali of Mysore in favour of Linga Raja, who had fled to him for help, and whom he placed on the throne on his consenting to cede certain territories and to pay tribute. On Linga Raja's death in 1780 Hyder Ali interned his sons, who were minors, in a fort in Mysore, and, under pretence of acting as their guardian, installed a Brahman governor at Mercara with a Mussulman garrison. In 1782, however, the Coorgs rose in rebellion and drove out the Mahommedans. Two years later Tippoo Sultan reduced the country; but the Coorgs having again rebelled in 1785 he vowed their destruction. Having secured some 70,000 of them by treachery, he drove them to Seringapatam, where he had them circumcised by force. Coorg was partitioned among Mussulman proprietors, and held down by garrisons in four forts. In 1788, however, Vira Raja (or Vira Rajendra Wodeyar), with his wife and his brothers Linga Raja and Appaji, succeeded in escaping from his captivity, at Periapatam and, placing himself at the head of a Coorg rebellion, succeeded in driving the forces of Tippoo out of the country. The British, who were about to enter on the struggle with Tippoo, now made a treaty with Vira Raja; and during the war that followed the Coorgs proved invaluable allies. By the treaty of peace Coorg, though not adjacent to the East India Company's territories, was included in the cessions forced upon Tippoo. On the spot where he had first met the British commander, General Abercromby, the raja founded the city of Virarajendrapet.

Vira Raja, who, in consequence of his mind becoming unhinged, was guilty towards the end of his reign of hideous atrocities, died in 1809 without male heirs, leaving his favourite daughter Devammāji as rani. His brother Linga Raja, however, after acting as regent for his niece, announced in 1811 his own assumption of the government. He died in 1820, and was succeeded by his son Vira Raja, a youth of twenty, and a monster of sensuality and cruelty. Among his victims were all the members of the families of his predecessors, including Devammāji. At last, in 1832, evidence of treasonable designs on the raja's part led to inquiries on the spot by the British resident at Mysore, as the result of which, and of the raja's refusal to amend his ways, a British force marched into Coorg in 1834. On the 11th of April the raja was deposed by Colonel Fraser, the political agent with the force, and on the 7th of May the state was formally annexed to the East India Company's territory. In 1852 the raja, who had been deported to Vellore, obtained leave to visit England with his favourite daughter Gauramma, to whom he wished to give a European education. On the 30th of June she was baptized, Queen Victoria being one of her sponsors; she afterwards married a British officer who, after her death in 1864, mysteriously disappeared together with their child. Vira Raja himself died in 1863, and was buried in Kensal Green cemetery.

The so-called Coorg rebellion of 1837 was really a rising of the Gaudas, due to the grievance felt in having to pay taxes in money instead of in kind. A man named Virappa, who pretended to have escaped from the massacre of 1820, tried to take advantage of this to assert his claim to be raja, but the Coorgs remained loyal to the British and the attempt failed. In 1861, after the Mutiny, the loyalty of the Coorgs was rewarded by their being exempted from the Disarmament Act.

See "The Coorgs and Yeravas," by T. H. Holland in the *Journal of the Asiatic Society of Bengal*, vol. lxx. part iii. No. 2 (1901); Rev. G. Richter, *Castes and Tribes found in the Province of Coorg* (Bangalore, 1887); *Imperial Gazetteer of India* (Oxford, 1908), vol. xi. s.v., where, besides an admirable account of the country and its inhabitants, the history of Coorg is dealt with in some detail.

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**COORNHERT, DIRCK VOLCKERTSZOON** (1522-1590), Dutch politician and theologian, youngest son of Volckert Coornhert, cloth merchant, was born at Amsterdam in 1522. As a child he spent some years in Spain and Portugal. Returning home, he was disinherited by his father's will, for his marriage with Cornelia (Neeltje) Simons, a portionless gentlewoman. He took for a time the post of major-domo to Reginald (Reinoud), count of Brederode. Soon he settled in Haarlem, as engraver on copper, and produced works which retain high values. Learning Latin, he published Dutch translations from Cicero, Seneca and Boetius. He was appointed secretary to the city (1562) and secretary to the burgomasters (1564). Throwing himself into the struggle with Spanish rule, he drew up the manifesto of William of Orange (1566). Imprisoned at the Hague (1568), he escaped to Cleves, where he maintained himself by his art. Recalled in 1572, he was secretary of state for a short time; his aversion to military violence led him to return to Cleves, where William continued to employ his services and his pen. As a religious man, he wrote and strove in favour of tolerance, being decidedly against capital punishment for heretics. He had no party views; the Heidelberg catechism, authoritative in Holland, he criticized. The great Arminius, employed to refute him, was won over by his arguments. He died at Gouda on the 29th of October 1590. His Dutch version of the New Testament, following the Latin of Erasmus, was never completed. His works, in prose and verse, were published in 1630, 3 vols.

See F. D. J. Moorrees, *Dirck Volckertszoon Coornhert* (1887); N. Delvenne, *Biog. des Pays-Bas* (1829); A. J. van der Aa, *Biog. Woordenboek der Nederlanden* (1855).

(A. Go.\*)

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**COOT**, a well-known water-fowl, the *Fulica atra* of Linnaeus, belonging to the family *Rallidae* or rails. The word coot, in some parts of England pronounced cute, or scute, is of uncertain origin, but perhaps cognate with scout and scoter—both names of aquatic birds—a possibility which seems to be more likely since the name "macreuse," by which the coot is known in the south of France, being in the north of that country applied to the scoter (*Oedemia nigra*) shows that, though belonging to very different families, there is in popular estimation some connexion between the two birds.<sup>1</sup> The Latin *Fulica* (in polite French, *Foulque*) is probably allied to *fuligo*, and has reference to the bird's dark colour.<sup>2</sup> The coot breeds abundantly in many of the larger inland waters of the northern parts of the Old World, in winter commonly resorting, and often in great numbers, to the mouth of rivers or shallow bays of the sea, where it becomes a general object of pursuit by gunners whether for sport or gain. At other times of the year it is comparatively unmolested, and being very prolific its abundance is easily understood. The nest is a large mass of flags, reeds or sedge, piled together among rushes in the water or on the margin, and not unfrequently contains as many as ten eggs. The young, when first hatched, are beautiful little creatures, clothed in jet-black down, with their heads of a bright orange-scarlet, varied with purplish-blue. This brilliant colouring is soon lost, and they begin to assume the almost uniform sooty-black plumage which is worn for the rest of their life; but a characteristic of the adult is a bare patch or callosity on the forehead, which being nearly white gives rise to the epithet "bald" often prefixed to the bird's name. The coot is about 18 in. in length, and will sometimes

weigh over 2 lb. Though its wings appear to be short in proportion to its size, and it seems to rise with difficulty from the water, it is capable of long-sustained and rather rapid flight, which is performed with the legs stretched out behind the stumpy tail. It swims buoyantly, and looks a much larger bird in the water than it really is. It dives with ease, and when wounded is said frequently to clutch the weeds at the bottom with a grasp so firm as not even to be loosened by death. It does not often come on dry land, but when there, marches leisurely and not without a certain degree of grace. The feet of the coot are very remarkable, the toes being fringed by a lobed membrane, which must be of considerable assistance in swimming as well as in walking over the ooze—acting as they do like mud-boards.

In England the sport of coot-shooting is pursued to some extent on the broads and backwaters of the eastern counties—in Southampton Water and Christchurch Bay—and is often conducted battue-fashion by a number of guns. But even in these cases the numbers killed in a day seldom reach more than a few hundreds, and come very short of those that fall in the officially-organized *chasses* of the lakes near the coast of Languedoc and Provence, of which an excellent description is given by the Vicomte Louis de Dax (*Nouveaux Souvenirs de chasse*, &c., pp. 53-65; Paris, 1860). The flesh of the coot is very variously regarded as food. To prepare the bird for the table, the feathers should be stripped, and the down, which is very close, thick and hard to pluck, be rubbed with powdered resin; the body is then to be dipped in boiling water, which dissolving the resin causes it to mix with the down, and then both can be removed together with tolerable ease. After this the bird should be left to soak for the night in cold spring-water, which will make it look as white and delicate as a chicken. Without this process the skin after roasting is found to be very oily, with a fishy flavour, and if the skin be taken off the flesh becomes dry and good for nothing (Hawker's *Instructions to Young Sportsmen*; Hele's *Notes about Aldeburgh*).

The coot is found throughout the Palaearctic region from Iceland to Japan, and in most other parts of the world is represented by nearly allied species, having almost the same habits. An African species (*F. cristata*), easily distinguished by two red knobs on its forehead, is of rare appearance in the south of Europe. The Australian and North American species (*F. australis* and *F. americana*) have very great resemblance to the English bird; but in South America half-a-dozen or more additional species are found which range to Patagonia, and vary much in size, one (*F. gigantea*) being of considerable magnitude. The remains of a very large species (*F. newtoni*) were discovered in Mauritius, where it must have been a contemporary of the dodo, but like that bird is now extinct.

(A. N.)

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- 1 It is owing to this interchange of their names that Yarrell in his *British Birds* refers Victor Hugo's description of the "chasse aux macreuses" to the scoter instead of the coot.
  - 2 Hence also we have *Fulix* or *Fuligula* applied to a duck of dingy appearance, and thus forming another parallel case.

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**COOTE, SIR EYRE** (1726-1783), British soldier, the son of a clergyman, was born near Limerick, and entered the 27th regiment. He saw active service in the Jacobite rising of 1745, and some years later obtained a captaincy in the 39th regiment, which was the first British regiment sent to India. In 1756 a part of the regiment, then quartered at Madras, was sent forward to join Clive in his operations against Calcutta, which was reoccupied without difficulty, and Coote was soon given the local rank of major for his good conduct in the surprise of the Nawab's camp. Soon afterwards came the battle of Plassey, which would in all probability not have taken place but for Coote's soldierly advice at the council of war; and after the defeat of the Nawab he led a detachment in pursuit of the French for 400 m. under extraordinary difficulties. His conduct won him the rank of lieutenant-colonel and the command of the 84th regiment, newly-raised for Indian service, but his exertions seriously injured his health. In October 1759 Coote's regiment arrived to take part in the decisive struggle between French and English in the Carnatic. He took command of the forces at Madras, and in 1760 led them in the decisive victory of Wandiwash (January 22). After a time the remnants of Lally's forces were shut up in Pondicherry. For some reason Coote was not entrusted with the siege operations, but he cheerfully and loyally supported Monson, who brought the siege to a successful end on the 15th of January 1761. Soon afterwards Coote was given the command of the East India Company's forces in Bengal, and conducted

the settlement of a serious dispute between the Nawab Mir Cassim and a powerful subordinate, and in 1762 he returned to England, receiving a jewelled sword of honour from the Company and other rewards for his great services. In 1771 he was made a K.B. In 1779 he returned to India as lieutenant-general commanding in chief. Following generally the policy of Warren Hastings, he nevertheless refused to take sides in the quarrels of the council, and made a firm stand in all matters affecting the forces. Hyder Ali's progress in southern India called him again into the field, but his difficulties were very great and it was not until the 1st of June 1781 that the crushing and decisive defeat of Porto Novo struck the first heavy blow at Hyder's schemes. The battle was won by Coote under most unfavourable conditions against odds of five to one, and is justly ranked as one of the greatest feats of the British in India. It was followed up by another hard-fought battle at Pollilur (the scene of an earlier triumph of Hyder over a British force) on the 27th of August, in which the British won another success, and by the rout of the Mysore troops at Sholingarh a month later. His last service was the arduous campaign of 1782, which finally shattered a constitution already gravely impaired by hardship and exertions. Sir Eyre Coote died at Madras on the 28th of April 1783. A monument was erected to him in Westminster Abbey.

For a short biography of Coote see *Twelve British Soldiers* (ed. Wilkinson, London, 1899), and for the battles of Wandewash and Porto Novo, consult Malleon, *Decisive Battles of India* (London, 1883). An account of Coote may be found in Wilk's *Historical Sketches of Mysore* (1810).

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**COPAIBA**, or COPAIVA (from Brazilian *cupauba*), an oleo-resin—sometimes termed a balsam—obtained from the trunk of the *Copaifera Lansdorfii* (natural order Leguminosae) and from other species of *Copaifera* found in the West Indies and in the valley of the Amazon. It is a somewhat viscous transparent liquid, occasionally fluorescent and of a light yellow to pale golden colour. The odour is aromatic and very characteristic, the taste acrid and bitter. It is insoluble in water, but soluble in absolute alcohol, ether and the fixed and volatile oils. Its approximate composition is more than 50% of a volatile oil and less than 50% of a resin. The pharmacopoeias contain the oleo-resin itself, which is given in doses of from a half to one drachm, and the *oleum copaibae*, which is given in doses of from five to twenty minims, but which is inferior, as a medicinal agent, to the oleo-resin. Copaiba shares the pharmacological characters of volatile oils generally. Its distinctive features are its disagreeable taste and the unpleasant eructations to which it may give rise, its irritant action on the intestine in any but small doses, its irritant action on the skin, often giving rise to an erythematous eruption which may be mistaken for that of scarlet fever, and its exceptionally marked stimulant action on the kidneys. In large doses this last action may lead to renal inflammation. The resin is excreted in the urine and is continually mistaken for albumin since it is precipitated by nitric acid, but the precipitate is re-dissolved, unlike albumin, on heating. Its nasty taste, its irritant action on the bowel, and its characteristic odour in the breath, prohibit its use—despite its other advantages—in all diseases but gonorrhoea. For this disease it is a valuable remedy, but it must not be administered until the acute symptoms have subsided, else it will often increase them. It is best given in cachets or in three times its own bulk of mucilage of acacia. Various devices are adopted to disguise its odour in the breath. The clinical evidence clearly shows that none of the numerous vegetable rivals to copaiba is equal to it in therapeutic value.

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**COPAL** (Mexican *copalli*, incense), a hard lustrous resin, varying in hue from an almost colourless transparent mass to a bright yellowish-brown, having a conchoidal fracture, and, when dissolved in alcohol, spirit of turpentine, or any other suitable menstruum, forming one of the most valuable varnishes. Copal is obtained from a variety of sources; the term is not uniformly applied or restricted to the products of any particular region or series of plants, but is vaguely used for resins which, though very similar in their physical properties, differ somewhat in their constitution, and are altogether distinct as to their source. Thus the resin obtained from *Trachylobium Hornemannianum* is known in commerce as Zanzibar



copal, or gum animé. Madagascar copal is the produce of *T. verrucosum*. From *Guibourtia copallifera* is obtained Sierra Leone copal, and another variety of the same resin is found in a fossil state on the west coast of Africa, probably the produce of a tree now extinct. From Brazil and other South American countries, again, copal is obtained which is yielded by *Trachylobium Martianum*, *Hymenaea Courbaril*, and various other species, while the dammar resins and the piney varnish of India are occasionally classed and spoken of as copal. Of the varieties above enumerated by far the most important from a commercial point of view is the Zanzibar or East African copal, yielded by *Trachylobium Hornemannianum*. The resin is found in two distinct conditions: (1) raw or recent, called by the inhabitants of the coast sandarusiza miti or chakazi, the latter name being corrupted by Zanzibar traders into "jackass" copal; and (2) ripe or true copal, the sandarusi inti of the natives. The raw copal, which is obtained direct from the trees, or found at their roots or near the surface of the ground, is not regarded by the natives as of much value, and does not enter into European commerce. It is sent to India and China, where it is manufactured into a coarse kind of varnish. The true or fossil copal is found embedded in the earth over a wide belt of the mainland coast of Zanzibar, on tracts where not a single tree is now visible. The copal is not found at a greater depth in the ground than 4 ft., and it is seldom the diggers go deeper than about 3 ft. It occurs in pieces varying from the size of small pebbles up to masses of several ounces in weight, and occasionally lumps weighing 4 or 5 lb have been obtained. After being freed from foreign matter, the resin is submitted to various chemical operations for the purpose of clearing the "goose-skin," the name given to the peculiar pitted-like surface possessed by fossil copal. The goose-skin was formerly supposed to be caused by the impression of the small stones and sand of the soil into which the soft resin fell in its raw condition; but it appears that the copal when first dug up presents no trace of the goose-skin, the subsequent appearance of which is due to oxidation or inter-molecular change.

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**COPALITE**, or **COPALINE**, also termed "fossil resin" and "Highgate resin," a naturally occurring organic substance found as irregular pieces of pale-yellow colour in the London clay at Highgate Hill. It has a resinous aromatic odour when freshly broken, volatilizes at a moderate temperature, and burns readily with a yellow, smoky flame, leaving scarcely any ash.

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**COPÁN**, an ancient ruined city of western Honduras, near the Guatemalan frontier, and on the right bank of the Río Copán, a tributary of the Motagua. For an account of its elaborately sculptured stone buildings, which rank among the most celebrated monuments of Mayan civilization, see [CENTRAL AMERICA: Archaeology](#). The city is sometimes regarded as identical with the Indian stronghold which, after a heroic resistance, was stormed by the Spaniards, under Hernando de Chaves, in 1530. It has given its name to the department in which it is situated.

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**COPARCENARY** (*co-*, with, and *parcener*, *i.e.* sharer; from O. Fr. *parçonier*, Lat. *partitio*, division), in law, the descent of lands of inheritance from an ancestor to two or more persons possessing an equal title to them. It arises either by common law, as where an ancestor dies intestate, leaving two or more females as his co-heiresses, who then take as coparceners or parceners; or, by particular custom, as in the case of gavelkind lands, which descend to all males in equal degrees, or in default of males, to all the daughters equally. These co-heirs, or parceners, have been so called, says Littleton (§ 241), "because by writ the law will constrain them, that partition shall be made among them." Coparcenary so far resembles joint tenancy in that there is unity of title, interest and possession, but whereas joint tenants

always claim by purchase, parceners claim by descent, and although there is unity of interest there is no entirety, for there is no *jus accrescendi* or survivorship. Coparcenary may be dissolved (a) by partition; (b) by alienation by one coparcener; (c) by all the estate at last descending to one coparcener, who thenceforth holds in severalty; (d) by a compulsory partition or sale under the Partition Acts.

The term "coparcenary" is not in use in the United States, joint heirship being considered as *tenancy in common*.

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**COPE, EDWARD DRINKER** (1840-1897), American palaeontologist, descended from a Wiltshire family who emigrated about 1687, was born in Philadelphia on the 28th of July 1840. At an early age he became interested in natural history, and in 1859 communicated a paper on the Salamandridae to the Academy of Natural Sciences at Philadelphia. He was educated partly in the University of Pennsylvania, and after further study and travel in Europe was in 1865 appointed curator to the Academy of Natural Sciences, a post which he held till 1873. In 1864-67 he was professor of natural science in Haverford College, and in 1889 he was appointed professor of geology and palaeontology in the University of Pennsylvania. To the study of the American fossil vertebrata he gave his special attention. From 1871 to 1877 he carried on explorations in the Cretaceous strata of Kansas, the Tertiary of Wyoming and Colorado; and in course of time he made known at least 600 species and many genera of extinct vertebrata new to science. Among these were some of the oldest known mammalia, obtained in New Mexico. He served on the U.S. Geological Survey in 1874 in New Mexico, in 1875 in Montana, and in 1877 in Oregon and Texas. He was also one of the editors of the *American Naturalist*. He died in Philadelphia on the 12th of April 1897.

PUBLICATIONS.—Reports for U.S. Geological Survey on *Eocene Vertebrata of Wyoming* (1872); on *Vertebrata of Cretaceous Formations of the West* (1875); *Vertebrata of the Tertiary Formations of the West* (1884); *The Origin of the Fittest: Essays on Evolution* (New York, 1887); *The Primary Factors of Organic Evolution* (Chicago, 1896). Memoir by Miss Helen D. King, *American Geologist*, Jan. 1899 (with portrait and bibliography); also memoir by P. Frazer, *American Geologist*, Aug. 1900 (with portrait).

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**COPE, EDWARD MEREDITH** (1818-1873), English classical scholar, was born in Birmingham on the 28th of July 1818. He was educated at Ludlow and Shrewsbury schools and Trinity College, Cambridge, of which society he was elected fellow in 1842, having taken his degree in 1841 as senior classic. He was for many years lecturer at Trinity, his favourite subjects being the Greek tragedians, Plato and Aristotle. When the professorship of Greek became vacant, the votes were equally divided between Cope and B. H. Kennedy, and the latter was appointed by the chancellor. It is said that the keenness of Cope's disappointment was partly responsible for the mental affliction by which he was attacked in 1869, and from which he never recovered. He died on the 5th of August 1873. As his published works show, Cope was a thoroughly sound scholar, with perhaps a tendency to over-minuteness. He was the author of *An Introduction to Aristotle's Rhetoric* (1867), a standard work; *The Rhetoric of Aristotle*, with a commentary, revised and edited by J. E. Sandys (1877); translations of Plato's *Gorgias* (2nd ed., 1884) and *Phaedo* (revised by H. Jackson, 1875). Mention may also be made of his criticism of Grote's account of the Sophists, in the *Cambridge Journal of Classical Philology*, vols. i., ii., iii. (1854-1857).

The chief authority for the facts of Cope's life is the memoir prefixed to vol. i. of his edition of *The Rhetoric of Aristotle*.

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**COPE** (M.E. *cape, cope*, from Med. Lat. *capa, cappa*), a liturgical vestment of the Western Church. The word “cope,” now confined to this sense, was in its origin identical with “cape” and “cap,” and was used until comparatively modern times also for an out-door cloak, whether worn by clergy or laity. This, indeed, was its original meaning, the *cappa* having been an outer garment common to men and women whether clerical or lay (see Du Cange, *Glossarium*, s.v.). The word *pluviale* (rain-cloak), which the cope bears in the Roman Church, is exactly parallel so far as change of meaning is concerned. In both words the etymology reveals the origin of the vestment, which is no more than a glorified survival of an article of clothing worn by all and sundry in ordinary life, the type of which survives, *e.g.* in the ample hooded cloak of Italian military officers. This origin is clearly traceable in the shape and details of the cope. When spread out this forms an almost complete semicircle. Along the straight edge there is usually a broad band, and at the neck is attached the “hood” (in Latin, the *clypeus* or shield), *i.e.* a shield-shaped piece of stuff which hangs down over the back. The vestment is secured in front by a broad tab sewn on to one side and fastening to the other with hooks, sometimes also by a brooch (called the *morse*, Lat. *morsus*). Sometimes the *morse* is attached as a mere ornament to the cross-piece. The cope thus preserves the essential shape of its secular original, and even the hood, though now a mere ornamental appendage, is a survival of an actual hood. The evolution of this latter into its present form was gradual; first the hood became too small for use, then it was transformed into a small triangular piece of stuff (13th century), which in its turn grew (14th and 15th centuries) into the shape of a shield (see Plate II., fig. 4), and this again, losing its pointed tip in the 17th century, expanded in the 18th into a flap which was sometimes enlarged so as to cover the whole back down to the waist. In its general effect, however, a cope now no longer suggests a “waterproof.” It is sometimes elaborately embroidered all over; more usually it is of some rich material, with the borders in front and the hood embroidered, while the *morse* has given occasion for some of the most beautiful examples of the goldsmith’s and jeweller’s craft (see Plate II., figs. 5, 6).

The use of the cope as a liturgical vestment can be traced to the end of the 8th century: a *pluviale* is mentioned in the foundation charter of the monastery of Obona in Spain. Before this the so-called *cappa choralis*, a black, bell-shaped, hooded vestment with no liturgical significance, had been worn by the secular and regular clergy at choir services, processions, &c. This was in its origin identical with the chasuble (*q.v.*), and if, as Father Braun seems to prove, the cope developed out of this, cope and chasuble have a common source.<sup>1</sup> Father Braun cites numerous inventories and the like to show that the cope (*pluviale*) was originally no more than a more elaborate *cappa* worn on high festivals or other ceremonial occasions, sometimes by the whole religious community, sometimes—if the stock were limited—by those, *e.g.* the cantors, &c., who were most conspicuous in the ceremony. In the 10th century, partly under the influence of the wealthy and splendour-loving community of Cluny, the use of the cope became very widespread; in the 11th century it was universally worn, though the rules for its ritual use had not yet been fixed. It was at this time, however, *par excellence* the vestment proper to the cantors, choirmaster and singers, whose duty it was to sing the *invitatorium*, *responses*, &c., at office, and the *introitus*, *graduale*, &c., at Mass. This use survived in the ritual of the pre-Reformation Church in England, and has been introduced in certain Anglican churches, *e.g.* St Mary Magdalen’s, Munster Square, in London.

By the beginning of the 13th century the liturgical use of the cope had become finally fixed, and the rules for this use included by Pope Pius V. in the Roman Missal and by Clement VIII. in the *Pontificale* and *Caeremoniale* were consequently not new, but in accordance with ancient and universal custom. The substitution of the cope for the chasuble in many of the functions for which the latter had been formerly used was primarily due to the comparative convenience of a vestment opened at the front, and so leaving the arms free. A natural conservatism preserved the chasuble, which by the 9th century had acquired a symbolical significance, as the vestment proper to the celebration of Mass; but the cope took its place in lesser functions, *i.e.* the censing of the altar during the Magnificat and at Mattins (whence the German name *Rauchmantel*, smoke-mantel), processions, solemn consecrations, and as the dress of bishops attending synods.

It is clear from this that the cope, though a liturgical, was never a sacerdotal vestment. If it was worn by priests, it could also be worn by laymen, and it was never worn by priests in their sacerdotal, *i.e.* their sacrificial, capacity. For this reason it was not rejected with the “Mass vestments” by the English Church at the Reformation, in spite of the fact that it was in no

ecclesiastical sense "primitive." By the First Prayer-book of Edward VI., which represented a compromise, it was directed to be worn as an alternative to the "vestment" (*i.e.* chasuble) at the celebration of the Communion; this at least seems the plain meaning of the words "vestment or cope," though they have been otherwise interpreted. In the Second Prayer-book vestment and cope alike disappear; but a cope was worn by the prelate who consecrated Archbishop Parker, and by the "gentlemen" as well as the priests of Queen Elizabeth's chapel; and, finally, by the 24th canon (of 1603) a "decent cope" was prescribed for the "principal minister" at the celebration of Holy Communion in cathedral churches as well as for the "gospeller and epistler." Except at royal coronations, however, the use of the cope, even in cathedrals, had practically ceased in England before the ritual revival of the 19th century restored its popularity. The disuse implied no doctrinal change; the main motive was that the stiff vestment, high in the neck, was incompatible with a full-bottomed wig. Scarlet copes with white fur hoods have been in continuous use on ceremonial occasions in the universities, and are worn by bishops at the opening of parliament.



FIG. 1.—Seventeenth Century Coronation Cope at Westminster Abbey.

With the liturgical cope may be classed the red mantle (*mantum*), which from the 11th century to the close of the middle ages formed, with the tiara, the special symbol of the papal dignity. The *immantatio* was the solemn investiture of the new pope immediately after his election, by means of the *cappa rubea*, with the papal powers. This ceremony was of great importance. In the contested election of 1159, for instance, though a majority of the cardinals had elected Cardinal Roland (Alexander III.), the defeated candidate Cardinal Octavian (Victor IV.), while his rival was modestly hesitating to accept the honour, seized the *pluviale* and put it on his own shoulders hastily, upside down; and it was on this ground that the council of Pavia in 1160 based their declaration in favour of Victor, and anathematized Alexander. The *immantatio* fell out of use during the papal exile at Avignon and was never restored.

**The Papal mantum.**

It will be convenient here to note other vestments that have developed out of the *cappa*. The *cappa choralis* has already been mentioned; it survived as a choir vestment that in winter took the place of the surplice, rochet or almuce. In the 12th century it was provided with arms (*cappa manicata*), but the use of this form was forbidden at choir services and other liturgical functions. From the hood of the *cappa* was developed the almuce (*q.v.*). At what date the *cappa choralis* developed into the *cappa magna*, a non-liturgical vestment peculiar to the pope, cardinals, bishops and certain privileged prelates, is not known; but mention of it is found as early as the 15th century. This vestment is a loose robe, with a large hood (lined with fur in winter and red silk in summer) and a long train, which is carried by a cleric called the *caudatarius*. Its colour varies with the hierarchical rank of the wearer:—red for cardinals, purple for bishops, &c.; or, if the dignitary belong to a religious order, it follows the colour of the habit of the order. The right to wear a violet *cappa magna* is conceded by the popes to the chapters of certain important cathedrals, but the train in this case is worn folded over the left arm or tied under it. It may only be worn by them, moreover, in their own church, or when the chapter appears elsewhere in its corporate capacity.

**The cappa magna.**

Lastly, from the *cappa* is probably derived the *mozzetta*, a short cape with a miniature hood, fastened down the front with buttons. The name is derived from the Italian *mozzare*, to cut off, and points to its being an abbreviated *cappa*, as the episcopal "apron" is a shortened cassock. It is worn over the rochet by the pope, cardinals, bishops and prelates, the colours varying as in the case of the *cappa magna*. Its use as confined to bishops can be traced to the 16th century.

**The mozzetta.**

See Joseph Braun, S. J., *Die liturgische Gewandung* (Freiburg im Breisgau, 1907); also the bibliography to the article [VESTMENTS](#).

(W. A. P.)

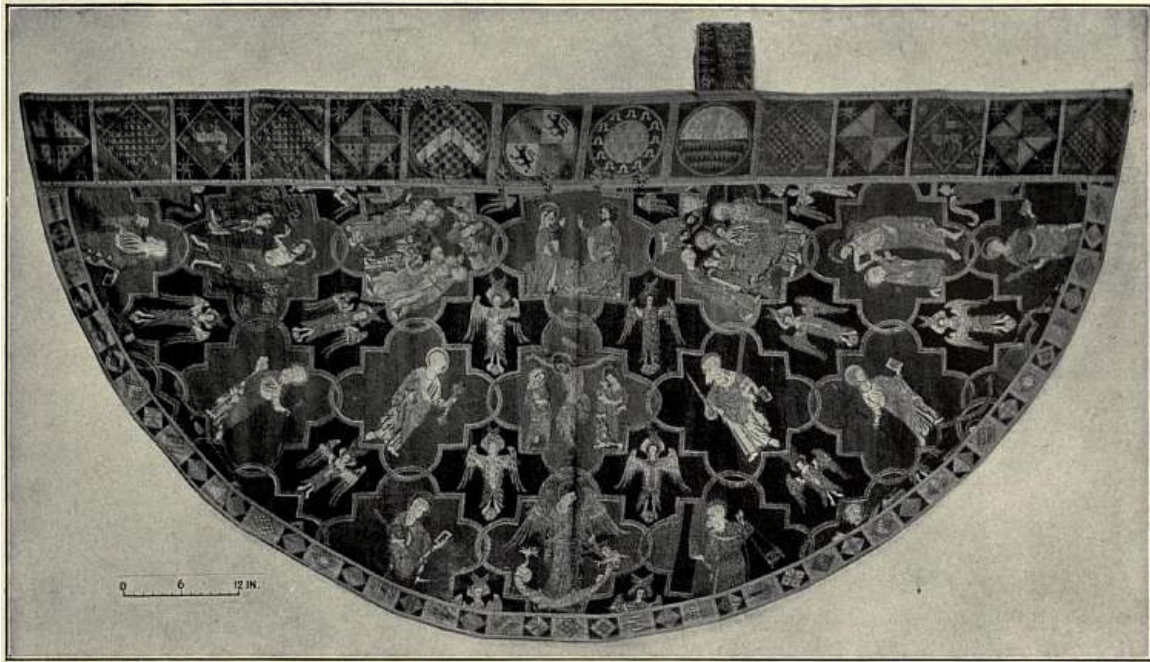


FIG. 2.—THE SYON COPE. (ENGLISH, 13TH CENTURY.)

The medallions with which it is embroidered contain representations of Christ on the Cross, Christ and St Mary Magdalene, Christ and Thomas, the death of the Virgin, the burial and coronation of the Virgin, St Michael and the twelve Apostles. Of the latter, four survive only in tiny fragments. The spaces between the four rows of medallions are filled with six-winged cherubim. The ground-work of the vestment is green silk embroidery, that of the medallions red. The figures are worked in silver and gold thread and coloured silks. The lower border and the orphrey with coats of arms do not belong to the original cope and are of somewhat later date. The cope belonged to the convent of Syon near Isleworth, was taken to Portugal at the Reformation, brought back early in the 19th century to England by exiled nuns and given by them to the Earl of Shrewsbury. In 1864 it was bought by the South Kensington Museum.

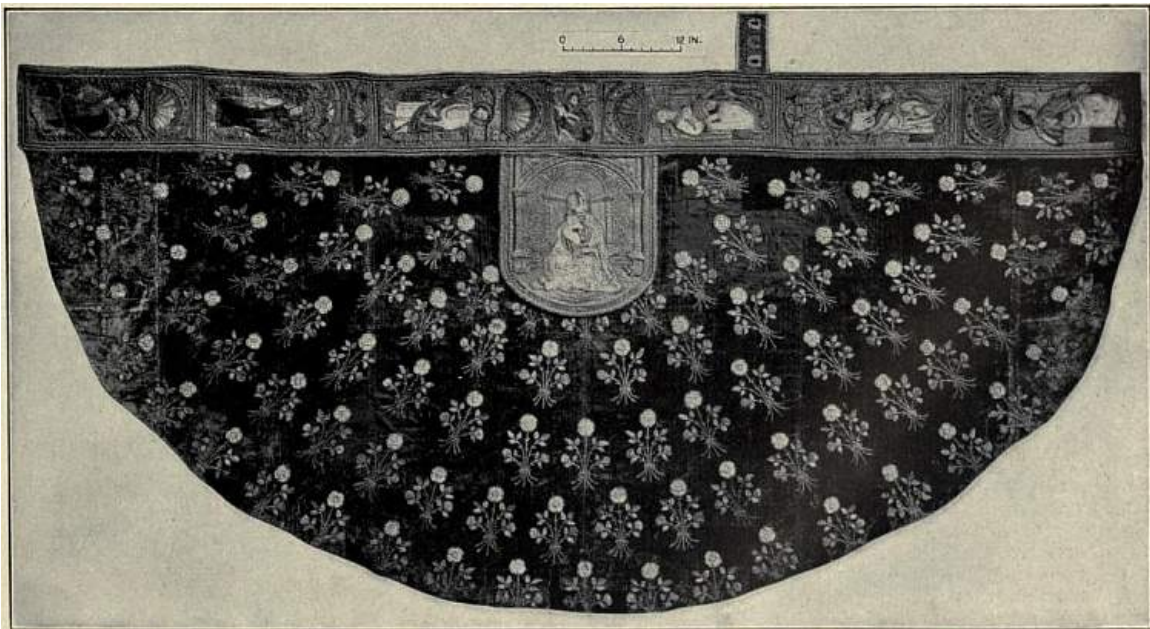


FIG. 3.—COPE OF BLUE SILK VELVET, WITH APPLIQUÉ WORK AND EMBROIDERY.

In the middle of the orphrey is a figure of Our Lord holding the orb in His left hand and with His right hand raised in benediction. To the right are figures of St Peter, St Bartholomew and St Ursula; and to the left, St Paul, St John the Evangelist and St Andrew. On the hood is a seated figure of the Virgin Mary holding the Infant Saviour. GERMAN: early 16th century. (In the Victoria and Albert Museum, No. 91. 1904.)

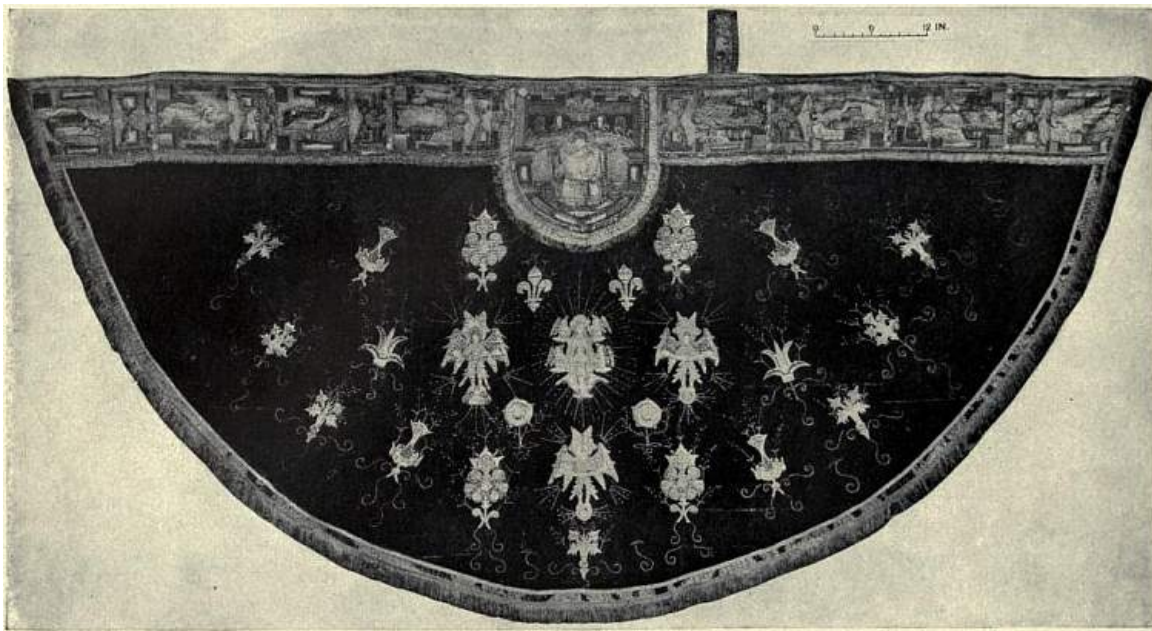


FIG. 4.—COPE OF EMBROIDERED PURPLE SILK VELVET.

In the middle is represented the Assumption of the Virgin, on the hood is a seated figure of the Almighty bearing three souls in a napkin. ENGLISH, about 1500. (In the Victoria and Albert Museum.)

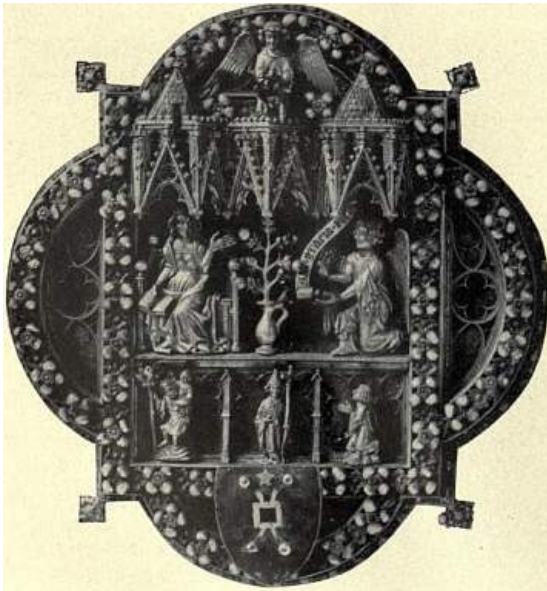


FIG. 5.—COPE MORSE (GERMAN, 14TH CENTURY) IN THE CATHEDRAL AT AIX-LA-CHAPELLE. (From a photograph by Father Joseph Braun, S. J.)



FIG. 6.—COPE MORSE (GERMAN, EARLY 14TH CENTURY), IN THE PARISH CHURCH AT ELTEN. (From a photograph by Father Joseph Braun, S. J.)

- 1 This derivation, suggested also by Dr Legg (*Archaeol. Journal*, 51, p. 39, 1894), is rejected by the five bishops in their report to Convocation (1908). Their statement, however, that it is "pretty clear" that the cope is derived from the Roman *lacerna* or *birrus* is very much open to criticism. We do not even know what the appearance and form of the *birrus* were; and the question of the origin of the cope is not whether it was derived from any garment of the time of the Roman Empire, and if so from which, but what garment in use in the 8th and 9th centuries it represents.

**COPELAND, HENRY**, an 18th century English cabinet-maker and furniture designer. He appears to have been the first manufacturing cabinet-maker who published designs for furniture. *A New Book of Ornaments* appeared in 1746, but it is not clear whether the engravings with this title formed part of a book, or were issued only in separate plates; a few of the latter are all that are known to exist. Between 1752 and 1769 several collections of designs were produced by Copeland in conjunction with Matthias Lock; in one of them

Copeland is described as of Cheapside. Some of the original drawings are in the National Art library at the Victoria and Albert Museum. Copeland was probably the originator of a peculiar type of chairback, popular for a few years in the middle of the 18th century, consisting of a series of interlaced circles. Much of his work has been attributed to Thomas Chippendale, and it is certain that one derived many ideas from the other, but which was the originator and which the copyist is by no means clear. The dates of Copeland's birth and death are unknown, but he was still living in 1768.

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**COPENHAGEN** (Danish *Kjöbenhavn*), the capital of the kingdom of Denmark, on the east coast of the island of Zealand (*Sjælland*) at the southern end of the Sound. Pop. (1901) 400,575. The latitude is approximately that of Moscow, Berwick-on-Tweed and Hopedale in Labrador. The nucleus of the city is built on low-lying ground on the east coast of the island of Zealand, between the sea and a series of small freshwater lakes, known respectively as St Jörgens Sø, Peblings Sø and Sortedams Sø, a southern portion occupying the northern part of the island of Amager. An excellent harbour is furnished by the natural channel between the two islands; and communication from one division to the other is afforded by two bridges—the Langebro and the Knippelsbro, which replaced the wooden drawbridge built by Christian IV. in 1620. The older city, including both the Zealand and Amager portions, was formerly surrounded by a complete line of ramparts and moats; but pleasant boulevards and gardens now occupy the westward or landward site of fortifications. Outside the lines of the original city (about 5 m. in circuit), there are extensive suburbs, especially on the Zealand side (Österbro, Nørrebro and Vesterbro or Österfölld, &c., and Frederiksberg), and Amagerbro to the south of Christianshavn.

The area occupied by the inner city is known as Gammelsholm (old island). The main artery is the Gothersgade, running from Kongens Nytorv to the western boulevards, and separating a district of regular thoroughfares and rectangular blocks to the north from one of irregular, narrow and picturesque streets to the south. The Kongens Nytorv, the focus of the life of the city and the centre of road communications, is an irregular open space at the head of a narrow arm of the harbour (Nyhavn) inland from the steamer quays, with an equestrian statue of Christian V. (d. 1699) in the centre. The statue is familiarly known as *Hesten* (the horse) and is surrounded by noteworthy buildings. The Palace of Charlottenborg, on the east side, which takes its name from Charlotte, the wife of Christian V., is a huge sombre building, built in 1672. Frederick V. made a grant of it to the Academy of Arts, which holds its annual exhibition of paintings and sculpture in April and May, in the adjacent *Kunstudstilling* (1883). On the south is the principal theatre, the Royal, a beautiful modern Renaissance building (1874), on the site of a former theatre of the same name, which dated from 1748. Statues of the poets Ludvig Holberg (d. 1754), and Adam Öhlenschläger (d. 1850), the former by Stein and the latter by H. V. Bissen, stand on either side of the entrance, and the front is crowned by a group by King, representing Apollo and Pegasus, and the Fountain of Hippocrene. Within, among other sculptures, is a relief figure of Ophelia, executed by Sarah Bernhardt. Other buildings in Kongens Nytorv are the foreign office, several great commercial houses, the commercial bank, and the Thotts Palais of c. 1685. The quays of the Nyhavn are lined with old gabled houses.

From the south end of Kongens Nytorv, a street called Holmens Kanal winds past the National Bank to the Holmens Kirke, or church for the royal navy, originally erected as an anchor-smithy by Frederick II., but consecrated by Christian IV., with a chapel containing the tombs of the great admirals Niels Juel and Peder Tordenskjöld, and wood-carving of the 17th century. The street then crosses a bridge on to the Slottsholm, an island divided from the mainland by a narrow arm of the harbour, occupied mainly by the Christiansborg and adjacent buildings. The royal palace of Christiansborg, originally built (1731-1745) by Christian VI., destroyed by fire in 1794, and rebuilt, again fell in flames in 1884. Fortunately most of the art treasures which the palace contained were saved. A decision was arrived at in 1903, in commemoration of the jubilee of the reign of Christian IX., to rebuild the palace for use on occasions of state, and to house the parliament. On the Slottsplads (Palace Square) which faces east, is an equestrian statue of Frederick VII. There are also preserved the bronze statues which stood over the portal of the palace before the fire—figures of Strength, Wisdom, Health and Justice, designed by Thorvaldsen. The palace chapel, adorned with works by Thorvaldsen and Bissen, was preserved from the fire, as was the royal library

of about 540,000 volumes and 20,000 manuscripts, for which a new building in Christiansgade was designed about 1900.

The exchange (*Börsen*), on the quay to the east, is an ornate gabled building erected in 1619-1640, surmounted by a remarkable spire, formed of four dragons, with their heads directed to the four points of the compass, and their bodies entwining each other till their tails come to a point at the top. To the south is the arsenal (*Tøjhus*) with a collection of ancient armour.

The Thorvaldsen museum (1839-1848), a sombre building in a combination of the Egyptian and Etruscan styles, consists of two storeys. In the centre is an open court, containing the artist's tomb. The exterior walls are decorated with groups of figures of coloured stucco, illustrative of events connected with Thorvaldsen's life. Over the principal entrance is the chariot of Victory drawn by four horses, executed in bronze from a model by Bissen. The front hall, corridors and apartments are painted in the Pompeian style, with brilliant colours and with great artistic skill. The museum contains about 300 of Thorvaldsen's works; and in one apartment is his sitting-room furniture arranged as it was found at the time of his death in 1844.

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On the mainland, immediately west of the Slotsholm, is the Prinsens Palais, once the residence of Christian V. and Frederick VI. when crown princes, containing the national museum. This consists of four sections, the Danish, ethnographical, antique and numismatic. It was founded in 1807 by Professor Nyerup, and extended between 1815 and 1885 by C. J. Thomsen and J. J. A. Worsaae, and the ethnographical collection is among the finest in the world. From this point the Raadhusgade leads north-west to the combined Nytorv-og-Gammelortv, where is the old townhall (*Raadhus*, 1815), and continues as the Nørregade to the Vor Frue Kirke (Church of our Lady), the cathedral church of Copenhagen. This church, the site of which has been similarly occupied since the 12th century, was almost entirely destroyed in the bombardment of 1807, but was completely restored in 1811-1829. The works of Thorvaldsen which it contains constitute its chief attraction. In the pediment is a group of sixteen figures by Thorvaldsen, representing John the Baptist preaching in the wilderness; over the entrance within the portico is a bas-relief of Christ's entry into Jerusalem; on one side of the entrance is a statue of Moses by Bissen, and on the other a statue of David by Jerichau. In a niche behind the altar stands a colossal marble statue of Christ, and marble statues of the twelve apostles adorn both sides of the church.

Immediately north of Vor Frue Kirke is the university, founded by Christian I. in 1479; though its existing constitution dates from 1788. The building dates from 1836. There are five faculties—theological, juridical, medical, philosophical and mathematical. In 1851 an English and in 1852 an Anglo-Saxon lectureship were established. All the professors are bound to give a series of lectures open to the public free of charge. The university possesses considerable endowments and has several foundations for the assistance of poor students; the "regent's charity," for instance, founded by Christian, affords free residence and a small allowance to one hundred bursars. There are about 2000 students. In connexion with the university are the observatory, the chemical laboratory in Ny Vester Gade, the surgical academy in Bredgade, founded in 1786, and the botanic garden. The university library, incorporated with the former Classen library, collected by the famous merchants of that name, contains about 200,000 volumes, besides about 4000 manuscripts, which include Rask's valuable Oriental collection and the Arne-Magnean series of Scandinavian documents. It shares with the royal library the right of receiving a copy of every book published in Denmark. There is also a zoological museum. Adjacent is St Peter's church, built in a quasi-Gothic style, with a spire 256 ft. high, and appropriated since 1585 as a parish church for the German residents in Copenhagen. A short distance along the Krystalgade is Trinity church. Its round tower is 111 ft. high, and is considered to be unique in Europe. It was constructed from a plan of Tycho Brahe's favourite disciple Longomontanus, and was formerly used as an observatory. It is ascended by a broad inclined spiral way, up which Peter the Great is said to have driven in a carriage and four. From this church the Kjöbermayergade runs south, a populous street of shops, giving upon the Høibro-plads, with its fine equestrian statue of Bishop Absalon, the city's founder. This square is connected by a bridge with the Slotsholm.

The quarter north-east of Kongens Nytorv and Gothersgaden is the richest in the city, including the palaces of Amalienborg, the castle and gardens of Rosenborg and several mansions of the nobility. The quarter extends to the strong moated citadel, which guards the harbour on the north-east. It is a regular polygon with five bastions, founded by Frederick III. about 1662-1663. One of the mansions, the Moltkes Palais, has a collection of Dutch paintings formed in the 18th century. This is in the principal thoroughfare of the quarter,



Bredgaden, and close at hand the palace of King George of Greece faces the Frederikskirke or Marble church. This church, intended to have been an edifice of great extent and magnificence, was begun in the reign of Frederick V. (1749), but after twenty years was left unfinished. It remained a ruin until 1874, when it was purchased by a wealthy banker, M. Tietgen, at whose expense the work was resumed. The edifice was not carried up to the height originally intended, but the magnificent dome, which recalls the finest examples in Italy, is conspicuous far and wide. The diameter is only a few feet less than that of St Peter's in Rome. As the church stands it is one of the principal works of the architect, F. Meldahl. Behind King George's palace from the Bredgade lies the Amalienborg-plads, having in the centre an equestrian statue of Frederick V., erected in 1768 at the cost of the former Asiatic Company. The four palaces, of uniform design, encircling this *plads*, were built for the residence of four noble families; but on the destruction of Christiansborg in 1794 they became the residence of the king and court, and so continued till the death of Christian VIII. in 1848. One of the four is inhabited by the king, the second and third by the crown prince and other members of the royal family, while the fourth is occupied by the coronation and state rooms. The Ameliegade crosses the *plads* and, with the Bredgade, terminates at the esplanade outside the citadel, prolonged in the pleasant promenade of Lange Linie skirting the Sound.

To the west of the citadel is the Ostbanegaard, or eastern railway station, from which start the local trains on the coast line to Klampenborg and Helsingør. South-west from this point extends the line of gardens which occupy the site of former landward fortifications, pleasantly diversified by water and plantations, skirted on the inner side by three wide boulevards, Östervold, Nørrevold and Vestervold Gade, and containing noteworthy public buildings, mostly modern. In the Östre Anlaeg is the art museum (1895) containing pictures, sculptures and engravings. In front of it is the Denmark monument (1896), commemorating the golden wedding (1892) of Christian IX. and Queen Louisa. Among various scenes in relief, the marriage of King Edward VII. of England and Queen Alexandra is depicted. The botanical garden (1874) contains an observatory with a statue of Tycho Brahe, and the chemical laboratory, mineralogical museum, polytechnic academy (1829) and communal hospital adjoin it. On the inner side of Östervold Gade is Rosenborg Park, with the palace of Rosenborg erected in 1610-1617. It is an irregular building in Gothic style, with a high pointed roof, and flanked by four towers of unequal dimensions. It contains the chronological collection of Danish monarchs, including a coin and medal cabinet, a fine collection of Venetian glass, the famous silver drinking-horn of Oldenburg (1474), the regalia and other objects of interest as illustrating the history of Denmark. The Riddersal, a spacious room, is covered with tapestry representing the various battles of Christian V., and has at one end a massive silver throne. The Nørrevold Gade leads through the Nørretorv past the Folke-teatre and the technical school to the Ørsteds park, and from its southern end the Vestervold Gade continues through the Raadhus Plads, a centre of tramways, flanked by the modern Renaissance town hall (1901), ornamented with bronze figures, with a tower at the eastern angle. Here is also the museum of industrial art, and the Ny-Carlsberg Glyptotek, with its collection of sculpture, is on this boulevard, which skirts the pleasure garden called Tivoli. From the Raadhus-plads the Vesterbro Gade runs towards the western quarter of the city, skirting the Tivoli. Here is the Dansk Folke museum, a collection illustrating the domestic life of the nation, particularly that of the peasantry since 1600. A column of Liberty (*Friheds-Støtte*) rises in an open space, erected in 1798 to commemorate the abolition of serfdom. Immediately north is the main railway station (*Banegaard*), and the North and Klampenborg stations near at hand. The western (residential) quarter contains the park of Frederiksberg, with its palace erected under Frederick IV. (d. 1730), used as a military school. The park contains a zoological garden, and is continued south in the pleasant Søndermarken, near which lies the old Glyptotek, which contained the splendid collection of sculptures, &c., made by H. C. Jacobsen since 1887, until their removal to the new Glyptotek founded by him in the Vestre Boulevard.

The quarter of Christianshavn is that portion of the city which skirts the harbour to the south, and lies within the fortifications. It contains the Vor Frelsers Kirke (Church of Our Saviour), dedicated in 1696, with a curious steeple 282 ft. high, ascended by an external spiral staircase. The lower part of the altar is composed of Italian marble, with a representation of Christ's sufferings in the garden of Gethsemane; and the organ is considered the finest in Copenhagen. The city does not extend much farther south, though the Amagerbro quarter lies without the walls. The island of Amager is fertile, producing vegetables for the markets of the capital. It was peopled by a Dutch colony planted by Christian II. in 1516, and many old peculiarities of dress, manners and languages are retained.

The environs of Copenhagen to the north and west are interesting, and the country, both along the coast northward and inland westward is pleasant, though in no way remarkable. The railway along the coast northward passes the seaside resorts of Klampenborg (6 m.) and Skodsborg (10 m.). Near Klampenborg is the Dyrehave (Deer park) or Skoven (the forest), a beautiful forest of beeches. The Zealand Northern railway passes Lyngby, on the lake of the same name, a favourite summer residence, and Hillerød (21 m.), a considerable town, capital of the *amt* (county) of Frederiksberg, and close to the palace of Frederiksberg. This was erected in 1602-1620 by Christian IV., embodying two towers of an earlier building, and partly occupying islands in a small lake. It suffered seriously from fire in 1859, but was carefully restored under the direction of F. Meldahl. It contains a national historical museum, including furniture and pictures. The palace church is an interesting medley of Gothic and Renaissance detail. The villa of Hvidøre was acquired by Queen Alexandra in 1907.

Among the literary and scientific associations of Copenhagen may be mentioned the Danish Royal Society, founded in 1742, for the advancement of the sciences of mathematics, astronomy, natural philosophy, &c., by the publication of papers and essays; the Royal Antiquarian Society, founded in 1825, for diffusing a knowledge of Northern and Icelandic archaeology; the Society for the Promotion of Danish Literature, for the publication of works chiefly connected with the history of Danish literature; the Natural Philosophy Society; the Royal Agricultural Society; the Danish Church History Society; the Industrial Association, founded in 1838; the Royal Geographical Society, established in 1876; and several musical and other societies. The Academy of Arts was founded by Frederick V. in 1754 for the instruction of artists, and for disseminating a taste for the fine arts among manufacturers and operatives. Attached to it are schools for the study of architecture, ornamental drawing and modelling. An Art Union was founded in 1826, and a musical conservatorium in 1870 under the direction of the composers N. W. Gade and J. P. E. Hartmann.

Among educational institutions, other than the university, may be mentioned the veterinary and agricultural college, established in 1773 and adopted by the state in 1776, the military academy and the school of navigation. Technical instruction is provided by the polytechnic school (1829), which is a state institution, and the school of the Technical Society, which, though a private foundation, enjoys public subvention. The schools which prepare for the university, &c., are nearly all private, but are all under the control of the state. Elementary instruction is mostly provided by the communal schools.

The churches already mentioned belong to the national Lutheran Church; the most important of those belonging to other denominations are the Reformed church, founded in 1688, and rebuilt in 1731, the Catholic church of St Ansgarius, consecrated in 1842, and the Jewish synagogue in Krystalgade, which dates from 1853. Of the monastic buildings of medieval Copenhagen various traces are preserved in the present nomenclature of the streets. The Franciscan establishment gives its name to the Graabrødretorv or Grey Friars' market; and St Clara's Monastery, the largest of all, which was founded by Queen Christina, is still commemorated by the Klareboder or Clara buildings, near the present post-office. The Duebrødre Kloster occupied the site of the hospital of the Holy Ghost.

Among the hospitals of Copenhagen, besides many modern institutions, there may be mentioned Frederick's hospital, erected in 1752-1757 by Frederick V., the Communal Hospital, erected in 1859-1863, on the eastern side of the Sortedamssø, the general hospital in Ameliegade, founded in 1769, and the garrison hospital, in Rigersgade, established in 1816 by Frederick VI. After the cholera epidemic of 1853, which carried off more than 4000 of the inhabitants, the medical association built several ranges of workmen's houses, and their example was followed by various private capitalists, among whom may be mentioned the Classen trustees, whose buildings occupy an open site on the western outskirts of the city.

Copenhagen is by far the most important commercial town in Denmark, and exemplifies the steady increase in the trade of the country. The harbour is mainly comprised in the narrow strait between the outer Sound and its inlet the Kalvebod or Kallebo Strand. The trading capabilities were aided by the construction in 1894 of the Frihavn (free port) at the northern extremity of the town, well supplied with warehouses and other conveniences. It is connected with the main railway station by means of a circular railway, while a short branch connects it with the ordinary custom-house quay. The commercial harbour is separated from the harbour for warships (*Orlogshavn*) by a barrier. The sea approaches are guarded by ten coast batteries besides the old citadel. The Middelgrund is a powerful defensive work completed in 1896 and most of the rest are modern. The landward defences of Copenhagen, it may be added, were left unprovided for after the Napoleonic wars until the patriotism of

Danish women, who subscribed sufficient funds for the first fort, shamed parliament into granting the necessary money for others (1886-1895). Copenhagen is not an industrial town. The manufactures carried on are mostly only such as exist in every large town, and the export of manufactured goods is inconsiderable. The royal china factory is celebrated for models of Thorvaldsen's works in biscuit china. The only very large establishment is one for the construction of iron steamers, engines, &c., but some factories have been erected within the area of the free port for the purpose of working up imported raw materials duty free.

*History.*—Copenhagen (*i.e.* Merchant's Harbour, originally simply Havn, latinized as *Hafnia*) is first mentioned in history in 1043. It was then only a fishing village, and remained so until about the middle of the 12th century, when Valdemar I. presented that part of the island to Axel Hvide, renowned in Danish history as Absalon (*q.v.*), bishop of Roskilde, and afterwards archbishop of Lund. In 1167 this prelate erected a castle on the spot where the Christiansborg palace now stands, and the building was called after him Axel-huus. The settlement gradually became a great resort for merchants, and thus acquired the name which, in a corrupted form, it still bears, of Kaupmannahöfn, Kjöbmannshavn, or *Portus Mercatorum* as it is translated by Saxo Grammaticus. In 1186, Bishop Absalon bestowed the castle and village, with the lands of Amager, on the see of Roskilde; but, as the place grew in importance, the Danish kings became anxious to regain it, and in 1245 King Eric IV. drove out Bishop Niels Stigson. On the king's death (1250), however, Bishop Jacob Erlandsen obtained the town, and, in 1254, gave to the burghers their first municipal privileges, which were confirmed by Pope Urban III. in 1286. In the charter of 1254, while there is mention of a *communitas* capable of making a compact with the bishop, there is nothing said of any trade or craft guilds. These are, indeed, expressly prohibited in the later charter of Bishop Johann Kvag (1294); and the distinctive character of the constitution of Copenhagen during the middle ages consisted in the absence of the free gild system, and the right of any burgher to pursue a craft under license from the *Vogt (advocatus)* of the overlord and the city authorities. Later on, guilds were established, in spite of the prohibition of the old charters; but they were strictly subordinate to the town authorities, who appointed their aldermen and suppressed them when they considered them useless or dangerous. The prosperity of Copenhagen was checked by an attack by the people of Lübeck in 1248, and by another on the part of Prince Jaromir of Rügen in 1259. In 1306 it managed to repel the Norwegians, but in 1362, and again in 1368, it was captured by the opponents of Valdemar Atterdag. In the following century a new enemy appeared in the Hanseatic league, which was jealous of its rivalry, but their invasion was frustrated by Queen Philippa. Various attempts were made by successive kings to obtain the town from the see of Roskilde, as the most suitable for the royal residence; but it was not till 1443 that the transference was finally effected and Copenhagen became the capital of the kingdom. From 1523 to 1524 it held out for Christian II. against Frederick I., who captured it at length and strengthened its defensive works; and it was only after a year's siege that it yielded in 1536 to Christian III. From 1658 to 1660 it was unsuccessfully beleaguered by Charles Gustavus of Sweden; and in the following year it was rewarded by various privileges for its gallant defence. In 1660 it gave its name to the treaty which concluded the Swedish war of Frederick III. In 1700 it was bombarded by the united fleets of England, Holland and Sweden; in 1728 a conflagration destroyed 1640 houses and five churches; another in 1795 laid waste 943 houses, the church of St Nicolas, and the *Raadhus*. In 1801 the Danish fleet was destroyed in the roadstead by the English (see below, § *Battle of Copenhagen*); and in 1807 the city was bombarded by the British under Lord Cathcart, and saw the destruction of the university buildings, its principal church and numerous other edifices.

See O. Nielsen, *Köbenhavns Historie oz Beskrivelse* (Copenhagen, 1877-1892); C. Bruun and P. Munch, *Köbenhavn, Skildring af dets Historie, &c.* (ibid. 1887-1901); Bering-Lüsberg, *Köbenhavn i gamle Dage* (ibid. 1898 et seq.).

(O. J. R. H.)

#### BATTLE OF COPENHAGEN

The formation of a league between the northern powers, Russia, Prussia, Denmark and Sweden, on the 16th of December 1800, nominally to protect neutral trade at sea from the enforcement by Great Britain of her belligerent claims, led to the despatch of a British fleet to the Baltic on the 12th of March 1801. It consisted of fifty-three sail in all, of which eighteen were of the line. Prussia possessed no fleet. The nominal strength of the Russian fleet was eighty-three sail of the line, of the Danish twenty-three, and of the Swedish eighteen. But this force was for the most part only on paper. Some of the Russian ships were at Archangel, others in the Mediterranean. Of those actually in the Baltic and fit to go to sea,

twelve were at Reval shut in by the ice, and the others were at Kronstadt. The Swedes could equip only eleven of the line for sea, and Denmark only seven or eight. It is highly doubtful whether the three powers could have collected more than forty ships of the line—and they would have been hastily manned, destitute of experience, and without confidence. A rapid British attack would in any case forestall the concentration of these heterogeneous squadrons. The superior quality of the veteran British crews was more than enough to counterbalance a mere superiority in numbers. The command of the British fleet was given to Sir Hyde Parker, an amiable man of no energy and little ability. He had Nelson with him as second in command—then a junior admiral but without rival in capacity and in his hold on the confidence of the fleet. Parker's orders were to give Denmark twenty-four hours in which to withdraw from the coalition, and on her refusal to destroy or neutralize her strength and then proceed against the Russians before the breaking up of the ice allowed the ships at Reval to join the squadron at Kronstadt.

On the 21st of March the British fleet, after a somewhat stormy passage, was at the entrance to the Sound. Nicholas Vansittart, afterwards Lord Bexley, the British diplomatic agent entrusted with the message to the Danish government, was landed, and left for Copenhagen. On the 23rd he returned with the refusal of the Danes. The British fleet then passed the Danish fort at Cronenburg, unhurt by its distant fire, and without being molested by the forts on the Swedish shore. Nelson urged immediate attack, and recommended, as an alternative, that part of the British fleet should watch the Danes while the remainder advanced up the Baltic to prevent the junction of the Russian Reval squadron with the ships in Kronstadt. Sir Hyde Parker was, however, unwilling to go up the Baltic with the Danes unsubdued behind him, or to divide his force. It was therefore resolved that an attack should be made on the Danish capital with the whole fleet in two divisions. Copenhagen lies on the east side of the island of Zealand; opposite it is the shoal known as the Middle Ground. To the east of the Middle Ground is another shoal known as Saltholm Flat, and there is a passage available for large ships between them. The main fortification of Copenhagen was the powerful Tre Kroner (Three Crown) battery at the northern end of the sea-front. Here the Danes had placed their strongest ships. The southern part of the city front was covered by hulks and gun-vessels or bomb-vessels. There were in all eighteen hulks or ships of the line in the Danish defence. To have made the attack from the northern end would in Nelson's words have been "to take the bull by the horns." He therefore proposed that he should be detached with ten sail of the line, and the frigates and small craft, to pass between the Middle Ground and Saltholm Flat, and assail the Danish line at the southern end while the remainder of the fleet engaged the Tre Kroner battery from the north. Sir Hyde Parker accepted his offer, and added two ships of the line to the ten asked for by Nelson.

During the nights of the 30th and 31st of March the channel between the Middle Ground and Saltholm Flat was sounded by the boats of the British fleet, the Danes making no attempt to interfere with them. On the 1st of April Nelson brought his ships through. He had transferred his flag from his own ship the "St George" (98) to the "Elephant" (74), commanded by Captain Foley, because the water was too shallow for a three-decker. On the morning of the 2nd of April the wind was fair from the south-east, and at 9.30 A.M. the British squadron weighed anchor, led by the "Amazon" frigate, commanded by Captain Riou, and began to pass along the front of the Danish line. The Danes could bring into action 375 guns in all. Their hulks and bomb-vessels were supported by batteries on Zealand; but, as the water is shallow for a long distance from the shore, these defences were too far off to render them effectual aid on the south end of their line. Nelson disposed of a greater number of guns, 1058 in all, but some did not come into action. The "Agamemnon" (64), commanded by Captain Fancourt, was unable to round the south point of the Middle Ground. The "Bellona" (74), commanded by Captain Thompson, and the "Russel" (74), commanded by Captain Cuming, ran ashore on the Middle Ground, but within range though at too great a distance for fully effective fire. Captain Thompson lost his leg in the battle. The other ships passed between the "Bellona" and "Russel" and the Danes. The leading British ship, the "Defiance" (74), carrying the flag of Rear-Admiral Graves, anchored just south of the Tre Kroner. As the wind was from the south-east Sir Hyde Parker was unable to make the proposed attack from the north. The place opposite the Danish fort which was to have been taken by him was occupied by Captain Riou and the frigates. The "Elephant" anchored almost in the middle of the line. Fire was opened about 10 A.M., and at 11.30 the action was at its height.

Until 1 o'clock there was no diminution of the Danish fire. Sir Hyde Parker, who saw the danger of Nelson's position, became anxious, and sent his second, Captain Robert Waller Ottway, to him with a message authorizing him to retire if he thought fit. Before Ottway, who had to go in a row-boat, reached the "Elephant," Sir Hyde Parker had reflected that it

would be more magnanimous in him to take the responsibility of ordering the retreat. He therefore hoisted the signal of recall. It was a well-meant but ill-judged order. Nelson could only have retreated before the south-easterly wind by going past the Trekroner fort, where the passage is narrow, and the navigation difficult. He therefore disregarded the signal, and amused himself and the few officers about him by putting his glass to his blind eye and saying that he could not see it. The frigates opposite the Trekroner did retreat, Captain Riou being slain as they drew off.

At about 2.30 the fire from the Danish hulks had been much beaten down, but as their crews fell, fresh men were sent from the shore and the fire was resumed. Nelson astutely and legitimately seized the opportunity to open negotiations with the Danes. He sent a flag of truce carried by Sir F. Thesiger ashore to the crown prince of Denmark (then regent of the kingdom), to say that unless he was allowed to take possession of the hulks which had surrendered he would be compelled to burn them, a course which he deprecated on the ground of humanity and his tenderness of "the brothers of the English the Danes." The crown prince, who was shaken by the spectacle of the battle, allowed himself to be drawn into a reply, and to be referred to Sir Hyde Parker. Fire was suspended by the Danes to allow of time to receive Sir Hyde Parker's answer. Nelson with intelligent promptitude availed himself of the interval to withdraw his squadron past the Trekroner. The difficulty found in getting the ships out—one of them grounded—showed how disastrous an attempt to draw off under fire of the forts must have been.

The Danish government, which had entered the coalition largely from fear of Russia, was not prepared to make very great sacrifices, and now entered into negotiations for an armistice. It was the more ready to do so because it received news of the assassination of the tsar Paul, which had happened on the 24th of March. An armistice was made for fourteen weeks, which left the British fleet free to proceed up the Baltic. On the 12th of April, after lightening the three-deckers of their guns, the fleet passed over the shallows. But its presence had now lost all military significance. Sir Hyde Parker was assured by the Russian minister at Copenhagen that the new tsar Alexander I. would not continue the policy of hostility with England and alliance with France which had proved fatal to his father. The Swedes, who like the Danes had entered the coalition under pressure from Russia, did not send their ships to sea. The government of the new tsar was prepared for an arrangement with England. The date of the final settlement was in all probability delayed by the activity of Nelson, and his belief that a British fleet was the best negotiator in Europe. The British government learnt of the tsar's death on the 15th of April. On the 17th it instructed Sir Hyde Parker to agree to a suspension of hostilities, and not to take active measures against Russia so long as the Reval squadron did not put to sea. On the 21st of April, having now received a full account of the battle at Copenhagen, it recalled Sir Hyde Parker, whose vacillating conduct and want of enterprise had become manifest. He received the news of his recall on the 5th of May. Nelson, to whom the command passed, at once put to sea, and hastened with a part of his fleet to Reval, which he reached on the 12th of May. The Russian squadron had, however, cut a passage through the ice in the harbour on the 3rd, and had sailed for Kronstadt. Nelson was received with formal civility by the Russian officers, with whom he exchanged visits. He wrote a letter to Mr Garlike, secretary of the British embassy at St Petersburg, saying that he had come with a small squadron as the best way of paying "the very highest compliment" to the tsar.

The Russian government, which not unnaturally wished to avoid any appearance of acting under dictation, and was now in no anxiety for the Reval squadron, treated his presence as a menace. On the 13th of May Count Pahlen answered in a most peremptory letter informing Nelson that negotiations would be suspended while he remained at Reval. This retort caused Nelson annoyance which he did not attempt to conceal, but he justly concluded that he had nothing further to do at Reval, and therefore returned down the Baltic. Nelson remained with the fleet till he was relieved at his own request, and was able to sail for England on the 18th of June. He gave a proof of his regard for the service of the country by taking his passage home in a small brig rather than withdraw a line of battle ship from the squadron, which his rank entitled him to do, and as other admirals of the time generally did. The British sailors and ships embargoed in Russia were released on the 17th of May. Great Britain released her prisoners on the 4th of June, and on the 17th of June was signed the convention which terminated the Baltic campaign.

See *Dispatches and Letters of Vice-Admiral Nelson*, by Sir N. Harris Nicolas (1845); *Life of Nelson*, by Capt. A. T. Mahan (London, 1899).

(D. H.)

**COPERNICUS** (OR KOPPERNIGK), **NICOLAUS** (1473-1543), Polish astronomer, was born on the 19th of February 1473, at Thorn in Prussian Poland, where his father, a native of Cracow, had settled as a wholesale trader. His mother, Barbara Watzelrode, belonged to a family of high mercantile and civic standing. After the death of his father in 1483, Nicolaus was virtually adopted by his uncle Lucas Watzelrode, later (in 1489) bishop of Ermeland. Placed at the university of Cracow in 1491, he devoted himself, during three years, to mathematical science under Albert Brudzewski (1445-1497), and incidentally acquired some skill in painting. At the age of twenty-three he repaired to Bologna, and there varied his studies of canon law by attending the astronomical lectures of Domenico Maria Novara (1454-1504). At Rome, in the Jubilee year 1500, he himself lectured with applause; but having been nominated in 1497 canon of the cathedral of Frauenburg, he recrossed the Alps in 1501 with the purpose of obtaining further leave of absence for the completion of his academic career. Late in the same year, accordingly, he entered the medical school of Padua, where he remained until 1505, having taken meanwhile a doctor's degree in canon law at Ferrara on the 31st of May 1503. After his return to his native country he resided at the episcopal palace of Heilsberg as his uncle's physician until the latter's death on the 29th of March 1512. He then retired to Frauenburg, and vigorously attended to his capitular duties. He never took orders, but acted continually as the representative of the chapter under harassing conditions, administrative and political; he was besides commissary of the diocese of Ermeland; his medical skill, always at the service of the poor, was frequently in demand by the rich; and he laid a scheme for the reform of the currency before the Diet of Graudenz in 1522. Yet he found time, amid these multifarious occupations, to elaborate an entirely new system of astronomy, by the adoption of which man's outlook on the universe was fundamentally changed.

The main lines of his great work were laid down at Heilsberg; at Frauenburg, from 1513, he sought, with scanty instrumental means, to test by observation the truth of the views it embodied (see [ASTRONOMY: History](#)). His dissatisfaction with Ptolemaic doctrines was of early date; and he returned from Italy, where so-called Pythagorean opinions were then freely discussed, in strong and irrevocable possession of the heliocentric theory. The epoch-making treatise in which it was set forth, virtually finished in 1530, began to be known through the circulation in manuscript of a *Commentariolus*, or brief popular account of its purport written by Copernicus in that year. Johann Albrecht Widmanstadt lectured upon it in Rome; Clement VII. approved, and Cardinal Schönberg transmitted to the author a formal demand for full publication. But his assent to this was only extracted from him in 1540 by the importunities of his friends, especially of his enthusiastic disciple George Joachim Rheticus (1514-1576), who printed, in the *Narratio prima* (Danzig, 1540), a preliminary account of the Copernican theory, and simultaneously sent to the press at Nuremberg his master's complete exposition of it in the treatise entitled *De revolutionibus orbium coelestium* (1543). But the first printed copy reached Frauenburg barely in time to be laid on the writer's death-bed. Copernicus was seized with apoplexy and paralysis towards the close of 1542, and died on the 24th of May 1543, happily unconscious that the fine Epistle, in which he had dedicated his life's work to Paul III., was marred of its effect by an anonymous preface, slipt in by Andreas Osiander (1498-1552), with a view to disarming prejudice by insisting upon the purely hypothetical character of the reasonings it introduced. The trigonometrical section of the book had been issued as a separate treatise (Wittenberg, 1542) under the care of Rheticus. The only work published by Copernicus on his own initiative was a Latin version of the Greek Epistles of Theophylact (Cracow, 1509). His treatise *De monetæ cudendæ ratione*, 1526 (first printed in 1816), written by order of King Sigismund I., is an exposition of the principles on which it was proposed to reform the currency of the Prussian provinces of Poland. It advocates unity of the monetary system throughout the entire state, with strict integrity in the quality of the coin, and the charge of a seigniorage sufficient to cover the expenses of mintage.

**AUTHORITIES.**—Rheticus was the only contemporary biographer of Copernicus, and his narrative perished irretrievably. Gassendi's jejune Life (Paris, 1654) is thus the earliest extant of any note. It was supplemented, during the 19th century, by the various publications of J. Sniadecki (Warsaw, 1803-1818); of J. H. W. Westphal, J. Czynski, M. Curtze, H. A. Wolynski, F. Hipler, and others, but their efforts were overshadowed by Dr Leopold Prowe's exhaustive *Nicolaus Copernicus* (Berlin, 1883-1884), embodying the outcome of researches indefatigably prosecuted for over thirty years. The first volume (in two parts) is a detailed biography of the great astronomer; the second includes some of his minor writings and correspondence, family records, and historical documents of local interest. The effects of his Italian sojourn upon the nascent ideas of Copernicus may be profitably studied in Domenico Berti's *Copernico e le vicende del sistema Copernicano in Italia* (Roma, 1876), and in G. V. Schiaparelli's *I Precursori del Copernico nell' antichità* (Milano, 1873). A centenary edition

**COPIAPÓ**, a city of northern Chile, capital of the province of Atacama, about 35 m. from the coast on the Copiapó river, in lat. 27° 36' S., long. 70° 23' W. Pop. (1895) 9301. The Caldera & Copiapó railway (built 1848-1851 and one of the first in South America) extends beyond Copiapó to the Chañarcillo mines (50 m.) and other mining districts. Copiapó stands 1300 ft. above sea-level and has a mean temperature of about 67° in summer and 51° in winter. Its port, Caldera, 50 m. distant by rail, is situated on a well-sheltered bay with good shipping facilities about 6 m. N. of the mouth of the Copiapó river. Copiapó is perhaps the best built and most attractive of the desert region cities. The river brings down from the mountains enough water to supply the town and irrigate a considerable area in its vicinity. Beyond the small fertile valley in which it stands is the barren desert, on which rain rarely falls and which has no economic value apart from its minerals (especially saline compounds). Copiapó was founded in 1742 by José de Manso (afterwards Conde de Superunda, viceroy of Peru) and took its name from the Copayapu Indians who occupied that region. It was primarily a military station and transport post on the road to Peru, but after the discovery of the rich silver deposits near Chañarcillo by Juan Godoy in 1832 it became an important mining centre. It has a good mining school and reduction works, and is the supply station for an extensive mining district. For many years the Famatina mines of Argentina received supplies from this point by way of the Come-Caballo pass.

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**COPING** (from "cope," Lat. *capa*), in architecture, the capping or covering of a wall. This may be made of stone, brick, tile, slate, metal, wood or thatch. In all cases it should be weathered to throw off the wet. In Romanesque work it was plain and flat, and projected over the wall with a throating to form a drip. In later work a steep slope was given to the weathering (mainly on the outer side), and began at the top with an astragal; in the Decorated style there were two or three sets off; and in the later Perpendicular period these assumed a wavy section, and the coping mouldings were continued round the sides, as well as at top and bottom, mitreing at the angles, as in many of the colleges at Oxford. The cheapest type of coping is that which caps the ordinary 9 in. brick wall, and consists of brick on edge above a double tile creasing, all in cement; the creasing consisting of one or two rows of tiles laid horizontally on the wall and projecting on each side about 2 in. to throw off the water (see also [MASONRY](#)).

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**COPLAND, ROBERT** (fl. 1515), English printer and author, is said to have been a servant of William Caxton, and certainly worked for Wynkyn de Worde. The first book to which his name is affixed as a printer is *The Boke of Justices of Peace* (1515), at the sign of the Rose Garland, in Fleet Street, London. Anthony à Wood supposed, on the ground that he was more educated than was usual in his trade, that he had been a poor scholar of Oxford. His best known works are *The hye way to the Spyttell hous*, a dialogue in verse between Copland and the porter of St Bartholomew's hospital, containing much information about the vagabonds who found their way there; and *Jyl of Breyntfords Testament*, dismissed in *Athenae Oxonienses* (ed. Bliss) as "a poem devoid of wit or decency, and totally unworthy of further notice." He translated from the French the romances of *Kynge Appolyne of Thyre* (W. de Worde, 1510), *The History of Helyas Knyght of the Swanne* (W. de Worde, 1513), and *The Life of Ipomydon (Hue of Rotelande)*, not dated. Among his other works is *The Complaynte of them that ben too late maryed*, an undated tract printed by W. de Worde.

William Copland, the printer, supposed to have been his brother, published three editions of *Howleglas*, perhaps by Robert, which in any case represent the earliest English version of *Till Eulenspiegel*.

The *Knyght of the Swanne* was reprinted in Thom's *Early Prose Romances*, vol. iii., and by the Grolier Club (1901); the *Hye Way* in W. C. Hazlitt's *Remains of the Early Popular Poetry of England*, vol. iv. (1866). See further the "Forewords" to Dr F. J. Furnivall's reprint of *Jyl of Breyntford* (for private circulation, 1871) and J. P. Collier, *Bibliographical and Critical Account of the Rarest Books in the English Language*, vol. i. p. 153 (1865). For the books issued from his press see *Hand-Lists of English Printers (1501-1556)*, printed for the Bibliographical Society in 1896.

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**COPLESTON, EDWARD** (1776-1849), English bishop, was born at Offwell in Devonshire, and educated at Oxford. He was elected to a tutorship at Oriel College in 1797, and in 1800 was appointed vicar of St Mary's, Oxford. As university professor of poetry (1802-1812) he gained a considerable reputation by his clever literary criticism and sound latinity. After holding the office of dean at Oriel for some years, he succeeded to the provostship in 1814, and owing largely to his influence the college reached a remarkable degree of prosperity during the first quarter of the 19th century. In 1826 he was appointed dean of Chester, and in the next year he was consecrated bishop of Llandaff. Here he gave his support to the new movement for church restoration in Wales, and during his occupation of the see more than twenty new churches were built in the diocese. The political problems of the time interested him greatly, and his writings include two able letters to Sir Robert Peel, one dealing with the *Variable Standard of Value*, the other with the *Increase of Pauperism* (Oxford, 1819).

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**COPLEY, JOHN SINGLETON** (1737-1815), English historical painter, was born of Irish parents at Boston, Massachusetts. He was self-educated, and commenced his career as a portrait-painter in his native city. The germ of his reputation in England was a little picture of a boy and squirrel, exhibited at the Society of Arts in 1760. In 1774 he went to Rome, and thence in 1775 came to England. In 1777 he was admitted associate of the Royal Academy; in 1783 he was made Academician on the exhibition of his most famous picture, the "Death of Chatham," popularized immediately by Bartolozzi's elaborate engraving; and in 1790 he was commissioned to paint a portrait picture of the defence of Gibraltar. The "Death of Major Pierson," in the National Gallery, also deserves mention. Copley's powers appear to greatest advantage in his portraits. He was the father of Lord Chancellor Lyndhurst.

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**COPPÉE, FRANÇOIS ÉDOUARD JOACHIM** (1842-1908), French poet and novelist, was born in Paris on the 12th of January 1842. His father held a small post in the civil service, and he owed much to the care of an admirable mother. After passing through the Lycée Saint-Louis he became a clerk in the ministry of war, and soon sprang into public favour as a poet of the young "Parnassian" school. His first printed verses date from 1864. They were republished with others in 1866 in a collected form (*Le Reliquaire*), followed (1867) by *Les Intimités* and *Poèmes modernes* (1867-1869). In 1869 his first play, *Le Passant*, was received with marked approval at the Odéon theatre, and later *Fais ce que dois* (1871) and *Les Bijoux de la délivrance* (1872), short metrical dramas inspired by the war, were warmly applauded.

After filling a post in the library of the senate, Coppée was chosen in 1878 as archivist of the Comédie-Française, an office which he held till 1884. In that year his election to the Academy caused him to retire altogether from his public appointments. He continued to



publish volumes of poetry at frequent intervals, including *Les Humbles* (1872), *Le Cahier rouge* (1874), *Olivier* (1875), *L'Exilée* (1876), *Contes en vers*, &c. (1881), *Poèmes et récits* (1886), *Arrière-saison* (1887), *Paroles sincères* (1890). In his later years his output of verse declined, but he published two more volumes, *Dans la prière et la lutte* and *Vers français*. He had established his fame as "le poète des humbles." Besides the plays mentioned above, two others written in collaboration with Armand d'Artois, and some light pieces of little importance, Coppée produced *Madame de Maintenon* (1881), *Severo Torelli* (1883), *Les Jacobites* (1885), and other serious dramas in verse, including *Pour la couronne* (1895), which was translated into English (*For the Crown*) by John Davidson, and produced at the Lyceum Theatre in 1896. The performance of a short episode of the Commune, *Le Pater*, was prohibited by the government (1889). Coppée's first story in prose, *Une Idylle pendant le siège*, appeared in 1875. It was followed by various volumes of short tales, by *Toute une jeunesse* (1890)—an attempt to reproduce the feelings, if not the actual wants, of the writer's youth,—*Les Vrais Riches* (1892), *Le Coupable* (1896), &c. He was made an officer of the Legion of Honour in 1888. A series of reprinted short articles on miscellaneous subjects, styled *Mon Franc Parler*, appeared from 1893 to 1896; and in 1898 was published *La Bonne Souffrance*, the outcome of Coppée's reconversion to the Roman Catholic Church, which gained very wide popularity. The immediate cause of his return to the faith was a severe illness which twice brought him to the verge of the grave. Hitherto he had taken little open interest in public affairs, but he now joined the most violent section of Nationalist politicians, while retaining contempt for the whole apparatus of democracy. He took a leading part against the prisoner in the Dreyfus case, and was one of the originators of the notorious Ligue de la Patrie Française. He died on the 23rd of May 1908.

Alike in verse and prose Coppée concerned himself with the plainest expressions of human emotion, with elemental patriotism, and the joy of young love, and the pitifulness of the poor, bringing to bear on each a singular gift of sympathy and insight. The lyric and idyllic poetry, by which he will chiefly be remembered, is animated by musical charm, and in some instances, such as *La Bénédiction* and *La Grève des forgerons*, displays a vivid, though not a sustained, power of expression. There is force, too, in the gloomy tale, *Le Coupable*. But he exhibits all the defects of his qualities. In prose especially, his sentiment often degenerates into sentimentality, and he continually approaches, and sometimes oversteps, the verge of the trivial. Nevertheless, by neglecting that canon of contemporary art which would reduce the deepest tragedies of life to mere subjects for dissection, he won those common suffrages which are the prize of exquisite literature.

See M. de Lescure's *François Coppée, l'homme, la vie, l'œuvre* (1889), and G. Druilhet, *Un Poète français* (1902).

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**COPPÉE, HENRY** (1821-1895), American educationalist and author, was born in Savannah, Georgia, on the 13th of October 1821, of a French family formerly settled in Haiti. He studied at Yale for two years, worked as a civil engineer, graduated at West Point in 1845, served in the Mexican War as a lieutenant and was breveted captain for gallantry at Contreras and Churubusco, was professor of English at West Point from 1850 to 1855 (when he resigned from the army), was professor of English literature and history in the University of Pennsylvania 1855-1866, and on the 1st of April 1866 was chosen first president of Lehigh University. In 1875 he was succeeded by John McD. Leavitt and became professor of history and English literature, but was president pro tem. from the death of Robert A. Lamberton (b. 1824) in September 1893 to his own death in Bethlehem on the 22nd of March 1895. He published elementary text-books of logic (1857), of rhetoric (1859), and of English literature (1872); various manuals of drill; *Grant, a Military Biography* (1866); *General Thomas* (1893), in the "Great Commanders" Series; *History of the Conquest of Spain by the Arab-Moors* (1881); and in 1862 a translation of Marmont's *Esprit des institutions militaires*, besides editing the Comte de Paris's *Civil War in America*.

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**COPPER** (symbol Cu, atomic weight 63.1, H = 1, or 63.6, O = 16), a metal which has been known to and used by the human race from the most remote periods. Its alloy with tin (bronze) was the first metallic compound in common use by mankind, and so extensive and characteristic was its employment in prehistoric times that the epoch is known as the Bronze Age. By the Greeks and Romans both the metal and its alloys were indifferently known as χαλκός and *aes*. As, according to Pliny, the Roman supply was chiefly drawn from Cyprus, it came to be termed *aes cyprium*, which was gradually shortened to *cyprium*, and corrupted into *cuprum*, whence comes the English word copper, the French *cuivre*, and the German *Kupfer*.

Copper is a brilliant metal of a peculiar red colour which assumes a pinkish or yellowish tinge on a freshly fractured surface of the pure metal, and is purplish when the metal contains cuprous oxide. Its specific gravity varies between 8.91 and 8.95, according to the treatment to which it may have been subjected; J. F. W. Hampe gives 8.945 ( $0\frac{1}{4}$ ) for perfectly pure and compact copper. Ordinary commercial copper is somewhat porous and has a specific gravity ranging from 8.2 to 8.5. It takes a brilliant polish, is in a high degree malleable and ductile, and in tenacity it only falls short of iron, exceeding in that quality both silver and gold. By different authorities its melting-point is stated at from 1000° to 1200° C.; C. T. Heycock and F. H. Neville give 1080°.5; P. Dejean gives 1085° as the freezing-point. The molten metal is sea-green in colour, and at higher temperatures (in the electric arc) it vaporizes and burns with a green flame. G. W. A. Kahlbaum succeeded in subliming the metal in a vacuum, and H. Moissan (*Compt. rend.*, 1905, 141, p. 853) distilled it in the electric furnace. Molten copper absorbs carbon monoxide, hydrogen and sulphur dioxide; it also appears to decompose hydrocarbons (methane, ethane), absorbing the hydrogen and the carbon separating out. These occluded gases are all liberated when the copper cools, and so give rise to porous castings, unless special precautions are taken. The gases are also expelled from the molten metal by lead, carbon dioxide, or water vapour. Its specific heat is 0.0899 at 0° C. and 0.0942 at 100°; the coefficient of linear expansion per 1° C. is 0.001869. In electric conductivity it stands next to silver; the conducting power of silver being equal to 100, that of perfectly pure copper is given by A. Matthiessen as 96.4 at 13° C.

Copper is not affected by exposure in dry air, but in a moist atmosphere, containing carbonic acid, it becomes coated with a green basic carbonate. When heated or rubbed it emits a peculiar disagreeable odour. Sulphuric and hydrochloric acids have little or no action upon it at ordinary temperatures, even when in a fine state of division; but on heating, copper sulphate and sulphur dioxide are formed in the first case, and cuprous chloride and hydrogen in the second. Concentrated nitric acid has also very little action, but with the dilute acid a vigorous action ensues. The first products of this reaction are copper nitrate and nitric oxide, but, as the concentration of the copper nitrate increases, nitrous oxide and, eventually, free nitrogen are liberated.

Many colloidal solutions of copper have been obtained. A reddish-brown solution is obtained from solutions of copper chloride, stannous chloride and an alkaline tartrate (Lottermoser, *Anorganische Colloïde*, 1901).

*Occurrence.*—Copper is widely distributed in nature, occurring in most soils, ferruginous mineral waters, and ores. It has been discovered in seaweed; in the blood of certain Cephalopoda and Ascidia as haemocyanin, a substance resembling the ferruginous haemoglobin, and of a species of *Limulus*; in straw, hay, eggs, cheese, meat, and other food-stuffs; in the liver and kidneys, and, in traces, in the blood of man and other animals (as an entirely adventitious constituent, however); it has also been shown by A. H. Church to exist to the extent of 5.9% in turacin, the colouring-matter of the wing-feathers of the Turaco.

Native copper, sometimes termed by miners malleable or virgin copper, occurs as a mineral having all the properties of the smelted metal. It crystallizes in the cubic system, but the crystals are often flattened, elongated, rounded or otherwise distorted. Twins are common. Usually the metal is arborescent, dendritic, filiform, moss-like or laminar. Native copper is found in most copper-mines, usually in the upper workings, where the deposit has been exposed to atmospheric influences. The metal seems to have been reduced from solutions of its salts, and deposits may be formed around mine-timber or on iron objects. It often fills cracks and fissures in the rock. It is not infrequently found in serpentine, and in basic eruptive rocks, where it occurs as veins and in amygdales. The largest known deposits are those in the Lake Superior region, near Keweenaw Point, Michigan, where masses upwards of 400 tons in weight have been discovered. The metal was formerly worked by the Indians for implements and ornaments. It occurs in a series of amygdaloidal dolerites or

diabases, and in the associated sandstones and conglomerates. Native silver occurs with the copper, in some cases embedded in it, like crystals in a porphyry. The copper is also accompanied by epidote, calcite, prehnite, analcite and other zeolitic minerals. Pseudomorphs after calcite are known; and it is notable that native copper occurs pseudomorphous after aragonite at Corocoro, in Bolivia, where the copper is disseminated through sandstone.

*Ores.*—The principal ores of copper are the oxides cuprite and melaconite, the carbonates malachite and chessylite, the basic chloride atacamite, the silicate chrysocolla, the sulphides chalcocite, chalcopyrite, erubescite and tetrahedrite. Cuprite (*q.v.*) occurs in most cupriferous mines, but never by itself in large quantities. Melaconite (*q.v.*) was formerly largely worked in the Lake Superior region, and is abundant in some of the mines of Tennessee and the Mississippi valley. Malachite is a valuable ore containing about 56% of the metal; it is obtained in very large quantities from South Australia, Siberia and other localities. Frequently intermixed with the green malachite is the blue carbonate chessylite or azurite (*q.v.*), an ore containing when pure 55.16% of the metal. Atacamite (*q.v.*) occurs chiefly in Chile and Peru. Chrysocolla (*q.v.*) contains in the pure state 30% of the metal; it is an abundant ore in Chile, Wisconsin and Missouri. The sulphur compounds of copper are, however, the most valuable from the economic point of view. Chalcocite, redruthite, copperglance (*q.v.*) or vitreous copper ( $\text{Cu}_2\text{S}$ ) contains about 80% of copper. Copper pyrites, or chalcopyrite, contains 34.6% of copper when pure; but many of the ores, such as those worked specially by wet processes on account of the presence of a large proportion of iron sulphide, contain less than 5% of copper. Cornish ores are almost entirely pyritic; and indeed it is from such ores that by far the largest proportion of copper is extracted throughout the world. In Cornwall copper lodes usually run east and west. They occur both in the “killas” or clay-slate, and in the “growan” or granite. Erubescite (*q.v.*), bornite, or horseflesh ore is much richer in copper than the ordinary pyrites, and contains 56 or 57% of copper. Tetrahedrite (*q.v.*), fahlerz, or grey copper, contains from 30 to 48% of copper, with arsenic, antimony, iron and sometimes zinc, silver or mercury. Other copper minerals are percyllite ( $\text{PbCuCl}_2(\text{OH})_2$ ), boleite ( $3\text{PbCuCl}_2(\text{OH})_2, \text{AgCl}$ ), stromeyerite  $\{(\text{Cu}, \text{Ag})_2\text{S}\}$ , cubanite ( $\text{CuS}, \text{Fe}_2\text{S}_3$ ), stannite ( $\text{Cu}_2\text{S}, \text{FeSnS}_3$ ), tennantite ( $3\text{Cu}_2\text{S}, \text{As}_2\text{S}_3$ ), emplectite ( $\text{Cu}_2\text{S}, \text{Bi}_2\text{S}_3$ ), wolfsbergite ( $\text{Cu}_2\text{S}, \text{Sb}_2\text{S}_3$ ), famatinite ( $3\text{Cu}_2\text{S}, \text{Sb}_2\text{S}_5$ ) and enargite ( $3\text{Cu}_2\text{S}, \text{As}_2\text{S}_5$ ). For other minerals, see *Compounds of Copper* below.

*Metallurgy.*—Copper is obtained from its ores by three principal methods, which may be denominated—(1) the pyro-metallurgical or dry method, (2) the hydro-metallurgical or wet method, and (3) the electro-metallurgical method.

The methods of working vary according to the nature of the ores treated and local circumstances. The dry method, or ordinary smelting, cannot be profitably practised with ores containing less than 4% of copper, for which and for still poorer ores the wet process is preferred.

*Copper Smelting.*—We shall first give the general principles which underlie the methods for the dry extraction of copper, and then proceed to a more detailed discussion of the plant used. Since all sulphuretted copper ores (and these are of the most economic importance) are invariably contaminated with arsenic and antimony, it is necessary to eliminate these impurities, as far as possible, at a very early stage. This is effected by calcination or roasting. The roasted ore is then smelted to a mixture of copper and iron sulphides, known as copper “matte” or “coarse-metal,” which contains little or no arsenic, antimony or silica. The coarse-metal is now smelted, with coke and siliceous fluxes (in order to slag off the iron), and the product, consisting of an impure copper sulphide, is variously known as “blue-metal,” when more or less iron is still present, “pimple-metal,” when free copper and more or less copper oxide is present, or “fine” or “white-metal,” which is a fairly pure copper sulphide, containing about 75% of the metal. This product is re-smelted to form “coarse-copper,” containing about 95% of the metal, which is then refined. Roasted ores may be smelted in reverberatory furnaces (English process), or in blast-furnaces (German or Swedish process). The matte is treated either in reverberatory furnaces (English process), in blast furnaces (German process), or in converters (Bessemer process). The “American process” or “Pyritic smelting” consists in the direct smelting of raw ores to matte in blast furnaces. The plant in which the operations are conducted varies in different countries. But though this or that process takes its name from the country in which it has been mainly developed, this does not mean that only that process is there followed.

The “English process” is made up of the following operations: (1) calcination; (2) smelting in reverberatory furnaces to form the matte; (3) roasting the matte; and (4) subsequent

smelting in reverberatory furnaces to fine- or white-metal; (5) treating the fine-metal in reverberatory furnaces to coarse- or blister-copper, either with or without previous calcination; (6) refining of the coarse-copper. A shorter process (the so-called "direct process") converts the fine-metal into refined copper directly. The "Welsh process" closely resembles the English method; the main difference consists in the enrichment of the matte by smelting with the rich copper-bearing slags obtained in subsequent operations. The "German or Swedish process" is characterized by the introduction of blast-furnaces. It is made up of the following operations: (1) calcination, (2) smelting in blast-furnaces to form the matte, (3) roasting the matte, (4) smelting in blast-furnaces with coke and fluxes to "black-" or "coarse-metal," (5) refining the coarse-metal. The "Anglo-German Process" is a combination of the two preceding, and consists in smelting the calcined ores in shaft furnaces, concentrating the matte in reverberatory furnaces, and smelting to coarse-metal in either.

The impurities contained in coarse-copper are mainly iron, lead, zinc, cobalt, nickel, bismuth, arsenic, antimony, sulphur, selenium and tellurium. These can be eliminated by an oxidizing fusion, and slagging or volatilizing the products resulting from this operation, or by electrolysis (see below). In the process of oxidation, a certain amount of cuprous oxide is always formed, which melts in with the copper and diminishes its softness and tenacity. It is, therefore, necessary to reconvert the oxide into the metal. This is effected by stirring the molten metal with a pole of green wood ("poling"); the products which arise from the combustion and distillation of the wood reduce the oxide to metal, and if the operation be properly conducted "tough-pitch" copper, soft, malleable and exhibiting a lustrous silky fracture, is obtained. The surface of the molten metal is protected from oxidation by a layer of anthracite or charcoal. "Bean-shot" copper is obtained by throwing the molten metal into hot water; if cold water be used, "feathered-shot" copper is formed. "Rosette" copper is obtained as thin plates of a characteristic dark-red colour, by pouring water upon the surface of the molten metal, and removing the crust formed. "Japan" copper is purple-red in colour, and is formed by casting into ingots, weighing from six ounces to a pound, and rapidly cooling by immersion in water. The colour of these two varieties is due to a layer of oxide. "Tile" copper is an impure copper, and is obtained by refining the first tapplings. "Best-selected" copper is a purer variety.

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*Calcination or Roasting and Calcining Furnaces.*—The roasting should be conducted so as to eliminate as much of the arsenic and antimony as possible, and to leave just enough sulphur as is necessary to combine with all the copper present when the calcined ore is smelted. The process is effected either in heaps, stalls, shaft furnaces, reverberatory furnaces or muffle furnaces. Stall and heap roasting require considerable time, and can only be economically employed when the loss of the sulphur is of no consequence; they also occupy much space, but they have the advantage of requiring little fuel and handling. Shaft furnaces are in use for ores rich in sulphur, and where it is desirable to convert the waste gases into sulphuric acid. Reverberatory roasting does not admit of the utilization of the waste gases, and requires fine ores and much labour and fuel; it has, however, the advantage of being rapid. Muffle furnaces are suitable for fine ores which are liable to decrepitate or sinter. They involve high cost in fuel and labour, but permit the utilization of the waste gases.

Reverberatory furnaces of three types are employed in calcining copper ores: (1) fixed furnaces, with either hand or mechanical rabbling; (2) furnaces with movable beds; (3) furnaces with rotating working chambers. Hand rabbling in fixed furnaces has been largely superseded by mechanical rabbling. Of mechanically rabbling furnaces we may mention the O'Harra modified by Allen-Brown, the Hixon, the Keller-Gaylord-Cole, the Ropp, the Spence, the Wethey, the Parkes, Pearce's "Turret" and Brown's "Horseshoe" furnaces. Blake's and Brunton's furnaces are reverberatory furnaces with a movable bed. Furnaces with rotating working chambers admit of continuous working; the fuel and labour costs are both low.

In the White-Howell revolving furnace with lifters—a modification of the Oxland—the ore is fed and discharged in a continuous stream. The Brückner cylinder resembles the Elliot and Russell black ash furnace; its cylinder tapers slightly towards each end, and is generally 18 ft. long by 8 ft. 6 in. in its greatest diameter. Its charge of from 8 to 12 tons of ore or concentrates is slowly agitated at a rate of three revolutions a minute, and in from 24 to 36 hours it is reduced from say 40 or 35% to 7% of sulphur. The ore is under better control than is possible with the continuous feed and discharge, and when sufficiently roasted can be passed red-hot to the reverberatory furnace. These advantages compensate for the wear and tear and the cost of moving the heavy dead-weight.

Shaft calcining furnaces are available for fine ores and permit the recovery of the sulphur.

They are square, oblong or circular in section, and the interior is fitted with horizontal or inclined plates or prisms, which regulate the fall of the ore. In the Gerstenhoffer and Hasenclever-Helbig furnaces the fall is retarded by prisms and inclined plates. In other furnaces the ore rests on a series of horizontal plates, and either remains on the same plate throughout the operation (Ollivier and Perret furnace), or is passed from plate to plate by hand (Malétra), or by mechanical means (Spence and M'Dougall).

The M'Dougall furnace is turret-shaped, and consists of a series of circular hearths, on which the ore is agitated by rakes attached to revolving arms and made to fall from hearth to hearth. It has been modified by Herreshoff, who uses a large hollow revolving central shaft cooled by a current of air. The shaft is provided with sockets, into which movable arms with their rakes are readily dropped. The Peter Spence type of calcining furnace has been followed in a large number of inventions. In some the rakes are attached to rigid frames, with a reciprocating motion, in others to cross-bars moved by revolving chains. Some of these furnaces are straight, others circular. Some have only one hearth, others three. This and the previous type of furnace, owing to their large capacity, are at present in greatest favour. The M'Dougall-Herreshoff, working on ores of over 30% of sulphur, requires no fuel; but in furnaces of the reverberatory type fuel must be used, as an excess of air enters through the slotted sides and the hinged doors which open and shut frequently to permit of the passage of the rakes. The consumption of fuel, however, does not exceed 1 of coal to 10 of ore. The quantity of ore which these large furnaces, with a hearth area as great as 2000 ft. and over, will roast varies from 40 to 60 tons a day. Shaft calcining furnaces like the Gerstenhoffer, Hasenclever, and others designed for burning pyrites fines have not found favour in modern copper works.

*The Fusion of Ores in Reverberatory and Cupola Furnaces.*—After the ore has been partially calcined, it is smelted to extract its earthy matter and to concentrate the copper with part of its iron and sulphur into a matte. In reverberatory furnaces it is smelted by fuel in a fireplace, separate from the ore, and in cupolas the fuel, generally coke, is in direct contact with the ore. When Swansea was the centre of the copper-smelting industry in Europe, many varieties of ores from different mines were smelted in the same furnaces, and the Welsh reverberatory furnaces were used. To-day more than eight-tenths of the copper ores of the world are reduced to impure copper bars or to fine copper at the mines; and where the character of the ore permits, the cupola furnace is found more economical in both fuel and labour than the reverberatory.

The Welsh method finds adherents only in Wales and Chile. In America the usual method is to roast ores or concentrates so that the matte yielded by either the reverberatory or cupola furnace will run from 45 to 50% in copper, and then to transfer to the Bessemer converter, which blows it up to 99%. In Butte, Montana, reverberatories have in the past been preferred to cupola furnaces, as the charge has consisted mainly of fine roasted concentrates; but the cupola is gaining ground there. At the Boston and Great Falls (Montana) works tilting reverberatories, modelled after open hearth steel furnaces, were first erected; but they were found to possess objectionable features. Now both these and the egg-shaped reverberatories are being abandoned for furnaces as long as 43 ft. 6 in. from bridge to bridge and of a width of 15 ft. 9 in. heated by gas, with regenerative checker work at each end, and fed with ore or concentrates, red-hot from the calciners, through a line of hoppers suspended above the roof. Furnaces of this size smelt 200 tons of charge a day. But even when the old type of reverberatory is preferred, as at the Argo works, at Denver, where rich gold- and silver-bearing copper matte is made, the growth of the furnace in size has been steady. Richard Pearce's reverberatories in 1878 had an area of hearth of 15 ft. by 9 ft. 8 in., and smelted 12 tons of cold charge daily, with a consumption of 1 ton of coal to 2.4 tons of ore. In 1900 the furnaces were 35 ft. by 16 ft., and smelted 50 tons daily of hot ore, with the consumption of 1 ton of coal to 3.7 tons of ore.

The home of cupola smelting was Germany, where it has never ceased to make steady progress. In Mansfeld brick cupola furnaces are without a rival in size, equipment and performance. They are round stacks, designed on the model of iron blast furnaces, 29 ft. high, fed mechanically, and provided with stoves to heat the blast by the furnace gases. The low percentage of sulphur in the roasted ore is little more than enough to produce a matte of 40 to 45%, and therefore the escaping gases are better fitted than those of most copper cupola furnaces for burning in a stove. But as the slag carries on an average 46% of silica, it is only through the utmost skill that it can be made to run as low on an average as 0.3% in copper oxide. As the matte contains on an average 0.2% of silver, it is still treated by the Ziervogel wet method of extraction, the management dreading the loss which might occur in the Bessemer process of concentration, applied as preliminary to electrolytic separation.

Blast furnaces of large size, built of brick, have been constructed for treating the richest and more silicious ores of Rio Tinto, and the Rio Tinto Company has introduced converters at the mine. This method of extraction contrasts favourably in time with the leaching process, which is so slow that over 10,000,000 tons of ore are always under treatment on the immense leaching floors of the company's works in Spain. In the United States the cupola has undergone a radical modification in being built of water-jacketed sections. The first water-jacketed cupola which came into general use was a circular inverted cone, with a slight taper, of 36 inches diameter at the tuyeres, and composed of an outer and an inner metal shell, between which water circulated. As greater size has been demanded, oval and rectangular furnaces—as large as 180 in. by 56 in. at the tuyeres—have been built in sections of cast or sheet iron or steel. A single section can be removed and replaced without entirely emptying the stack, as a shell of congealed slag always coats the inner surface of the jacket. The largest furnaces are those of the Boston & Montana Company at Great Falls, Montana, which have put through 500 tons of charge daily, pouring their melted slag and matte into large wells of 10 ft. in diameter. A combined brick- and water-cooled furnace has been adopted by the Iron Mountain Company at Keswick, Cal., for matte concentration. In it the cooling is effected by water pipes, interposed horizontally between the layers of bricks. The Mt. Lyell smelting works in Tasmania, which are of special interest, will be referred to later. (See *Pyritic Smelting* below.)

*Concentrating Matte to Copper in the Bessemer Converter.*—As soon as the pneumatic method of decarburizing pig iron was accepted as practicable, experiments were made with a view to Bessemerizing copper ores and mattes. One of the earliest and most exhaustive series of experiments was made on Rio Tinto ores at the John Brown works by John Hollway, with the aim of both smelting the ore and concentrating the matte in the same furnace, by the heat evolved through the oxidation of their sulphur and iron. Experiments along the same lines were made by Francis Bawden at Rio Tinto and Claude Vautin in Australia. The difficulty of effecting this double object in one operation was so great that in subsequent experiments the aim was merely to concentrate the matte to metallic copper in converters of the Bessemer type. The concentration was effected without any embarrassment till metallic copper commenced to separate and chill in the bottom tuyeres. To meet this obstacle P. Manhès proposed elevated side tuyeres, which could be kept clear by punching through gates in a wind box. His invention was adopted by the Vivians, at the Eguilles works near Sargues, Vaucluse, France, and at Leghorn in Italy. But the greatest expansion of this method has been in the United States, where more than 400,000,000 lb of copper are annually made in Bessemer converters. Vessels of several designs are used—some modelled exactly after steel converters, others barrel-shaped, but all with side tuyeres elevated about 10 in. above the level of the bottom lining. Practice, however, in treating copper matte differs essentially from the treatment of pig iron, inasmuch as from 20 to 30% of iron must be eliminated as slag and an equivalent quantity of silica must be supplied. The only practical mode of doing this, as yet devised, is by lining the converter with a silicious mixture. This is so rapidly consumed that the converters must be cooled and partially relined after 3 to 6 charges, dependent on the iron contents of the matte. When available, a silicious rock containing copper or the precious metals is of course preferred to barren lining. The material for lining, and the frequent replacement thereof, constitute the principal expense of the method. The other items of cost are *labour*, the quantity of which depends on the mechanical appliances provided for handling the converter shells and inserting the lining; and the *blast*, which in barrel-shaped converters is low and in vertical converters is high, and which varies therefore from 3 to 15 lb to the square inch. The quantity of air consumed in a converter which will blow up about 35 tons of matte per day is about 3000 cub. ft. per minute. The operation of raising a charge of 50% matte to copper usually consists of two blows. The first blow occupies about 25 minutes, and oxidizes all but a small quantity of the iron and some of the sulphur, raising the product to white metal. The slag is then poured and skimmed, the blast turned on and converter retilted. During the second blow the sulphur is rapidly oxidized, and the charge reduced to metal of 99% in from 30 to 40 minutes. Little or no slag results from the second blow. That from the first blow contains between 1% and 2% of copper, and is usually poured from ladles operated by an electric crane into a reverberatory, or into the settling well of the cupola. The matte also, in all economically planned works, is conveyed, still molten, by electric cranes from the furnace to the converters. When lead or zinc is not present in notable quantity, the loss of the precious metals by volatilization is slight, but more than 5% of these metals in the matte is prohibitive. Under favourable conditions in the larger works of the United States the cost of converting a 50% matte to metallic copper is generally understood to be only about  $\frac{5}{10}$  to  $\frac{6}{10}$  of a cent per lb. of refined copper.

*Pyritic Smelting.*—The heat generated by the oxidation of iron and sulphur has always been used to maintain combustion in the kilns or stalls for roasting pyrites. Pyritic smelting is a development of the Russian engineer Semenikov's treatment (proposed in 1866) of copper matte in a Bessemer converter. Since John Holloway's and other early experiments of Lawrence Austin and Robert Sticht, no serious attempts have been made to utilize the heat escaping from a converting vessel in smelting ore and matte either in the same apparatus or in a separate furnace. But considerable progress has been made in smelting highly sulphuretted ores by the heat of their own oxidizable constituents. At Tilt Cove, Newfoundland, the Cape Copper Company smelted copper ore, with just the proper proportion of sulphur, iron and silica, successfully without any fuel, when once the initial charge had been fused with coke. The furnaces used were of ordinary design and built of brick. Lump ore alone was fed, and the resulting matte showed a concentration of only 3 into 1. When, however, a hot blast is used on highly sulphuretted copper ores, a concentration of 8 of ore into 1 of matte is obtained, with a consumption of less than one-third the fuel which would be consumed in smelting the charge had the ore been previously calcined. A great impetus to pyritic smelting was given by the investigations of W. L. Austin, of Denver, Colorado, and both at Leadville and Silverton raw ores are successfully smelted with as low a fuel consumption as 3 of coke to 100 of charge.

Two types of pyritic smelting may be distinguished: one, in which the operation is solely sustained by the combustion of the sulphur in the ores, without the assistance of fuel or a hot blast; the other in which the operation is accelerated by fuel, or a hot blast, or both. The largest establishment in which advantage is taken of the self-contained fuel is at the smelting works of the Mt. Lyell Company, Tasmania. There the blast is raised from 600° to 700° F. in stoves heated by extraneous fuel, and the raw ore smelted with only 3% of coke. The ore is a compact iron pyrites containing copper 2.5%, silver 3.83 oz., gold 0.139 oz. It is smelted raw with hot blast in cupola furnaces, the largest being 210 in. by 40 in. The resulting matte runs 25%. This is reconcentrated raw in hot-blast cupolas to 55%, and blown directly into copper in converters. Thus these ores, as heavily charged with sulphur as those of the Rio Tinto, are speedily reduced by three operations and without roasting, with a saving of 97.6% of the copper, 93.2% of the silver and 93.6% of the gold.

Pyritic smelting has met with a varying economic success. According to Herbert Lang, its most prominent chance of success is in localities where fuel is dear, and the ores contain precious metals and sufficient sulphides and arsenides to render profitable dressing unnecessary.

*The Nicholls and James Process.*—Nicholls and James have applied, very ingeniously, well-known reactions to the refining of copper, raised to the grade of white metal. This process is practised by the Cape Copper and Elliot Metal Company. A portion of the white metal is calcined to such a degree of oxidation that when fused with the unroasted portion, the reaction between the oxygen in the roasted matte and the sulphur in the raw material liberates the metallic copper. The metal is so pure that it can be refined by a continuous operation in the same furnace.

*Wet Methods for Copper Extraction.*—Wet methods are only employed for low grade ores (under favourable circumstances ore containing from  $\frac{1}{4}$  to 1% of copper has admitted of economic treatment), and for gold and silver bearing metallurgical products.

The fundamental principle consists in getting the ore into a solution, from which the metal can be precipitated. The ores of any economic importance contain the copper either as oxide, carbonate, sulphate or sulphide. These compounds are got into solution either as chlorides or sulphates, and from either of these salts the metal can be readily obtained. Ores in which the copper is present as oxide or carbonate are soluble in sulphuric or hydrochloric acids, ferrous chloride, ferric sulphate, ammoniacal compounds and sodium thiosulphate. Of these solvents, only the first three are of economic importance. The choice of sulphuric or hydrochloric acid depends mainly upon the cost, both acting with about the same rapidity; thus if a Leblanc soda factory is near at hand, then hydrochloric acid would most certainly be employed. Ferrous chloride is not much used; the Douglas-Hunt process uses a mixture of salt and ferrous sulphate which involves the formation of ferrous chloride, and the new Douglas-Hunt process employs sulphuric acid in which ferrous chloride is added after leaching.

Sulphuric acid may be applied as such on the ores placed in lead, brick, or stone chambers; or as a mixture of sulphur dioxide, nitrous fumes (generated from Chile saltpetre and sulphuric acid), and steam, which permeates the ore resting on the false bottom of a brick chamber. When most of the copper has been converted into the sulphate, the ore is

lixiviated. Hydrochloric acid is applied in the same way as sulphuric acid; it has certain advantages of which the most important is that it does not admit the formation of basic salts; its chief disadvantage is that it dissolves the oxides of iron, and accordingly must not be used for highly ferriferous ores. The solubility of copper carbonate in ferrous chloride solution was pointed out by Max Schaffner in 1862, and the subsequent recognition of the solubility of the oxide in the same solvent by James Douglas and Sterry Hunt resulted in the "Douglas-Hunt" process for the wet extraction of copper. Ferrous chloride decomposes the copper oxide and carbonate with the formation of cuprous and cupric chlorides (which remain in solution), and the precipitation of ferrous oxide, carbon dioxide being simultaneously liberated from the carbonate. In the original form of the Douglas-Hunt process, ferrous chloride was formed by the interaction of sodium chloride (common salt) with ferrous sulphate (green vitriol), the sodium sulphate formed at the same time being removed by crystallization. The ground ore was stirred with this solution at 70° C. in wooden tubs until all the copper was dissolved. The liquor was then filtered from the iron oxides, and the filtrate treated with scrap iron, which precipitated the copper and reformed ferrous chloride, which could be used in the first stage of the process. The advantage of this method rests chiefly on the small amount of iron required; but its disadvantages are that any silver present in the ores goes into solution, the formation of basic salts, and the difficulty of filtering from the iron oxides. A modification of the method was designed to remedy these defects. The ore is first treated with dilute sulphuric acid, and then ferrous or calcium chloride added, thus forming copper chlorides. If calcium chloride be used the precipitated calcium sulphate must be removed by filtration. Sulphur dioxide is then blown in, and the precipitate is treated with iron, which produces metallic copper, or milk of lime, which produces cuprous oxide. Hot air is blown into the filtrate, which contains ferrous or calcium chlorides, to expel the excess of sulphur dioxide, and the liquid can then be used again. In this process ("new Douglas-Hunt") there are no iron oxides formed, the silver is not dissolved, and the quantity of iron necessary is relatively small, since all the copper is in the cuprous condition. It is not used in the treatment of ores, but finds application in the case of calcined argentiferous lead and copper mattes.

The precipitation of the copper from the solution, in which it is present as sulphate, or as cuprous and cupric chlorides, is generally effected by metallic iron. Either wrought, pig, iron sponge or iron bars are employed, and it is important to notice that the form in which the copper is precipitated, and also the time taken for the separation, largely depend upon the condition in which the iron is applied. Spongy iron acts most rapidly, and after this follow iron turnings and then sheet clippings. Other precipitants such as sulphuretted hydrogen and solutions of sulphides, which precipitate the copper as sulphides, and milk of lime, which gives copper oxides, have not met with commercial success. When using iron as the precipitant, it is desirable that the solution should be as neutral as possible, and the quantity of ferric salts present should be reduced to a minimum; otherwise, a certain amount of iron would be used up by the free acid and in reducing the ferric salts. Ores in which the copper is present as sulphate are directly lixiviated and treated with iron. Mine waters generally contain the copper in this form, and it is extracted by conducting the waters along troughs fitted with iron gratings.

The wet extraction of metallic copper from ores in which it occurs as the sulphide, may be considered to involve the following operations: (1) conversion of the copper into a soluble form, (2) dissolving out the soluble copper salt, (3) the precipitation of the copper. Copper sulphide may be converted either into the sulphate, which is soluble in water; the oxide, soluble in sulphuric or hydrochloric acid; cupric chloride, soluble in water; or cuprous chloride, which is soluble in solutions of metallic chlorides.

The conversion into sulphate is generally effected by the oxidizing processes of weathering, calcination, heating with iron nitrate or ferric sulphate. It may also be accomplished by calcination with ferrous sulphate, or other easily decomposable sulphates, such as aluminium sulphate. Weathering is a very slow, and, therefore, an expensive process; moreover, the entire conversion is only accomplished after a number of years. Calcination is only advisable for ores which contain relatively much iron pyrites and little copper pyrites. Also, however slowly the calcination may be conducted, there is always more or less copper sulphide left unchanged, and some copper oxide formed. Calcination with ferrous sulphate converts all the copper sulphide into sulphate. Heap roasting has been successfully employed at Agordo, in the Venetian Alps, and at Majdanpek in Servia. Josef Perino's process, which consists in heating the ore with iron nitrate to 50°-150° C., is said to possess several advantages, but it has not been applied commercially. Ferric sulphate is only used as an auxiliary to the weathering process and in an electrolytic process.



The conversion of the sulphide into oxide is adopted where the Douglas-Hunt process is employed, or where hydrochloric or sulphuric acids are cheap. The calcination is effected in reverberatory furnaces, or in muffle furnaces, if the sulphur is to be recovered. Heap, stall or shaft furnace roasting is not very satisfactory, as it is very difficult to transform all the sulphide into oxide.

The conversion of copper sulphide into the chlorides may be accomplished by calcining with common salt, or by treating the ores with ferrous chloride and hydrochloric acid or with ferric chloride. The dry way is best; the wet way is only employed when fuel is very dear, or when it is absolutely necessary that no noxious vapours should escape into the atmosphere. The dry method consists in an oxidizing roasting of the ores, and a subsequent chloridizing roasting with either common salt or *Abraumsalz* in reverberatory or muffle furnaces. The bulk of the copper is thus transformed into cupric chloride, little cuprous chloride being obtained. This method had been long proposed by William Longmaid, Max Schaffner, Becchi and Haupt, but was only introduced into England by the labours of William Henderson, J. A. Phillips and others. The wet method is employed at Rio Tinto, the particular variant being known as the "Dötsch" process. This consists in stacking the broken ore in heaps and adding a mixture of sodium sulphate and ferric chloride in the proportions necessary for the entire conversion of the iron into ferric sulphate. The heaps are moistened with ferric chloride solution, and the reaction is maintained by the liquid percolating through the heap. The liquid is run off at the base of the heaps into the precipitating tanks, where the copper is thrown down by means of metallic iron. The ferrous chloride formed at the same time is converted into ferric chloride which can be used to moisten the heaps. This conversion is effected by allowing the ferrous chloride liquors slowly to descend a tower, filled with pieces of wood, coke or quartz, where it meets an ascending current of chlorine.

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The sulphate, oxide or chlorides, which are obtained from the sulphuretted ores, are lixiviated and the metal precipitated in the same manner as we have previously described.

The metal so obtained is known as "cement" copper. If it contains more than 55% of copper it is directly refined, while if it contains a lower percentage it is smelted with matte or calcined copper pyrites. The chief impurities are basic salts of iron, free iron, graphite, and sometimes silica, antimony and iron arsenates. Washing removes some of these impurities, but some copper always passes into the slimes. If much carbonaceous matter be present (and this is generally so when iron sponge is used as the precipitant) the crude product is heated to redness in the air; this burns out the carbon, and, at the same time, oxidizes a little of the copper, which must be subsequently reduced. A similar operation is conducted when arsenic is present; basic-lined reverberatory furnaces have been used for the same purpose.

*Electrolytic Refining.*—The principles have long been known on which is based the electrolytic separation of copper from the certain elements which generally accompany it, whether these, like silver and gold, are valuable, or, like arsenic, antimony, bismuth, selenium and tellurium, are merely impurities. But it was not until the dynamo was improved as a machine for generating large quantities of electricity at a very low cost that the electrolysis of copper could be practised on a commercial scale. To-day, by reason of other uses to which electricity is applied, electrically deposited copper of high conductivity is in ever-increasing demand, and commands a higher price than copper refined by fusion. This increase in value permits of copper with not over £2 or \$10 worth of the precious metals being profitably subjected to electrolytic treatment. Thus many million ounces of silver and a great deal of gold are recovered which formerly were lost.

The earliest serious attempt to refine copper industrially was made by G. R. Elkington, whose first patent is dated 1865. He cast crude copper, as obtained from the ore, into plates which were used as anodes, sheets of electro-deposited copper forming the cathodes. Six anodes were suspended, alternately with four cathodes, in a saturated solution of copper sulphate in a cylindrical fire-clay trough, all the anodes being connected in one parallel group, and all the cathodes in another. A hundred or more jars were coupled in series, the cathodes of one to the anodes of the next, and were so arranged that with the aid of side-pipes with leaden connexions and india-rubber joints the electrolyte could, once daily, be made to circulate through them all from the top of one jar to the bottom of the next. The current from a Wilde's dynamo was passed, apparently with a current density of 5 or 6 amperes per sq. ft., until the anodes were too crippled for further use. The cathodes, when thick enough, were either cast and rolled or sent into the market direct. Silver and other insoluble impurities collected at the bottom of the trough up to the level of the lower side-tube, and were then run off through a plug in the bottom into settling tanks, from which they were removed for metallurgical treatment. The electrolyte was used until the accumulation

of iron in it was too great, but was mixed from time to time with a little water acidulated by sulphuric acid. This process is of historic interest, and in principle it is identical with that now used. The modifications introduced have been chiefly in details, in order to economize materials and labour, to ensure purity of product, and to increase the rate of deposition.

The chemistry of the process has been studied by Martin Kiliani (*Berg- und Hüttenmännische Zeitung*, 1885, p. 249), who found that, using the (low) current-density of 1.8 ampere per sq. ft. of cathode, and an electrolyte containing 1½ lb of copper sulphate and ½ lb of sulphuric acid per gallon, all the gold, platinum and silver present in the crude copper anode remain as metals, undissolved, in the anode slime or mud, and all the lead remains there as sulphate, formed by the action of the sulphuric acid (or SO<sub>4</sub> ions); he found also that arsenic forms arsenious oxide, which dissolves until the solution is saturated, and then remains in the slime, from which on long standing it gradually dissolves, after conversion by secondary reactions into arsenic oxide; antimony forms a basic sulphate which in part dissolves; bismuth partly dissolves and partly remains, but the dissolved portion tends slowly to separate out as a basic salt which becomes added to the slime; cuprous oxide, sulphide and selenides remain in the slime, and very slowly pass into solution by simple chemical action; tin partly dissolves (but in part separates again as basic salt) and partly remains as basic sulphate and stannic oxide; zinc, iron, nickel and cobalt pass into solution—more readily indeed than does the copper. Of the metals which dissolve, none (except bismuth, which is rarely present in any quantity) deposits at the anode so long as the solution retains its proper proportion of copper and acid, and the current-density is not too great. Neutral solutions are to be avoided because in them silver dissolves from the anode and, being more electro-negative than copper, is deposited at the cathode, while antimony and arsenic are also deposited, imparting a dark colour to the copper. Electrolytic copper should contain at least 99.92% of metallic copper, the balance consisting mainly of oxygen with not more than 0.01% in all of lead, arsenic, antimony, bismuth and silver. Such a degree of purity is, however, unattainable unless the conditions of electrolysis are rigidly adhered to. It should be observed that the free acid is gradually neutralized, partly by chemical action on certain constituents of the slime, partly by local action between different metals of the anode, both of which effect solution independently of the current, and partly by the peroxidation (or aëration) of ferrous sulphate formed from the iron in the anode. At the same time there is a gradual substitution of other metals for copper in the solution, because although copper *plus* other (more electro-positive) metals are constantly dissolving at the anode, only copper is deposited at the cathode. Hence the composition and acidity of the solution, on which so much depends, must be constantly watched.

The dependence of the mechanical qualities of the copper upon the current-density employed is well known. A very weak current gives a pale and brittle deposit, but as the current-density is increased up to a certain point, the properties of the metal improve; beyond this point they deteriorate, the colour becoming darker and the deposit less coherent, until at last it is dark brown and spongy or pulverulent. The presence of even a small proportion of hydrochloric acid imparts a brown tint to the deposit. Baron H. v. Hübl (*Mittheil. des k. k. militär-geograph. Inst.*, 1886, vol. vi. p. 51) has found that with neutral solutions a 5% solution of copper sulphate gave no good result, while with a 20% solution the best deposit was obtained with a current-density of 28 amperes per sq. ft.; with solutions containing 2% of sulphuric acid, the 5% solution gave good deposits with current-densities of 4 to 7.5 amperes, and the 20% solution with 11.5 to 37 amperes, per sq. ft. The maximum current-densities for a *pure* acid solution at rest were: for 15% pure copper sulphate solutions 14 to 21 amperes, and for 20% solutions 18.5 to 28 amperes, per sq. ft.; but when the solutions were kept in gentle motion these maxima could be increased to 21-28 and 28-37 amperes per sq. ft. respectively. The necessity for adjusting the current-density to the composition and treatment of the electrolyte is thus apparent. The advantage of keeping the solution in motion is due partly to the renewal of solution thus effected in the neighbourhood of the electrodes, and partly to the neutralization of the tendency of liquids undergoing electrolysis to separate into layers, due to the different specific gravities of the solutions flowing from the opposing electrodes. Such an irregular distribution of the bath, with strong copper sulphate solution from the anode at the bottom and acid solution from the cathode at the top, not only alters the conductivity in different strata and so causes irregular current-distribution, but may lead to the current-density in the upper layers being too great for the proportion of copper there present. Irregular and defective deposits are therefore obtained. Provision for circulation of solution is made in the systems of copper-refining now in use. Henry Wilde, in 1875, in depositing copper on iron printing-rollers, recognized this principle and rotated the rollers during electrolysis, thereby renewing the surfaces of metal and liquid in mutual contact, and imparting sufficient motion to the solution to prevent stratification; as an alternative he imparted motion to the electrolyte by means of propeller blades. Other workers have followed more or less on the same lines; reference may be made to the patents of F. E. and A. S. Elmore, who sought to improve the character of the deposit by burnishing

during electrolysis, of E. Dumoulin, and Sherard Cowper-Coles (*Engineering Review*, 1905, vol. xiii. p. 392), who prefers to rotate the cathode at a speed that maintains a peripheral velocity of at least 1000 ft. per minute. Certain other inventors have applied the same principle in a different way. H. Thofehrn in America and J. C. Graham in England have patented processes by which jets of the electrolyte are caused to impinge with considerable force upon the surface of the cathode, so that the renewal of the liquid at this point takes place very rapidly, and current-densities per sq. ft. of 50 to 100 amperes are recommended by the former, and of 300 amperes by the latter. Graham has described experiments in this direction, using a jet of electrolyte forced (beneath the surface of the bath) through a hole in the anode upon the surface of the cathode. Whilst the jet was playing, a good deposit was formed with so high a current-density as 280 amperes per sq. ft., but if the jet was checked, the deposit (now in a still liquid) was instantaneously ruined. When two or more jets were used side by side the deposit was good opposite the centre of each, but bad at the point where two currents met, because the rate of flow was reduced. By introducing perforated shields of ebonite between the electrodes, so that the full current-density was only attained at the centres of the jets, these ill effects could be prevented. One of the chief troubles met with was the formation of arborescent growths around the edges of the cathode, due to the greater current-density in this region; this, however, was also obviated by the use of screens. By means of a very brisk rotation of cathode, combined with a rapid current of electrolyte, J. W. Swan has succeeded in depositing excellent copper at current-densities exceeding 1000 amperes per sq. ft. The methods by which such results are to be obtained cannot, however, as yet be practised economically on a working scale; one great difficulty in applying them to the refining of metals is that the jets of liquid would be liable to carry with them articles of anode mud, and Swan has shown that the presence of solid particles in the electrolyte is one of the most fruitful causes of the well-known nodular growths on electro-deposited copper. Experiments on a working scale with one of the jet processes in America have, it is reported, been given up after a full trial.

In copper-refining practice, the current-density commonly ranges from 7.5 to 12 or 15, and occasionally to 18, amperes per sq. ft. The electrical pressure required to force a current of this intensity through the solution, and to overcome a certain opposing electromotive force arising from the more electro-negative impurities of the anode, depends upon the composition of the bath and of the anodes, the distance between the electrodes, and the temperature, but under the usual working conditions averages 0.3 volt for every pair of electrodes in series. In nearly all the processes now used, the solution contains about  $1\frac{1}{2}$  to 2 lb of copper sulphate and from 5 to 10 oz. of sulphuric acid per gallon of water, and the space between the electrodes is from  $1\frac{1}{2}$  to 2 in., whilst the total area of cathode surface in each tank may be 200 sq. ft., more or less. The anodes are usually cast copper plates about (say) 3 ft. by 2 ft. by  $\frac{3}{4}$  or 1 in. The cathodes are frequently of electro-deposited copper, deposited to a thickness of about  $\frac{1}{32}$  in. on black-leaded copper plates, from which they are stripped before use. The tanks are commonly constructed of wood lined with lead, or tarred inside, and are placed in terrace fashion each a little higher than the next in series, to facilitate the flow of solution through them all from a cistern at one end to a well at the other. Gangways are left between adjoining rows of tanks, and an overhead travelling-crane facilitates the removal of the electrodes. The arrangement of the tanks depends largely upon the voltage available from the electric generator selected; commonly they are divided into groups, all the baths in each group being in series. In the huge Anaconda plant, for example, in which 150 tons of refined copper can be produced daily by the Thofehrn multiple system (not the jet system alluded to above), there are 600 tanks about  $8\frac{1}{4}$  ft. by  $4\frac{1}{2}$  ft. by  $3\frac{1}{4}$  ft. deep, arranged in three groups of 200 tanks in series. The connexions are made by copper rods, each of which, in length, is twice the width of the tank, with a bayonet-bend in the middle, and serves to support the cathodes in the one and the anodes in the next tank. Self-registering voltmeters indicate at any moment the potential difference in every tank, and therefore give notice of short circuits occurring at any part of the installation. The chief differences between the commercial systems of refining lie in the arrangement of the baths, in the disposition and manner of supporting the electrodes in each, in the method of circulating the solution, and in the current-density employed. The various systems are often classed in two groups, known respectively as the *Multiple* and *Series* systems, depending upon the arrangement of the electrodes in each tank. Under the multiple system anodes and cathodes are placed alternately, all the anodes in one tank being connected to one rod, and all the cathodes to another, and the potential difference between the terminals of each tank is that between a single pair of plates. Under the series system only the first anode and the last cathode are connected to the conductors; between these are suspended, isolated from one another, a number of intermediate bi-polar electrode plates of raw copper, each of these plates acting on one side as a cathode, receiving a deposit of copper, and on the other as an anode, passing into solution; the voltage between the terminals of the tank will be as many times as great as that between a single pair of plates as there are spaces between electrodes in the tank. In time the original impure copper of the plates becomes replaced by refined

copper, but if the plates are initially very impure and dissolve irregularly, it may happen that much residual scrap may have to be remelted, or that some of the metal may be twice refined, thus involving a waste of energy. Moreover, the high potential difference between the terminals of the series tank introduces a greater danger of short-circuiting through scraps of metal at the bottom of the bath; for this reason, also, lead-lined vats are inadmissible, and tarred slate tanks are often used instead. A valuable comparison of the multiple and series systems has been published by E. Keller (see *The Mineral Industry*, New York, 1899, vol. vii. p. 229). G. Kroupa has calculated that the cost of refining is 8s. per ton of copper higher under the series than it is under the multiple system; but against this, it must be remembered that the new works of the Baltimore Copper Smelting and Rolling Company, which are as large as those of the Anaconda Copper Mining Company, are using the Hayden process, which is the chief representative of the several series systems. In this system rolled copper anodes are used; these, being purer than many cast anodes, having flat surfaces, and being held in place by guides, dissolve with great regularity and require a space of only  $\frac{5}{8}$  in. between the electrodes, so that the potential difference between each pair of plates may be reduced to 0.15-0.2 volt.

J. A. W. Borchers, in Germany, and A. E. Schneider and O. Szontagh, in America, have introduced a method of circulating the solution in each vat by forcing air into a vertical pipe communicating between the bottom and top of a tank, with the result that the bubbling of the air upward aspirates solution through the vertical pipe from below, at the same time aërating it, and causing it to overflow into the top of the tank. Obviously this slow circulation has but little effect on the rate at which the copper may be deposited. The electrolyte, when too impure for further use, is commonly recrystallized, or electrolysed with insoluble anodes to recover the copper.

The yield of copper per ampere (in round numbers, 1 oz. of copper per ampere per diem) by Faraday's law is never attained in practice; and although 98% may with care be obtained, from 94 to 96% represents the more usual current-efficiency. With 100% current-efficiency and a potential difference of 0.3 volt between the electrodes, 1 lb of copper should require about 0.154 electrical horse-power hours as the amount of energy to be expended in the tank for its production. In practice the expenditure is somewhat greater than this; in large works the gross horse-power required for the refining itself and for power and lighting in the factory may not exceed 0.19 to 0.2 (or in smaller works 0.25) horse-power hours per pound of copper refined.

Many attempts have been made to use crude sulphide of copper or matte as an anode, and recover the copper at the cathode, the sulphur and other insoluble constituents being left at the anode. The best known of these is the Marchese process, which was tested on a working scale at Genoa and Stolberg in Rhenish Prussia. As the operation proceeded, it was found that the voltage had to be raised until it became prohibitive, while the anodes rapidly became honeycombed through and, crumbling away, filled up the space at the bottom of the vat. The process was abandoned, but in a modified form appears to be now in use in Nijni-Novgorod in Russia. Siemens and Halske introduced a combined process in which the ore, after being part-roasted, is leached by solutions from a previous electrolytic operation, and the resulting copper solution electrolysed. In this process the anode solution had to be kept separate from the cathode solution, and the membrane which had in consequence to be used, was liable to become torn, and so to cause trouble by permitting the two solutions to mix. Modifications of the process have therefore been tried.

Modern methods in copper smelting and refining have effected enormous economy in time, space, and labour, and have consequently increased the world's output. With pyritic smelting a sulphuretted copper ore, fed into a cupola in the morning, can be passed directly to the converter, blown up to metal, and shipped as 99% bars by evening—an operation which formerly, with heap roasting of the ore and repeated roasting of the mattes in stalls, would have occupied not less than four months. A large furnace and a Bessemer converter, the pair capable of making a million pounds of copper a month from a low-grade sulphuretted ore, will not occupy a space of more than 25ft. by 100ft.; and whereas, in making metallic copper out of a low-grade sulphuretted ore, one day's labour used to be expended on every ton of ore treated, to-day one day's labour will carry at least four tons of ore through the different mechanical and metallurgical processes necessary to reduce them to metal. About 70% of the world's annual copper output is refined electrolytically, and from the 461,583 tons refined in the United States in 1907, there were recovered 13,995,436 oz. of silver and 272,150 oz. of gold. The recovery of these valuable metals has contributed in no small degree to the expansion of electrolytic refining.

*Production.*—The sources of copper, its applications and its metallurgy, have undergone great changes. Chile was the largest producer in 1869 with 54,867 tons; but in 1899 her production had fallen off to 25,000 tons. Great Britain, though she had made half the world's

copper in 1830, held second place in 1860, making from native ores 15,968 tons; in 1900 her production was 777 tons, and in 1907, 711 tons. The United States made only 572 tons in 1850, and 12,600 tons in 1870; but she to-day makes more than 60% of the world's total. In 1879, Spain was the largest producer, but now ranks third.

The estimated total production for each decade of the 19th century in metric tons is here shown:—

1801-1810	91,000
1811-1820	96,000
1821-1830	135,000
1831-1840	218,400
1841-1850	291,000
1851-1860	506,999
1861-1870	900,000
1871-1880	1,189,000
1881-1890	2,373,398
1891-1900	3,708,901

The following table gives the output of various countries and the world's production for the years 1895, 1900, 1905, 1907:—

Country.	1895.	1900.	1905.	1907.
United States	175,294	274,933	397,003	398,736
Spain and Portugal	55,755	53,718	45,527	50,470
Japan	18,725	28,285	36,485	49,718
Chile	22,428	26,016	29,632	27,112
Germany	16,799	20,635	22,492	20,818
Australasia	10,160	23,368	34,483	41,910
Mexico	12,806	22,473	70,010	61,127
Russia	5,364	8,128	8,839	15,240
World's production	339,994	496,819	699,514	723,807

As the stock on hand rarely exceeds three months' demand, and is often little more than a month's supply, it is evident that consumption has kept close pace with production.

The large demand for copper to be used in sheathing ships ceased on the introduction of iron in shipbuilding because of the difficulty of coating iron with an impervious layer of copper; but the consumption in the manufacture of electric apparatus and for electric conductors has far more than compensated.

*Alloys of Copper.*—Copper unites with almost all other metals, and a large number of its alloys are of importance in the arts. The principal alloys in which it forms a leading ingredient are brass, bronze, and German or nickel silver; under these several heads their respective applications and qualities will be found.

*Compounds of Copper.*—Copper probably forms six oxides, viz.  $\text{Cu}_4\text{O}$ ,  $\text{Cu}_3\text{O}$ ,  $\text{Cu}_2\text{O}$ ,  $\text{CuO}$ ,  $\text{Cu}_2\text{O}_3$  and  $\text{CuO}_2$ . The most important are cuprous oxide,  $\text{Cu}_2\text{O}$ , and cupric oxide,  $\text{CuO}$ , both of which give rise to well-defined series of salts. The other oxides do not possess this property, as is also the case of the hydrated oxides  $\text{Cu}_3\text{O}_2 \cdot 2\text{H}_2\text{O}$  and  $\text{Cu}_4\text{O}_3 \cdot 5\text{H}_2\text{O}$ , described by M. Siewert.

#### ***Oxides and hydroxides.***

Cuprous oxide,  $\text{Cu}_2\text{O}$ , occurs in nature as the mineral cuprite (*q.v.*). It may be prepared artificially by heating copper wire to a white heat, and afterwards at a red heat, by the atmospheric oxidation of copper reduced in hydrogen, or by the slow oxidation of the metal under water. It is obtained as a fine red crystalline precipitate by reducing an alkaline copper solution with sugar. When finely divided it is of a fine red colour. It fuses at red heat, and colours glass a ruby-red. The property was known to the ancients and during the middle ages; it was then lost for several centuries, to be rediscovered in about 1827. Cuprous oxide is reduced by hydrogen, carbon monoxide, charcoal, or iron, to the metal; it dissolves in hydrochloric acid forming cuprous chloride, and in other mineral acids to form cupric salts, with the separation of copper. It dissolves in ammonia, forming a colourless solution which rapidly oxidizes and turns blue. A hydrated cuprous oxide,  $(4\text{Cu}_2\text{O}, \text{H}_2\text{O})$ , is obtained as a bright yellow powder, when cuprous chloride is treated with potash or soda. It rapidly absorbs oxygen, assuming a blue colour. Cuprous oxide corresponds to the series of cuprous salts, which are mostly white in colour, insoluble in water, and readily oxidized to cupric salts.

Cupric oxide,  $\text{CuO}$ , occurs in nature as the mineral melaconite (*q.v.*), and can be obtained

as a hygroscopic black powder by the gentle ignition of copper nitrate, carbonate or hydroxide; also by heating the hydroxide. It oxidizes carbon compounds to carbon dioxide and water, and therefore finds extensive application in analytical organic chemistry. It is also employed to colour glass, to which it imparts a light green colour. Cupric hydroxide,  $\text{Cu}(\text{OH})_2$ , is obtained as a greenish-blue flocculent precipitate by mixing cold solutions of potash and a cupric salt. This precipitate always contains more or less potash, which cannot be entirely removed by washing. A purer product is obtained by adding ammonium chloride, filtering, and washing with hot water. Several hydrated oxides, *e.g.*  $\text{Cu}(\text{OH})_2 \cdot 3\text{CuO}$ ,  $\text{Cu}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$ ,  $6\text{CuO} \cdot \text{H}_2\text{O}$ , have been described. Both the oxide and hydroxide dissolve in ammonia to form a beautiful azure-blue solution (Schweizer's reagent), which dissolves cellulose, or perhaps, holds it in suspension as water does starch; accordingly, the solution rapidly perforates paper or calico. The salts derived from cupric oxide are generally white when anhydrous, but blue or green when hydrated.

Copper quadrantoxide,  $\text{Cu}_4\text{O}$ , is an olive-green powder formed by mixing well-cooled solutions of copper sulphate and alkaline stannous chloride. The trientoxide,  $\text{Cu}_3\text{O}$ , is obtained when cupric oxide is heated to  $1500^\circ\text{--}2000^\circ\text{C}$ . It forms yellowish-red crystals, which scratch glass, and are unaffected by all acids except hydrofluoric; it also dissolves in molten potash. Copper dioxide,  $\text{CuO}_2 \cdot \text{H}_2\text{O}$ , is obtained as a yellowish-brown powder, by treating cupric hydrate with hydrogen peroxide. When moist, it decomposes at about  $6^\circ\text{C}$ ., but the dry substance must be heated to about  $180^\circ$ , before decomposition sets in (see L. Moser, *Abst. J.C.S.*, 1907, ii. p. 549).

Cuprous hydride,  $(\text{CuH})_n$ , was first obtained by Wurtz in 1844, who treated a solution of copper sulphate with hypophosphorous acid, at a temperature not exceeding  $70^\circ\text{C}$ . According to E. J. Bartlett and W. H. Merrill, it decomposes when heated, and gives cupric hydride,  $\text{CuH}_2$ , as a reddish-brown spongy mass, which turns to a chocolate colour on exposure. It is a strong reducing agent.

Cuprous fluoride,  $\text{CuF}$ , is a ruby-red crystalline mass, formed by heating cuprous chloride in an atmosphere of hydrofluoric acid at  $1100^\circ\text{--}1200^\circ\text{C}$ . It is soluble in boiling hydrochloric acid, but it is not reprecipitated by water, as is the case with cuprous chloride. Cupric fluoride,  $\text{CuF}_2$ , is obtained by dissolving cupric oxide in hydrofluoric acid. The hydrated form,  $(\text{CuF}_2, 2\text{H}_2\text{O}, 5\text{HF})$ , is obtained as blue crystals, sparingly soluble in cold water; when heated to  $100^\circ\text{C}$ . it gives the compound  $\text{CuF}(\text{OH})$ , which, when heated with ammonium fluoride in a current of carbon dioxide, gives anhydrous copper fluoride as a white powder.

Cuprous chloride,  $\text{CuCl}$  or  $\text{Cu}_2\text{Cl}_2$ , was obtained by Robert Boyle by heating copper with mercuric chloride. It is also obtained by burning the metal in chlorine, by heating copper and cupric oxide with hydrochloric acid, or copper and cupric chloride with hydrochloric acid. It dissolves in the excess of acid, and is precipitated as a white crystalline powder on the addition of water. It melts at below red heat to a brown mass, and its vapour density at both red and white heat corresponds to the formula  $\text{Cu}_2\text{Cl}_2$ . It turns dirty violet on exposure to air and light; in moist air it absorbs oxygen and forms an oxychloride. Its solution in hydrochloric acid readily absorbs carbon monoxide and acetylene; hence it finds application in gas analysis. Its solution in ammonia is at first colourless, but rapidly turns blue, owing to oxidation. This solution absorbs acetylene with the precipitation of red cuprous acetylide,  $\text{Cu}_2\text{C}_2$ , a very explosive compound. Cupric chloride,  $\text{CuCl}_2$ , is obtained by burning copper in an excess of chlorine, or by heating the hydrated chloride, obtained by dissolving the metal or cupric oxide in an excess of hydrochloric acid. It is a brown deliquescent powder, which rapidly forms the green hydrated salt  $\text{CuCl}_2, 2\text{H}_2\text{O}$  on exposure. The oxychloride  $\text{Cu}_3\text{O}_2\text{Cl}_2 \cdot 4\text{H}_2\text{O}$  is obtained as a pale blue precipitate when potash is added to an excess of cupric chloride. The oxychloride  $\text{Cu}_4\text{O}_3\text{Cl}_2, 4\text{H}_2\text{O}$  occurs in nature as the mineral atacamite. It may be artificially prepared by heating salt with ammonium copper sulphate to  $100^\circ$ . Other naturally occurring oxychlorides are botallackite and tallingite. "Brunswick green," a light green pigment, is obtained from copper sulphate and bleaching powder.

The bromides closely resemble the chlorides and fluorides.

Cuprous iodide,  $\text{Cu}_2\text{I}_2$ , is obtained as a white powder, which suffers little alteration on exposure, by the direct union of its components or by mixing solutions of cuprous chloride in hydrochloric acid and potassium iodide; or, with liberation of iodine, by adding potassium iodide to a cupric salt. It absorbs ammonia, forming the compound  $\text{Cu}_2\text{I}_2, 4\text{NH}_3$ . Cupric iodide is only known in combination, as in  $\text{CuI}_2, 4\text{NH}_3, \text{H}_2\text{O}$ , which is obtained by exposing  $\text{Cu}_2\text{I}_2, 4\text{NH}_3$  to moist air.

Cuprous sulphide,  $\text{Cu}_2\text{S}$ , occurs in nature as the mineral chalcocite or copper-glance (*q.v.*), and may be obtained as a black brittle mass by the direct combination of its constituents. (See above, [METALLURGY](#).) Cupric sulphide,  $\text{CuS}$ , occurs in nature as the mineral covellite. It may be prepared by heating cuprous sulphide with sulphur, or triturating cuprous sulphide

with cold strong nitric acid, or as a dark brown precipitate by treating a copper solution with sulphuretted hydrogen. Several polysulphides, *e.g.*  $\text{Cu}_2\text{S}_5$ ,  $\text{Cu}_2\text{S}_6$ ,  $\text{Cu}_4\text{S}_6$ ,  $\text{Cu}_2\text{S}_3$ , have been described; they are all unstable, decomposing into cupric sulphide and sulphur. Cuprous sulphite,  $\text{CuSO}_3 \cdot \text{H}_2\text{O}$ , is obtained as a brownish-red crystalline powder by treating cuprous hydrate with sulphurous acid. A cuproso-cupric sulphite,  $\text{Cu}_2\text{SO}_3$ ,  $\text{CuSO}_3 \cdot 2\text{H}_2\text{O}$ , is obtained by mixing solutions of cupric sulphate and acid sodium sulphite.

Cupric sulphate or "Blue Vitriol,"  $\text{CuSO}_4$ , is one of the most important salts of copper. It occurs in cupriferous mine waters and as the minerals chalcantite or cyanosite,  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , and boothite,  $\text{CuSO}_4 \cdot 7\text{H}_2\text{O}$ . Cupric sulphate is obtained commercially by the oxidation of sulphuretted copper ores (see above, *Metallurgy; wet methods*), or by dissolving cupric oxide in sulphuric acid. It was obtained in 1644 by Van Helmont, who heated copper with sulphur and moistened the residue, and in 1648 by Glauber, who dissolved copper in strong sulphuric acid. (For the mechanism of this reaction see C. H. Sluiter, *Chem. Weekblad*, 1906, 3, p. 63, and C. M. van Deventer, *ibid.*, 1906, 3, p. 515.) It crystallizes with five molecules of water as large blue triclinic prisms. When heated to  $100^\circ$ , it loses four molecules of water and forms the bluish-white monohydrate, which, on further heating to  $250^\circ$ - $260^\circ$ , is converted into the white  $\text{CuSO}_4$ . The anhydrous salt is very hygroscopic, and hence finds application as a desiccating agent. It also absorbs gaseous hydrochloric acid. Copper sulphate is readily soluble in water, but insoluble in alcohol; it dissolves in hydrochloric acid with a considerable fall in temperature, cupric chloride being formed. The copper is readily replaced by iron, a knife-blade placed in an aqueous solution being covered immediately with a bright red deposit of copper. At one time this was regarded as a transmutation of iron into copper. Several basic salts are known, some of which occur as minerals; of these, we may mention brochantite (*q.v.*),  $\text{CuSO}_4 \cdot 3\text{Cu}(\text{OH})_2$ , langite,  $\text{CuSO}_4 \cdot 3\text{Cu}(\text{OH})_2 \cdot \text{H}_2\text{O}$ , lyellite (or devilline), warringtonite; woodwardite and enysite are hydrated copper-aluminium sulphates, connellite is a basic copper chlorosulphate, and spangolite is a basic copper aluminium chlorosulphate. Copper sulphate finds application in calico printing and in the preparation of the pigment Scheele's green.

A copper nitride,  $\text{Cu}_3\text{N}$ , is obtained by heating precipitated cuprous oxide in ammonia gas (A. Guntz and H. Bassett, *Bull. Soc. Chim.*, 1906, 35, p. 201). A maroon-coloured powder, of composition  $\text{CuNO}_2$ , is formed when pure dry nitrogen dioxide is passed over finely-divided copper at  $25^\circ$ - $30^\circ$ . It decomposes when heated to  $90^\circ$ ; with water it gives nitric oxide and cupric nitrate and nitrite. Cupric nitrate,  $\text{Cu}(\text{NO}_3)_2$ , is obtained by dissolving the metal or oxide in nitric acid. It forms dark blue prismatic crystals containing 3, 4, or 6 molecules of water according to the temperature of crystallization. The trihydrate melts at  $114.5^\circ$ , and boils at  $170^\circ$ , giving off nitric acid, and leaving the basic salt  $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{Cu}(\text{OH})_2$ . The mineral gerhardtite is the basic nitrate  $\text{Cu}_2(\text{OH})_3\text{NO}_3$ .

Copper combines directly with phosphorus to form several compounds. The phosphide obtained by heating cupric phosphate,  $\text{Cu}_2\text{H}_2\text{P}_2\text{O}_8$ , in hydrogen, when mixed with potassium and cuprous sulphides or levigated coke, constitutes "Abel's fuse," which is used as a primer. A phosphide,  $\text{Cu}_3\text{P}_2$ , is formed by passing phosphoretted hydrogen over heated cuprous chloride. (For other phosphides see E. Heyn and O. Bauer, *Rep. Chem. Soc.*, 1906, 3, p. 39.) Cupric phosphate,  $\text{Cu}_3(\text{PO}_4)_2$ , may be obtained by precipitating a copper solution with sodium phosphate. Basic copper phosphates are of frequent occurrence in the mineral kingdom. Of these we may notice libethenite,  $\text{Cu}_2(\text{OH})\text{PO}_4$ ; chalcosiderite, a basic copper iron phosphate; torbernite, a copper uranyl phosphate; andrewsite, a hydrated copper iron phosphate; and henwoodite, a hydrated copper aluminium phosphate.

Copper combines directly with arsenic to form several arsenides, some of which occur in the mineral kingdom. Of these we may mention whitneyite,  $\text{Cu}_9\text{As}$ , algodonite,  $\text{Cu}_6\text{As}$ , and domeykite,  $\text{Cu}_3\text{As}$ . Copper arsenate is similar to cupric phosphate, and the resemblance is to be observed in the naturally occurring copper arsenates, which are generally isomorphous with the corresponding phosphates. Olivenite corresponds to libethenite; clinoclase, euchroite, cornwallite and tyrolite are basic arsenates; zeunerite corresponds to torbernite; chalcophyllite (tamarite or "copper-mica") is a basic copper aluminium sulphato-arsenate, and bayldonite is a similar compound containing lead instead of aluminium. Copper arsenite forms the basis of a number of once valuable, but very poisonous, pigments. Scheele's green is a basic copper arsenite; Schweinfurt green, an aceto-arsenite; and Casselmann's green a compound of cupric sulphate with potassium or sodium acetate.

Normal cupric carbonate,  $\text{CuCO}_3$ , has not been definitely obtained, basic hydrated forms being formed when an alkaline carbonate is added to a cupric salt. Copper carbonates are of wide occurrence in the mineral kingdom, and constitute the valuable ores malachite and azurite. Copper rust has the same composition as malachite; it results from the action of carbon dioxide and water on the metal. Copper carbonate is also the basis of the valuable blue to green pigments verditer, Bremen blue and Bremen green. Mountain or mineral green

is a naturally occurring carbonate.

By the direct union of copper and silicon, cuprosilicon, consisting mainly of  $\text{Cu}_4\text{Si}$ , is obtained (Lebeau, C.R., 1906; Vigouroux, *ibid.*).

Copper silicates occur in the mineral kingdom, many minerals owing their colour to the presence of a cupriferous element. Dioptase (*q.v.*) and chrysocolla (*q.v.*) are the most important forms.

*Detection.*—Compounds of copper impart a bright green coloration to the flame of a Bunsen burner. Ammonia gives a characteristic blue coloration when added to a solution of a copper salt; potassium ferrocyanide gives a brown precipitate, and, if the solution be very dilute, a brown colour is produced. This latter reaction will detect one part of copper in 500,000 of water. For the borax beads and the qualitative separation of copper from other metals, see [CHEMISTRY: Analytical](#). For the quantitative estimation, see [ASSAYING: Copper](#).

*Medicine.*—In medicine copper sulphate was employed as an emetic, but its employment for this purpose is now very rare, as it is exceedingly depressant, and if it fails to act, may seriously damage the gastric mucous membrane. It is, however, a useful superficial caustic and antiseptic. All copper compounds are poisonous, but not so harmful as the copper arsenical pigments.

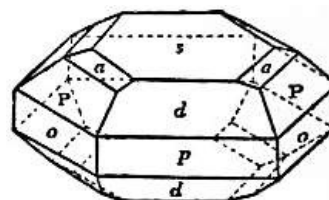
REFERENCES.—See generally H. J. Steven's *Copper Handbook* (annual), W. H. Weld, *The Copper Mines of the World* (1907), *The Mineral Industry* (annual), and *Mineral Resources of the United States* (annual). For the dry metallurgy, see E. D. Peters, *Principles of Copper Smelting* (New York, 1907); for pyritic smelting, see T. A. Rickard, *Pyrite Smelting* (1905); for wet methods, see Eissler, *Hydrometallurgy of Copper* (London, 1902); and for electrolytic methods, see T. Ulke, *Die electrolytische Raffination des Kupfers* (Halle, 1904). Reference should also be made to the articles [METALLURGY](#) and [ELECTRO-METALLURGY](#). For the chemistry of copper and its compounds see the references in the article [CHEMISTRY: INORGANIC](#). Toxicologic and hygienic aspects are treated in Tschirsch's *Das Kupfer vom Standpunkt der gerichtlichen Chemie, Toxikologie und Hygiene* (Stuttgart, 1893).

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**COPPERAS** (Fr. *couperose*; Lat. *cupri rosa*. the flower of copper), green vitriol, or ferrous sulphate,  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , having a bluish-green colour and an astringent, inky and somewhat sweetish taste. It is used in dyeing and tanning, and in the manufacture of ink and of Nordhausen sulphuric acid or fuming oil of vitriol (see [IRON](#)).

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**COPPER-GLANCE**, a mineral consisting of cuprous sulphide,  $\text{Cu}_2\text{S}$ , and crystallizing in the orthorhombic system. It is known also as chalcocite, redruthite and vitreous copper (German, *Kupferglaserz* of G. Agricola, 1546). The crystals have the form of six-sided tables or prisms; the angle between the prism faces (lettered o in the figure) being  $60^\circ 25'$ . When twinned on the prism planes o, as is frequently the case, the crystals simulate hexagonal symmetry still more closely, as in the minerals aragonite and chrysoberyl. Twinning also takes place according to two other laws, giving rise to interpenetrating crystals with the basal planes (s) of the two individuals inclined at angles of  $69^\circ$  or  $87^\circ 56'$  respectively. The mineral also occurs as compact masses of considerable extent. The colour is dark lead-grey with a metallic lustre, but this is never very bright, since the material is readily altered, becoming black and dull on exposure to light. The mineral is soft (H.= $2\frac{1}{2}$ ) and sectile, and can be readily cut with a knife, like argentite; sp. gr. 5.7. Analyses agree closely with the formula  $\text{Cu}_2\text{S}$ , which corresponds to 79.8% of copper; small quantities of iron and silver are sometimes present.



Next to chalcopyrite, copper-glance is the most important ore of copper. It usually occurs in the upper part of the copper-bearing lodes, and is a secondary sulphide derived from the



chalcopyrite met with at greater depths; sometimes, however, the two minerals are found together in the same part of the lodes. The best crystals are from St Just, St Ives, and Redruth in Cornwall, and from Bristol in Connecticut. Small crystals of recent formation are found on Roman bronze coins in the thermal springs at Bourbonne-les-Bains.

Copper-glance readily alters to other minerals, such as malachite, covellite, melaconite and chalcopyrite. On the other hand, it is found as pseudomorphs after chalcopyrite, galena, and organic structures such as wood; copper-glance pseudomorphous after galena preserves the cleavage of the original mineral and is known as harrisite.

Isomorphous with copper-glance is the orthorhombic mineral stromeyerite, a double copper and silver sulphide,  $\text{CuAgS}$ , which occurs in abundance in the Altai Mountains.

(L. J. S.)

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**COPPERHEADS**, an American political epithet, applied by Union men during the Civil War to those men in the North who, deeming it impossible to conquer the Confederacy, were earnestly in favour of peace and therefore opposed to the war policy of the president and of Congress. Such men were not necessarily friends of the Confederate cause. The term originated in the autumn of 1862, and its use quickly spread throughout the North. In the Western states early in 1863 the terms "Copperhead" and "Democrat" had become practically synonymous. The name was adopted because of the fancied resemblance of the peace party to the venomous copperhead snake, and, though applied as a term of opprobrium, it was willingly assumed by those upon whom it was bestowed.

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**COPPERMINE**, a river of Mackenzie district, Canada, about 475 m. long, rising in a small lake in approximately  $110^{\circ} 20' \text{ W.}$  and  $65^{\circ} 50' \text{ N.}$ , and flowing south to Lake Gras and then north-westward to Coronation Gulf in the Arctic Ocean. Like Back's river, the only other large river of this part of Canada, it is unnavigable, being a succession of lakes and violent rapids. The country through which it flows is a mass of low hills and morasses. The river was discovered by Samuel Hearne in 1771, and was explored from Point Lake to the sea by Captain (afterwards Sir John) Franklin in 1821.

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**COPPER-PYRITES**, or **CHALCOPYRITE**, a copper iron sulphide ( $\text{CuFeS}_2$ ), an important ore of copper. The name copper-pyrites is from the Ger. *Kupferkies*, which was used as far back as 1546 by G. Agricola; chalcopyrite (from  $\chi\alpha\lambda\kappa\acute{o}\varsigma$ , "copper," and pyrites) was proposed by J. F. Henckel in his *Pyritologia, oder Kiess-Historie* (1725). By the ancients copper-pyrites was included with other minerals under the term pyrites, though the copper-ore from Cyprus referred to by Aristotle as chalcites may possibly have been identical with this mineral.

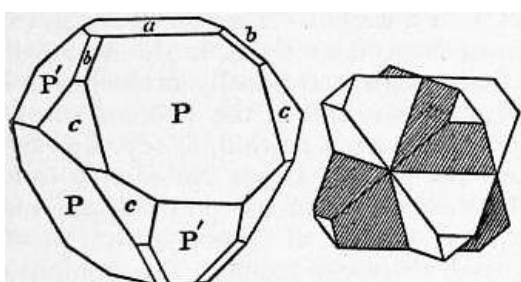


FIG. 1.

FIG. 2.

these two forms produces a figure resembling an octahedron, the angle between P and P'

Chalcopyrite crystallizes in the tetragonal system with inclined hemihedrism, but the form is so nearly cubic that it was not recognized as tetragonal until accurate measurements were made in 1822. Crystals are usually tetrahedral in aspect, owing to the large development of the sphenoid P  $\{111\}$ . The faces of this form are dull and striated, whilst the smaller faces of the complementary sphenoid P'  $\{111\}$  (fig. 1) are bright and smooth. The combination of

being  $70^{\circ} 7\frac{1}{2}'$ , corresponding to the angle  $70^{\circ} 32'$  of the regular octahedron. The other faces shown in fig. 1 are the basal pinacoid, a {001}, and two square pyramids, b {101} and c {201}. Crystals are usually twinned, and are often complex and difficult to decipher. There are three twin-laws, the twin-planes being (111), (101) and (110) respectively. Twinning according to the first law is effected by rotation about an axis normal to the sphenoidal face (111), the resulting form resembling the twins of blende and spinel. Twinning according to the second law can only be explained by reflection across the plane (101), not by rotation about an axis; chalcopyrite affords an excellent example of this comparatively rare type of symmetric twinning. Interpenetration twins (fig. 2) with (110) as twin-plane are of very rare occurrence.

Crystals have imperfect cleavages parallel to the eight faces of the pyramid c {201}. The fracture is conchoidal, and the material is brittle. Hardness 4; specific gravity 4.2. The colour is brass-yellow, and the lustre metallic; the streak, or colour of the powder, is greenish-black. The mineral is especially liable to surface alteration, tarnishing with beautiful iridescent colours; a blue colour usually predominates, owing probably to the alteration of the chalcopyrite to covellite (CuS). The massive and compact mineral frequently exhibits this iridescent tarnish, and is consequently known to miners as "peacock ore" or "peacock copper." The massive mineral sometimes occurs in mammillary and botryoidal forms with a smooth brassy surface, and is then known to Cornish miners as "blister-copper-ore."

Chalcopyrite or copper-pyrites may be readily distinguished from iron-pyrites (or pyrites), which it somewhat resembles in appearance, by its deeper colour and lower degree of hardness: the former is easily scratched by a knife, whilst the latter can only be scratched with difficulty or not at all. Chalcopyrite is decomposed by nitric acid with separation of sulphur and formation of a green solution; ammonia added in excess to this solution changes the green colour to deep blue and precipitates red ferric hydroxide.

The chemical formula  $\text{CuFeS}_2$  corresponds with the percentage composition Cu=34.5, Fe=30.5, S=35.0. Analyses usually, however, show the presence of more iron, owing to the intimate admixture of iron-pyrites. Traces of gold, silver, selenium or thallium are sometimes present, and the mineral is sometimes worked as an ore of gold or silver.

Chalcopyrite is of wide distribution and is the commonest of the ores of copper. It occurs in metalliferous veins, often in association with iron-pyrites, chalybite, blende, &c., and in Cornwall and Devon, where it is abundant, with cassiterite. The large deposits at Falun in Sweden occur with serpentine in gneiss, and those at Montecatini, near Volterra in the province of Pisa, serpentine and gabbro. At Rammelsberg in the Harz it forms a bed in argillaceous schist, and at Mansfield in Thuringia it occurs in the Kupferschiefer with ores of nickel and cobalt. Extensive deposits are mined in the United States, particularly at Butte in Montana, and in Namaqualand, South Africa. Well-crystallized specimens are met with at many localities; for example, formerly at Wheal Towan (hence the name towanite, which has been applied to the species) in the St Agnes district of Cornwall, at Freiberg in Saxony, and Joplin, Missouri.

(L. J. S.)

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**COPPICE**, or COPSE (from an O. Fr. *copeis* or *coupeis*, from Late Lat. *colpare*, to cut with a blow; *colpas*, the Late Lat. for "blow," is a shortened form of *colapus* or *colaphus*, adapted from the Gr. κόλαφος), a small plantation or thicket of planted or self-sown trees, which are cut periodically for use or sale, before the trees grow into large timber. Whether naturally or artificially grown the produce is looked on by the English law as *fructus industrialis*. The tenant for life or years may appropriate this produce (see *Dashwood v. Magniac*, 1891, 3 Ch. 306).

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**COPRA** (a Spanish and Portuguese adaptation of the Malay *kopperah*, and Hindustani

*khopra*, the coco-nut), the dried broken kernel of the coco-nut from which coco-nut oil is extracted by boiling and pressing. Copra is the form in which the product of the coco-nut is exported for commercial purposes (see [COCONUT PALM](#)).

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**COPROLITES** (from Gr. κόπρος, dung, and λίθος, stone), the fossilized excrements of extinct animals. The discovery of their true nature was made by Dr William Buckland, who observed that certain convoluted bodies occurring in the Lias of Gloucestershire had the form which would have been produced by their passage in the soft state through the intestines of reptiles or fishes. These bodies had long been known as “fossil fir cones” and “bezoar stones.” Buckland’s conjecture that they were of faecal origin, and similar to the *album grecum* or excrement of hyaenas, was confirmed by Dr W. Prout, who on analysis found they consisted essentially of calcium phosphate and carbonate, and not infrequently contained fragments of unaltered bone. The name “coprolites” was accordingly given to them by Buckland, who subsequently expressed his belief that they might be found useful in agriculture on account of the calcium phosphate they contained. The Liassic coprolites are described by Buckland as resembling oblong pebbles, or kidney-potatoes; they are mostly 2 to 4 in. long, and from 1 to 2 in. in diameter, but those of the larger ichthyosauri are of much greater dimensions. In colour they vary from ash-grey to black, and their fracture is conchoidal. Internally they are found to consist of a lamina twisted upon itself, and externally they generally exhibit a tortuous structure, produced, before the cloaca was reached, by the spiral valve of a compressed small intestine (as in skates, sharks and dog-fishes); the surface shows also vascular impressions and corrugations due to the same cause. Often the bones, teeth and scales of fishes are to be found dispersed through the coprolites, and sometimes the bones of small ichthyosauri, which were apparently a prey to the larger marine saurians. Coprolites have been found at Lyme Regis, enclosed by the ribs of ichthyosauri, and in the remains of several species of fish; also in the abdominal cavities of a species of fossil fish, *Macropoma Mantelli*, from the chalk of Lewes. Professor T. Jäger has described coprolites from the alum-slate of Gaildorf in Württemberg; the fish-coprolites of Burdiehouse and of Newcastle-under-Lyme are of Carboniferous age. The so-called “beetle-stones” of the coal-formation of Newhaven, near Leith, which have mostly a coprolite nucleus, have been applied to various ornamental purposes by lapidaries. The name “cololites” (from the Greek κῶλον, the large intestine, λίθος, stone) was given by Agassiz to fossil wormlike bodies, found in the lithographic slate of Solenhofen, which he determined to be either the petrified intestines or contents of the intestines of fishes. The bone-bed of Axmouth in Devonshire and Westbury and Aust in Gloucestershire, in the Penarth or Rhaetic series of strata, contains the scales, teeth and bones of saurians and fishes, together with abundance of coprolites; but neither there nor at Lyme Regis is there a sufficient quantity of phosphatic material to render the working of it for agricultural purposes remunerative.

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The term coprolites has been made to include all kinds of phosphatic nodules employed as manures, such, for example, as those obtained from the Coralline and the Red Crag of Suffolk. At the base of the Red Crag in that county is a bed, 3 to 18 in. thick, containing rolled fossil bones, cetacean and fish teeth, and shells of the Crag period, with nodules or pebbles of phosphatic matter derived from the London Clay, and often investing fossils from that formation. These are distinguishable from the grey Chalk coprolites by their brownish ferruginous colour and smooth appearance. When ground they give a yellowish-red powder. These nodules were at first taken by Professor J. S. Henslow for coprolites; they were afterwards termed by Buckland “pseudo-coprolites.” “The nodules, having been imbued with phosphatic matter from their matrix in the London Clay, were dislodged,” says Buckland, “by the waters of the seas of the first period, and accumulated by myriads at the bottom of those shallow seas where is now the coast of Suffolk. Here they were long rolled together with the bones of large mammalia, fishes, and with the shells of molluscous creatures that lived in shells. From the bottom of this sea they have been raised to form the dry lands along the shores of Suffolk, whence they are now extracted as articles of commercial value, being ground to powder in the mills of Mr [afterwards Sir John] Lawes, at Deptford, to supply our farms with a valuable substitute for guano, under the accepted name of coprolite manure.” The phosphatic nodules occurring throughout the Red Crag of Suffolk are regarded as derived from the Coralline Crag. The Suffolk beds have been worked since 1846; and immense quantities of coprolite have also been obtained from Essex, Norfolk and Cambridgeshire. The Cambridgeshire coprolites are believed to be derived from deposits of

Gault age; they are obtained by washing from a stratum about a foot thick, resting on the Gault, at the base of the Chalk Marl, and probably homotaxeous with the Chloritic Marl. An acre used to yield on an average 300 tons of phosphatic nodules, value £750. About £140 per acre was paid for the lease of the land, which after two years was restored to its owners re-soiled and levelled. Plicatulae have been found attached to these coprolites, showing that they were already hard bodies when lying at the bottom of the Chalk ocean. The Cambridgeshire coprolites are either amorphous or finger-shaped; the coprolites from the Greensand are of a black or dark-brown colour; while those from the Gault are greenish-white on the surface, brownish-black internally. Samples of Cambridgeshire and Suffolk coprolite have been found by A. Voelcker to give on analysis phosphoric acid equivalent to about 55 and 52.5% of tribasic calcium phosphate respectively (*Journ. R. Agric. Soc. Eng.*, 1860, xxi. 358). The following analysis of a saurio-coprolite from Lyme Regis is given by T. J. Herapath (*ibid.* xii. 91):—

Water	3.976
Organic matter	2.001
Calcium sulphate	2.026
Calcium carbonate	28.121
Calcium fluoride	not determined
Calcium and magnesium phosphate	53.996
Magnesium carbonate	0.423
Aluminic phosphate	1.276
Ferric phosphate	6.182
Silica	0.773
	— — —
	98.734

An ichthyo-coprolite from Tenby was found to contain 15.4% of phosphoric anhydride. The pseudo-coprolites of the Suffolk Crag have been estimated by Herapath to be as rich in phosphates as the true ichthyo-coprolites and saurio-coprolites of other formations, the proportion of  $P_2O_5$  contained varying between 12.5 and 37.25%, the average proportion, however, being 32 or 33%.

Coprolite is reduced to powder by powerful mills of peculiar construction, furnished with granite and buhrstones, before being treated with concentrated sulphuric acid. The acid renders it available as a manure by converting the calcium phosphate,  $Ca_3P_2O_8$ , that it contains into the soluble monocalcium salt,  $CaH_4P_2O_8$ , or "superphosphate." The phosphate thus produced forms an efficacious turnip manure, and is quite equal in value to that produced from any other source. The Chloritic Marl in the Wealden district furnishes much phosphatic material, which has been extensively worked at Froyle. In the vicinity of Farnham it contains a bed of "coprolites" of considerable extent and 2 to 15 ft. in thickness. Specimens of these from the Dippen Hall pits, analysed by Messrs J. M. Paine and J. T. Way, showed the presence of phosphates equivalent to 55.96 of bone-earth (*Journ. R. Agric. Soc. Eng.* ix. 56). Phosphatic nodules occur also in the Chloritic Marl of the Isle of Wight and Dorsetshire, and at Wroughton, near Swindon. They are found in the Lower Greensand, or Upper Neocomian series, in the Atherfield Clay at Stopham, near Pulborough; occasionally at the junction of the Hythe and Sandgate beds; and in the Folkeston beds, at Farnham. At Woburn, Leighton, Ampthill, Sandy, Upware, Wicken and Potton, near the base of Upper Neocomian iron-sands, there is a band between 6 in. and 2 ft. in thickness containing "coprolites"; these consist of phosphatized wood, bones, casts of shells, and shapeless lumps. The coprolitic stratum of the Speeton Clay, on the coast to the north of Flamborough Head, is included by Professor Judd with the Portland beds of that formation. In 1864 two phosphatic deposits, a limestone 3 ft. thick, with beds of calcium phosphate, and a shale of half that thickness, were discovered by Hope Jones in the neighbourhood of Cwmgynen, about 16 m. from Oswestry. They are at a depth of about 12 ft., in slaty shale containing Llandeilo fossils and contemporaneous felspathic ash and scoriae. A specimen of the phosphatic limestone analysed by A. Voelcker yielded 34.92% tricalcium phosphate, a specimen of the shale 52.15% (*Report of Brit. Assoc.*, 1865). Phosphatic beds, supposed to have had a coprolitic origin, are found in the Lower Silurian rocks of Canada.

See T. J. Herapath, *Chem. Gaz.*, 1849, p. 449; W. Buckland, *Geology and Mineralogy* (4th ed., 1869); O. Fisher, *Quart. Journ. Geol. Soc.*, 1873, p. 52; J. J. H. Teall, *On the Potton and Wicken Phosphatic Deposits* (Sedgwick Prize Essay for 1873) (1875) and "The Natural History of Phosphatic Deposits," *Proc. Geol. Assoc.* xvi. (1900); L. W. Collet, *Proc. Roy. Soc. Edin.* xxv. pt. 10, p. 862; T. G. Bonney, *Cambridgeshire Geology* (1875); L. Gruner, *Bull. soc. géol. franc.* xxviii. (2nd series), p. 62; J. Martin, *ibid.* iii. (3rd series), p. 273.

**COPTOS** (Egyptian *Keft*, *Kepto*), the modern  $\kappa\upsilon\phi\tau$  (a village with railway station a short distance from the west bank of the Nile about 25 m. north-east of Thebes), an ancient city, capital of the fifth nome of Upper Egypt, and the starting-point of several roads to the Red Sea, of which that which passes along the valley running due east to Kosseir past the ancient quarries of Hammāmāt was the most frequented, until the foundation of Berenice (*q.v.*) by Ptolemy Philadelphus made an even more important line of traffic to the south-west. The growth of trade with Arabia and India thereafter raised Coptos to great commercial prosperity; but in A.D. 292 its share in the rebellion against Diocletian led to an almost total devastation. It again appears, however, as a place of importance, and as the seat of a considerable Christian community, though the stream of traffic turned aside to the neighbouring  $\kappa\upsilon\varsigma$ . During part of the 7th century it was called Justinianopolis in honour of the emperor Justinian.

The local god of Coptos, as of Khemmis (Akhmīm, *q.v.*), was the ithyphallic Min; but in late times Isis was of equal importance in the city. Min was especially the god of the desert routes. Petrie's excavations on the site of the temple brought to light remains of all periods, the most remarkable objects being three very primitive limestone statues of the god with figures of an elephant, swords of sword-fish, sea-shells, &c., engraved upon them: there were also found some very peculiar terra-cottas of the Old Kingdom, and the decree of an Antef belonging to the latter part of the Middle Kingdom, deposing the monarch for siding with the king's enemy.

**COPTS**, the early native Christians of Egypt and their successors of the Monophysite sect, now racially the purest representatives of the ancient Egyptians. The name is a Europeanized form, dating perhaps from the 14th century, of the Arabic *ḵibt* (or *ḵubt*), which, in turn, is derived from the Greek Αἰγύπτιοι, "Egyptians" (the Copts in the Coptic language likewise style themselves  $\rho\epsilon\iota\mu\eta\chi\eta\mu\iota$ , "people of Egypt," "Egyptians").

The limited application of the name is explained by the circumstances of the time when Mahomet sent forth his challenge to the world and 'Amr conquered Egypt (A.D. 627-641). At that time the population of Egypt was wholly Christian (except for a sprinkling of Jews, &c.), divided into two fiercely hostile sects, the Monophysites and the Melkites. The division was in great measure racial. The Melkites, adherents of the orthodox or court religion sanctioned by the council of Chalcedon, were mainly of foreign extraction, from the various Hellenistic races which peopled the Eastern Roman empire, while the bulk of the population, the true Egyptians, were Monophysite. Amongst the latter political aspirations, apart from religion, may be said not to have existed. It has generally been held that the Copts invited and aided the Moslems to seize the country in order that at all costs they might be freed from the yoke of the state religion imposed by the Eastern Roman Empire; but Dr A. J. Butler has shown this view to be untenable, while admitting that the religious feuds of the Christians made the task of the Arabs easy. The mysterious Muḵauḵis, who treacherously handed over Alexandria, impregnable as it was for Arab warriors, and then capitulated, was none other than Cyrus, the Melkite patriarch and governor of Egypt; the native Monophysite party, however, smarting under the persecution of the Emperor Heraclius, seemed to have most to gain by a change of masters. The prophet Mahomet himself had prescribed indulgence to the Copts before his death, and 'Amr was mercifully disposed to them. Although they offered resistance in some places, after the Roman forces had been destroyed or had abandoned Egypt they generally acquiesced in the inevitable; and when in 646 a Roman fleet and army recaptured Alexandria and harried the Delta, the Copts helped the Moslems to cast out the Christian invaders. Some of the Copts embraced Islam at once, but as yet they formed practically a solid Christian nation under the protection of the conquering Arabs, and the religious and political distinction between the "true believers" and the Christians was so sharp that a native Christian turning Moslem was no longer a Copt, *i.e.* Egyptian; he practically changed his nationality.

The beginnings of Christianity in Egypt are obscure; the existence of it among the natives

(as opposed to the mixed "Greek" population of Egypt and Alexandria which produced so many leading figures and originated leading doctrines in the early church) can be traced back as far as the Decian persecution (A.D. 249-251) in the purely Egyptian names of several martyrs. St Anthony (c. A.D. 270) was a Copt; so also was Pachomius, the founder of Egyptian monasticism at the beginning of the 4th century. The scriptures were translated into Coptic not later than the 4th century. A religion founded on morality and with a clear doctrine of life after death was especially congenial to the Egyptians; thus the lower orders in the country embraced Christianity fervently, while the Alexandrian pagans were lost in philosophical speculation and Neoplatonism was spread amongst the rich "Greek" landowners; these last, partly out of religious enthusiasm, partly from greed, annoyed and oppressed their Christian peasantry. Egypt was then terribly impoverished; the upper country was constantly overrun by raiders from Nubia and the desert; and the authority of the imperial government was too weak to interfere actively on behalf of the Christians. The monasteries, however, were refuges that could bid defiance to the most powerful of the pagan aristocracy as well as to barbarian hordes, and became centres of united action that, at the summons of Shenoute, the organizer of the national church, swept away the idols of the oppressors in riot and bloodshed. In the course of the 5th century the Christians reached a position in which they were able to treat the pagans mercifully as a feeble remnant.

The Copts had little interest in theology; they were content to take their doctrine as prepared for them by the subtler minds of their Greek leaders at Alexandria, choosing the simplest form when disputes arose. In 325 their elected patriarch, Athanasius, and his following of Greeks and Copts, triumphed at the council of Nicaea against Arius; but in 451 the banishment of Dioscorus, patriarch of Alexandria, by the council of Chalcedon created a great schism, the Egyptian church holding to his Monophysite tenets (see *Coptic Church*, below), while the Catholic and imperial party at Constantinople ever sought to further the "Melkite" cause in Egypt at the expense of the native church. Thenceforward there were generally two patriarchs, belonging to the rival communities, and the Copts were oppressed by the Melkites; Heraclius, in 638 after the repulse of the Persians, endeavoured to unite the churches, but, failing in that, he persecuted the Monophysites more severely than ever before, until 'Amr brought Egypt under the Moslem rule of 'Omar, as has been related above. Under the persecution many Copts had gone over to the Melkites, but now it was the turn of the Melkites, as supporters of the emperor of Constantinople, to suffer, and they almost entirely disappeared from Egypt, though a remnant headed by a patriarch of Alexandria of the Orthodox Christians has survived to this day.

But after a few years of the mild rule of 'Amr the Egyptians began to be squeezed for the benefit of the Moslem exchequer and persecuted for their religion. Many of the more thoughtful and sober Christians must long have been disgusted with religious strife, and had already embraced the simple and congenial doctrines of Islam; others went over for the sake of material gain. Conflicts arose from time to time between the Mahommedan minority and the Christians. The Copts were excellent scribes and accountants and were continued in their posts under the Arab rule; the government offices were full of them; sometimes even the wazirate (vizierate) was held by a Copt, and that too in a time of persecution of the Christians. The pride of the Copts, still seen in the objection which the poorest among them have to engaging in any mean work or trade, was a serious danger, perhaps even a chief source of their troubles, in earlier days; devout Moslems on more than one occasion stirred the mob to fury when they saw Christians lording it over "true believers." The lower orders of the Copts were continually oppressed. Thus there was every inducement amongst the Christians to turn Mahommedan. Arab tribes, too, were encouraged to settle in Egypt until the Mahommedans exceeded the Copts in numbers.

The history of the Copts consists on the one hand of the record of religious strife, of growing scandals in the church, such as simony, and attempted reforms; and on the other hand of persecutions at the hands of the Moslems. As examples of the severity of the persecutions, it may be noted that, in the 8th century, the monks not only were compelled to pay a capitation tax, but were branded with name and number, civilians were oppressed with heavy taxation, churches demolished, pictures and crosses destroyed (722-723). Degrading dresses were imposed upon the Christians (849-850); later, under Hakim (997), they were compelled to wear heavy crosses and black turbans as an ignominious distinction. Salaheddin (Saladin) in 1171 reenforced these statutes and defiled the churches. In 1301, the blue turban was introduced, but many Copts preferred a change of religion to the adoption of this head-dress. In 1348 a religious war, attended by the destruction of churches and mosques and great loss of life, raged at Cairo between the Copts and Mahommedans, and large numbers of the former embraced Islam. Their oppression practically ceased under Mehemet Ali (1811).

There have been very few cases of conversion from Mahommedanism to Christianity; and, as intermarriage of Christians with Mahommedans implied conversion to Islam, the Copts have undoubtedly preserved the race of the Egyptians as it existed at the time of the Arab conquest in remarkable purity. The Coptic agricultural population (fellahīn) in the villages of Upper Egypt and elsewhere are not markedly different from the Mahommedan fellahīn, who, of course, are of the same stock, but mixed with Arab blood. The Copts in the towns, who have always been engaged in sedentary occupations, as scribes and handicraftsmen, have a more delicate frame and complexion, and may have mingled with Syrian and Armenian Christians.

According to the 1907 census, there were 667,036 orthodox Copts in Egypt, or less than  $\frac{1}{4}$ th of the total population, this being the same proportion as in 1830, when, according to Lane, they numbered about 150,000. The number of churches and monasteries at the same time had risen from 146 to 450, not including Protestant chapels nor Coptic Catholic churches. At the 1907 census the total number of Christians in Egypt described as Copts was 706,322; among them there were 24,710 Protestants and 14,576 Roman Catholics.

Monogamy is strict among the Copts, and divorce is granted only for adultery. Circumcision of both sexes is common before baptism. In regard to dress, at present only the clergy retain the old distinctive costume and black turban. The rest of the Copts dress exactly like their Moslem brethren, from whom they can be distinguished only by the cross which many of them still have tattooed just below the palm of the right hand. Since the British occupation of the country there has been a tendency amongst the Coptic women to give up the veil, which they had borrowed from the Mahommedans; this is especially noticeable at places like Assiūt, where, thanks to the efforts of American missionaries, female education has made much progress.

In trades and professions, so long as the Copts had no foreign competition to contend against, they maintained their supremacy over the rest of the population. They filled government offices; in towns and villages they monopolized trades and professions requiring care and skill. They were the accountants, the architects, the goldsmiths, the carpenters, the land-surveyors, the bonesetters, &c. But, with the extension of railways and agricultural roads and the increased facilities of communication and prosperity, there has been a great influx of Italian, Greek, Armenian and other Levantine workmen, who, with their better tools, are undoubtedly superior to the Copts, and have proved most formidable rivals. Furthermore, the importation of cheap European wares of every description is slowly killing all native industry. Lastly, since the British, as the dominant race, have filled most posts of responsibility in the government, the Moslems, in general, are obliged to content themselves with the subordinate posts which in the past they left to the Copts. Some Copts have attained high office, and in 1908 a Copt became prime minister. Moreover, the Copts have to a certain extent made up for the ground they lose elsewhere by engaging in agriculture and banking, and there are now to be found many rich Coptic landowners and farmers, especially in Upper Egypt.

*Language.*—The language spoken by the Copts was of various dialects, named Sahidic, Akhmimic, Fayumic, &c., descended from the ancient Egyptian with more or less admixture of Greek (for the Coptic dialects see [EGYPT: Language](#)). Coptic, however, has been entirely extinct as a spoken language for over 200 years, having been supplanted by Arabic; in the 13th century it was already so much decayed that Arabic translations of the liturgies were necessary. The Gospels, however, are still read in the churches in the Bohairic dialect. This dialect appears in literature later than the others, having become of importance only with the extinction of Greek in Lower Egypt; for a time it shared the field with Sahidic, after the disappearance of Akhmimic and Fayumic, but eventually displaced it in the churches, where it now survives alone.

Coptic literature is almost entirely religious, and consists mainly of translations from the Greek. Such was the enthusiasm for Christianity amongst the lower classes in Egypt that translations of the Bible were made into three of the dialects of Coptic before the council of Chalcedon; they probably date back at least as early as the middle of the 4th century. For the dwellers in the Delta the Greek version was probably sufficient, until the break with the Greek (Melkite) Church in the 5th century induced them to make a separate translation in their own native northern or Bohairic dialect. The Gnostic heresy, otherwise known only through the works of its opponents, is illustrated in some Coptic MSS. of the 4th century, the so-called *Pistis Sophia* or Askew Codex, and the Bruce Codex, respectively in the British Museum and Bodleian Libraries. According to Schmidt and Harnack, they are translations dating from the 3rd century and belong to an ascetic or encratitic sect of the Gnostics which arose in Egypt itself. There is abundance of apocryphal works, of apocalypses, of patristic

writings from Athanasius to the council of Chalcedon, homilies, lives of saints and anecdotes of holy men, acts of martyrs extending from the persecution of Diocletian to that of the Persians in the 7th century, and lives of later ascetics and martyrs reaching down to the 14th century. Unless some of the Egyptian *acta sanctorum et martyrum* should prove to have been originally written in Coptic, almost the only original works in that language of any importance are the numerous sermons and letters of Shenoute, a monk of Atrêpe near Akhmîm, written in the Sahidic dialect in the 4th century. After the Arab conquest, as a defence to the threatened church, language and nationality, versifications of the Proverbs, of Solomon's Song and of various legends were composed, with other religious songs. They are mostly antiphonal, a number of stresses in a line marking the rhythm. There is no musical notation in the MSS., but traditional church tunes are generally referred to or prescribed for the songs. Of secular literature strangely little existed or at least has survived: only a few magical texts, fragments of a medical treatise, of the story of Alexander, and of a story of the conquest of Egypt by Cambyses, are known, apart from numerous legal and business documents.

Coptic was occasionally employed for literary purposes as late as the 14th century, but from the 10th century onward the Copts wrote mostly in Arabic. Severus of Eshmunain (c. 950), who wrote a history of the patriarchs of Alexandria, was one of the first to employ Arabic; Cyril ibn Laklak and others in the 13th and 14th centuries translated much of the older literature from Coptic into Arabic and Ethiopic for the use of the Egyptian and Abyssinian churches. From this period also date the native Coptic grammars and lexicons of Ibn 'Assal and others. At the present time literature among the Copts is represented by Claudius Labîb, an enthusiast for the revival of the Coptic tongue, Marcus Simaika, a leader of the progressive movement, and others.

(F. LL. G.)

*The Coptic Church.*—Up to the 5th century the church of Alexandria played a part in the Christian world scarcely second to that of Rome: the names of Origen, Athanasius and Cyril bear witness to her greatness. But in the time of the patriarch Dioscorus the church, always fond of speculation, was rent asunder by the controversy concerning the single or twofold nature of our Lord, as stated by Eutyches. The Eutychian doctrine, approved by the council of Ephesus, was condemned by that of Chalcedon in 451. But to this decision, though given by 636 bishops, the Copts refused assent—a refusal which profoundly affected both the religious and the political history of their country. From that moment they were treated as heretics. The emperor appointed a new bishop of Alexandria, whose adherents the Copts styled Melkites or Imperialists, while the Copts are distinguished as Monophysites and Jacobites. The court party and the native party each maintained its own line of patriarchs, and each treated the other with bitter hostility. For nearly two centuries strife and persecution continued. The well-meant ecthesis of Heraclius was a failure and was followed by repression, till in 640 the Copts were released from the Roman dominion by the Saracen invasion. But it was only after prolonged resistance to the Arabs that the Copts accepted a change of masters, which gave them for a while religious freedom. The orthodox or Melkite party, consisting mostly of Byzantine Greeks, was swept away, and the double succession of patriarchs practically ceased. True, even now there is an orthodox patriarch of Alexandria living in Cairo, but he has only a few Greeks for followers, and scarcely a nominal succession has been maintained. But the Coptic succession has been continuous and real.

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The distinctive Monophysite doctrine of the Copts is not easy to state intelligibly, and yet they cling to it with something of the tenacity which has marked their whole history. They repudiate the heresy of Eutyches as strongly as that of Nestorius, and claim to stand between the two doctrines teaching that Christ was one person with one nature which was made up by the indissoluble union of a divine and a human nature, but that notwithstanding this absolute union the two natures remained after union distinct, unconfounded and uncommingled, separate though inseparable. The creed thus savours of paradox, not to say contradiction. It is set forth in the Liturgy and recited at every Coptic mass in the following words:—"I believe that this is the life-giving flesh which thine only Son took from the ... Holy Mary. He united it with His Divinity without mingling and without confusion and without alteration.... I believe that His Divinity was not separated from His Manhood for one moment or for the twinkling of an eye." On all other points of dogma, including the single procession of the Holy Ghost, the Copts agree with the Greek Church.

"The most holy pope and patriarch of the great city of Alexandria and of all the land of Egypt, of Jerusalem the holy city, of Nubia, Abyssinia and Pentapolis, and all the preaching of St Mark," as he is still called, had originally jurisdiction over all the places named.



**Hierarchy.** Jurisdiction over Abyssinia remains, but from Nubia and Pentapolis Christianity has disappeared. The ancient rule is that no bishop is eligible for the patriarchate. The requirement of a period of desert life has so far prevailed that no one but a monk from one of the desert monasteries is now qualified. This rule, harmless perhaps when the monasteries were the great schools of learning and devotion, now puts a premium on ignorance, and is disastrous to the church; more particularly as even bishops must be chosen from the monks. The patriarch is elected by an assembly of bishops and elders. The candidate is brought in chains from the desert, and, if only in monk's orders, is passed through the higher grades except that of bishop. The patriarch's seat was transferred some time after the Arab conquest from Alexandria to the fortress town of Babylon (Old Cairo), and in modern times it was shifted to Cairo proper. The other orders and offices in the church are metropolitan, bishop, chief priest, priest, archdeacon, deacon, reader and monk. The number of bishoprics in ancient times was very large—Athanasius says nearly 100. At present there remain ten in Egypt, one at Khartum and three in Abyssinia.

The numerous remaining churches in Egypt but faintly represent the vast number standing in ancient times. Rufinus says that he found 10,000 monks in the one region of Arsinoe. Later, in 616, the Persians are described as destroying 600

**Buildings.** monasteries near Alexandria. Abū Sālih (12th century) gives a list of churches surviving in his day, and their number is astonishing. The earliest were cut out of rocks and caverns. In the days of Constantine and Justinian basilicas of great splendour were built, such as the church of St Mark at Alexandria and the Red Monastery in Upper Egypt. This type of architecture permanently influenced Coptic builders, but there prevailed also a type, probably native in origin, though possessing Byzantine features, such as the domed roofing. There is no church now standing which bears any trace of the fine glass mosaics which once adorned the basilicas, nor is there any example of a well-defined cruciform ground-plan. But the use of the dome by Coptic architects is almost universal, and nearly every church has at least three domes overshadowing the three altars. The domes are sometimes lighted by small windows; but the walls are windowless, and the churches consequently gloomy. Among the most interesting churches are those of Old Cairo, those in the Wadi Natron, and the Red and White Monasteries (*Der el-Abiad* and *Der el-Ahmar*) near Suhag in Upper Egypt.

Every church has three altars at the eastern end in three contiguous chapels. The central division is called the *haikal* or sanctuary, which is always divided from the choir by a fixed partition or screen with a small arched doorway closed by double doors.

**Church fittings.** This resembles the Greek iconostasis, the screen on which the "icons" or sacred pictures are placed. *Haikal* screen and choir screen are often sumptuously carved and inlaid. A marble basin for the mandatum in the nave, and an epiphany tank at the west are common features. The altar is usually built of brick or stone, hollow within, and having an opening to the interior. A wooden altar-slab covered with crosses, &c., lies in a rectangular depression on the surface, and it is used in case of need as a portable altar. Chalice and paten, ewer and basin, censer and chrismatory, are found as in the Western churches. The aster consists of two crossed half-hoops of silver and is used to place over the wafer. The flabellum is used, though now rarely made of precious metal. Some examples of silver-cased textus now remaining are very fine. Every church possesses thuribles—the use of incense being universal and frequent—and diadems for the marriage service. The use of church bells is forbidden by the Moslems, except in the desert, and church music consists merely of cymbals and triangles which accompany the chanting.

The sacramental wine is usually made from raisins, but the juice must be fermented. Churches even in Cairo have a press for crushing the raisins. The eucharistic bread is baked

**Rites and ceremonies.** in an oven built near the sanctuary. The wafer is a small loaf about 3 inches in diameter and 1 inch thick, stamped with the trisagion and with crosses. Communion must be received fasting. Confession is required, but has somewhat fallen into disuse. Laymen receive in both kinds. The wafer being broken into the chalice, crumbs or "pearls" are taken out in a spoon and so administered, as in the Greek rite. Reservation is uncanonical. Renaudot states that it was permitted in cases of great extremity, when the host remained upon the altar with lamps burning and a priest watching, but it is not now practised, and there is no evidence of any such vessel as a pyx in Coptic ritual. Small benedictional crosses belong to each altar, and processional crosses are common. The crucifix is unknown, for while paintings and frescoes abound, graven images are absolutely forbidden. The liturgy was read exclusively in the extinct Coptic language till the end of the 19th century, but parts are now read in Arabic, while the lessons have long

been read in Arabic as well as in Coptic. The services are still excessively long, that of Good Friday lasting eleven hours; but benches are now provided in the newer churches. Seven sacraments are recognized—baptism, confirmation, eucharist, penance, orders, matrimony, and unction of the sick. The chief fasts are those of Advent, of Nineveh, of Heraclius, Lent and Pentecost. Pilgrimage to Jerusalem is a duty and sometimes a penance.

The Coptic ritual deserves much fuller study than it has received. Since the 7th century the church has been so isolated as to be little influenced by changes affecting other communions. Consequently it remains in many respects the most ancient monument of primitive rites and ceremonies in Christendom. But centuries of subjection to Moslem rule have much weakened it. For the liturgical dress see **VESTMENTS**; **CHASUBLE**, &c.

The British occupation of Egypt profoundly modified Coptic religious life. Before it the Copts lived in their own semi-fortified quarters in Cairo or Old Cairo or in country or desert Dairs (Ders). Walls and gates were now thrown down or disused: the Copts began to mix and live freely among the Moslems, their children to frequent the same schools, and the people to abandon their distinctively Christian dress, names, customs and even religion. Freedom and prosperity threatened to injure the Church more than centuries of persecution. Many of the younger generation of Copts began openly to boast their indifference and even scepticism: in the large towns churches came to be too often frequented only by the old or the uneducated, confession and fasts fell into neglect and the number of communicants diminished; while the facility of divorce granted by Islam occasioned many perversions from among the Copts to that religion. On the other hand the necessity of resistance to these tendencies and of reform from within was strongly realized. Unfortunately, the institution of a lay council of eminent churchmen, which has been formed for the patriarch and for every bishop in his own diocese, has led to prolonged struggles and on one occasion to a serious crisis, in which the patriarch and the metropolitan of Alexandria were for a while banished to the desert. A principal object of these lay councils is to control the financial and legal powers vested in patriarch and bishops—powers which have often been greatly abused. Other objects are (1) to provide Christian religious education in all Coptic schools and to raise these schools to a high standard in secular matters; (2) to promote the education of women; (3) to apply church revenues to the maintenance of churches and schools and to the better payment of the clergy, who are now often compelled to live on charity; (4) to ensure prompt administration of justice in ecclesiastical causes such as divorce, inheritance, &c.; and (5) to establish colleges for the efficient training of the clergy. Educated Copts remember the time when the church of Alexandria was as famous for learning as for zeal. They desire also to resist the serious encroachments of Roman Catholic, American Presbyterian, and other foreign missions upon their ancient faith.

(A. J. B.)

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**COPYHOLD**, in English law, an ancient form of land tenure, legally defined as a "holding at the will of the lord according to the custom of the manor." Though nowadays of diminishing practical importance, its incidents are historically interesting. Its origin is to be found in the occupation by villani, or non-freemen, of portions of land belonging to the manor of a feudal lord. In the time of the Domesday survey the manor was in part granted to free tenants, in part reserved by the lord himself for his own uses. The estate of the free tenants is the freehold estate of English law; as tenants of the same manor they assembled together in manorial court or court baron, of which they were the judges. The portion of the manor reserved for the lord (the *demesne*, or domain) was cultivated by labourers who were bound to the land (*adscripti glebae*). They could not leave the manor, and their service was obligatory. These villani, however, were allowed by the lord to cultivate portions of land for their own use. It was a mere occupation at the pleasure of the lord, but in course of time it grew into an occupation by right, recognized first of all by custom and afterwards by law. This kind of tenure is called by the lawyers *villenagium*, and it probably marks a great advance in the general recognition of the right when the name is applied to lands held on the same conditions not by villeins but by free men. The tenants in villenage were not, like the freeholders, members of the court baron, but they appear to have attended in a humbler capacity, and to have solicited the succession to the land occupied by a deceased father, or the admission of a new tenant who had purchased the goodwill, as it might be called, of the holding, paying for such favours certain customary fines or dues. In relation to the tenants in villenage, the court baron was called the customary court. The records of the court constituted the title of the villein tenant, held by copy of the court roll (whence the term "copyhold"); and the customs of the manor therein recorded formed the real property law applicable to his case.

Copyhold had long been established in practice before it was formally recognized by the law. At first it was in fact, as it is now in the fictitious theory of the law, a tenancy at will, for which none of the legal remedies of a freeholder were available. In the reign of Edward IV., however, it was held that a tenant in villenage had an action of trespass against the lord. In this way a species of tenant-right, depending on and strongly supported by popular opinion, was changed into a legal right. But it retained many incidents characteristic of its historical origin. The life of copyhold assurance, it is said, is custom. Copyhold is necessarily parcel of a manor, and the freehold is said to be in the lord of the manor. The court roll of the manor is the evidence of title and the record of the special laws as to fines, quit rents, heriots, &c., prevailing in the manor. When copyhold land is conveyed from one person to another, it is surrendered by the owner to the lord, who by his payment of the customary fine makes a new grant of it to the purchaser. The lord must admit the vendor's nominee, but the form of the conveyance is still that of surrender and re-grant. The lord, as legal owner of the fee-simple of the lands, has a right to all the mines and minerals and to all the growing timber, although the tenant may have planted it himself. Hence it appears that the existence of copyhold tenures may sometimes be traced by the total absence of timber from such lands, while on freehold lands it grows in abundance. Hence also the popular saying that the "oak grows not except on free land." The copyholder must not commit waste either by cutting

down timber, &c., or by neglecting to repair buildings. In such respects the law treats him as a mere lessee,—the real owner being supposed to be the lord. On the other hand, the lord may not enter the land to cut his own timber or open his mines. The limitations of estates usual in respect of other lands, as found in copyhold, become subject of course to the operations of its peculiar conditions as to the relation of lord and tenant. An estate for life, or *pour autre vie* (*i.e.* for another's life), an estate entail, or in fee-simple, may be carved out of copyhold.

A species of tenure resembling copyhold is what is known as *customary freehold*. The land is held by copy of court-roll, but not by will of the lord. The question has been raised whether the freehold of such lands is in the lord of the manor or in the tenant, and the courts of law have decided in favour of the former. In some instances copyhold for lives alone is recognized, and in such cases the lord of the manor may ultimately, when all the lives have dropped, get back the land into his own hands.

The feudal obligations attaching to copyhold tenure have been found to cause much inconvenience to the tenants, while they are of no great value to the lord. One of the most vexatious of these is the *heriot*, under which name the lord is entitled to seize the tenant's best beast or other chattel in the event of the tenant's death. The custom dates from the time when all the copyholder's property, including the copyholder himself, belonged to the lord, and is supposed to have been fixed by way of analogy to the custom which gave a military tenant's habiliments to his lord in order to equip his successor. Instances have occurred of articles of great value being seized as heriots for the copyhold tenements of their owners. A race horse worth £2000 or £3000 was thus seized. The fine payable on the admission of a new tenant, whether by alienation or succession, is to a certain extent arbitrary, but the courts long ago laid down the rule that it must be reasonable, and anything beyond two years' improved value of the lands they disallowed.

The inconvenience caused by these feudal incidents of the tenure led to a series of statutes, having for their object the conversion of copyhold into freehold. The first Copyhold Act, that of 1841, was consolidated by the Copyhold Act 1894. Owing to the incidents attaching to land "holden by copy of court roll according to the custom of the manor" in the shape of fines and heriots, the inability to grant a lease for a term exceeding a year, and to the peculiar rules as to descent, waste, dower, curtesy, alienation, and other matters, varying often from manor to manor and widely differing from the uniform law applicable to land in general, enfranchisement, or the conversion of land held by copyhold tenure into freehold, is often desired. This could and may still be effected at common law, but only by agreement on the part of both the lord and the tenant. Moreover, it was subject to other disadvantages. The cost fell on the tenant, and the land when enfranchised was subject to the encumbrances attaching to the manor, and so an investigation into the lord's title was necessary. In 1841 an act was passed to provide a statutory method of enfranchisement, removing some of the barriers existing at common law; but the machinery created was only available where both lord and tenant were in agreement. The Copyhold Act 1852 went further, and for the first time introduced the principle of compulsory enfranchisement on the part of either party. By the Copyhold Act 1894, which now governs statutory enfranchisement, the former Copyhold Acts 1841-1887, were repealed, and the law was consolidated and improved. Enfranchisement is now effected under this act, though in certain cases it is also to be obtained under special acts, such as the Land Clauses Consolidation Act 1848; and the old common law method with all its disadvantages is still open. The Copyhold Act 1894 deals both with compulsory and with voluntary enfranchisement. In either case the sanction of the Board of Agriculture must be obtained; and powers are bestowed on it to decide questions arising on enfranchisement, with an appeal to the High Court. The actual enfranchisement, where it is compelled by one of the parties, is effected by an award made by the board; in the case of a voluntary enfranchisement it is completed by deed. Under the act it is open to both lord and tenant to compel enfranchisement, though the expenses are to be borne by the party requiring it. The compensation to the lord, in the absence of an agreement, is ascertained under the direction of the board on a valuation made by a valuer or valuers appointed by the lord and tenant; and may be paid either in a gross sum or by way of an annual rent charge issuing out of the land enfranchised, and equivalent to interest at the rate of 4% on the amount fixed upon as compensation. This rent charge is redeemable on six months' notice at twenty-five times its annual amount. The tenant, even if he is the compelling party, may elect either method; but the lord has not the same option, and where the enfranchisement is at his instance, unless there is either an agreement to the contrary or a notice on the part of the tenant to exercise his option, the compensation is a rent charge. Power is conferred on the lord to purchase the tenant's interest where a change in the condition of the land by enfranchisement would

prejudice his mansion house, park or gardens; while on the other hand, in the interest of the public or the other tenants, the board is authorized to continue conditions of user for their benefit.

So far the provisions relating to compulsory enfranchisement have been dealt with; but even in the case of a voluntary agreement the lord and tenant are only entitled to accept enfranchisement with the consent of the Board of Agriculture. The consideration in addition to a gross sum or a rent charge may consist of a conveyance of land, or of a right to mines or minerals, or of a right to waste in lands belonging to the manor, or partly in one way and partly in another. The effect of enfranchisement, whether it be voluntary or compulsory, is that the land becomes of freehold tenure subject to the same laws relating to descent, dower and curtesy as are applicable to freeholds, and so freed from Borough English, Gavelkind (save in Kent), and other customary modes of descent, and from any custom relating to dower or free-bench or tenancy by curtesy. Nevertheless, the lord is entitled to escheat in the event of failure of heirs, just as if the land had not been enfranchised. The land is held under the same title as that under which it was held at the date at which the enfranchisement takes effect; but it is not subject to any estate right, charge, or interest affecting the manor. Every mortgage of copyhold estate in the land enfranchised becomes a mortgage of the freehold, though subject to the priority of the rent charge paid in compensation under the act. All rights and interests of any person in the land and all leases remain binding in the same manner. On the other hand the tenant's rights of common still continue attached to the freehold; and, without express consent in writing of the lord or tenant respectively, the right of either in mines or minerals shall not be affected by the change. No creation of new copyholds by granting land out of the waste is permissible, save with the consent of the Board of Agriculture; and the act enacts that a valid admittance of a new copyholder may be made without holding a court.

Under the earlier acts, machinery to free the land from the burden of the old rents, fines and heriots was set up, commuting them into a rent charge or a fine. Commutation, however, is never compulsory, and differs from enfranchisement in that, whereas by enfranchisement the land in question is converted into freehold, by commutation it still continued parcel of the manor, though subject to a rent charge or a fine, as might have been agreed. The ordinary laws of descent, dower, and curtesy were, however, substituted for the customs in relation to these matters incidental to the land in question before commutation, and the timber became the tenant's.

AUTHORITIES.—C. I. Elton, *Law of Copyholds* (1898); C. Watkins, *On Copyholds* (1825); *Scriven on Copyholds*, ed. A. Brown (1896); A. Brown, *Copyhold Enfranchisement Acts* (1895).

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**COPYING MACHINES.** Appliances of various kinds have been devised for producing copies of writings made by the pen or pencil. A simple method commonly adopted when only a single copy is required is to write the original with specially prepared copying ink (formed by adding some thickening substance like sugar or gum to ordinary ink), to place upon it a damped sheet of thin absorbent paper, and to press the two together in some way, as in a copying press. The resulting impression, being reversed, must be read from the back of the absorbent paper, which is thin enough to be transparent. Another process, by which a considerable number of copies can be made simultaneously, consists in interleaving a number of sheets of thin white paper with sheets of paper prepared with lampblack ("carbon paper") and writing on the top sheet with a "style" or other sharp-pointed instrument. The hectograph may be taken as typical of manifold processes analogous to lithography. In it the writing is in first instance done with aniline ink, and then a transfer is made to a plate of a gelatinous composition, from which a series of duplicates can be taken off. Another class of methods involves the preparation of what are essentially stencils. In the cyclostyle, paper of a special kind is stretched over a smooth metal plate, and the writing instrument consists of a holder having at the end a small wheel provided with a serrated edge on its periphery, which perforates the paper with lines of minute cuts and thus forms a stencil. When ink is passed over this stencil with a roller it goes through the perforations and leaves an impression on a piece of paper placed underneath. In the tryptograph a similar result is attained by using a simple style for writing, but stretching the paper over a metal plate having its surface covered with fine sharp corrugations which pierce the paper as the style

is moved over them. In the Edison electric pen the stencil is formed by the aid of a style containing a fine needle, which is rapidly moved up and down by a small electric motor mounted at the top of the pen, and thus a series of minute holes is punctured in the paper by the act of writing. For copying plans and drawings, engineers, architects, &c., use a "blue print" process which depends on the action of light on certain salts of iron (see [SUN-COPYING](#) and [PHOTOGRAPHY](#)).

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**COPYRIGHT**, in law, the right, belonging exclusively to the author or his assignees, of multiplying for sale copies of an original work or composition, in literature or art. As a recognized form of property it is, compared with others, of recent origin, being in fact, in the use of literary works, mainly the result of the facility for multiplying copies created by the discovery of printing. It is with copyright in literary compositions that we are here primarily concerned, as it was established first, the analogous right as regards works of plastic art, &c., following in its train.

1. Whether copyright was recognized at all by the common law of England was long a much debated legal question. Blackstone thinks that "this species of property, being grounded on labour and invention, is more properly reducible to the head of occupancy than any other, since the right of occupancy itself is supposed by Mr Locke and many others to be founded on the personal labour of the occupant." But he speaks doubtfully of its existence—merely mentioning the opposing views, "that on the one hand it hath been thought no other man can have a right to exhibit the author's work without his consent, and that it is urged on the other hand that the right is of too subtle and unsubstantial a nature to become the subject of property at the common law, and only capable of being guarded by positive statutes and special provisions of the magistrate." He notices that the Roman law adjudged that if one man wrote anything on the paper or parchment of another, the writing should belong to the owner of the blank materials, but as to any other property in the works of the understanding the law is silent, and he adds that "neither with us in England hath there been (till very lately) any final determination upon the rights of authors at the common law." The common law undoubtedly gives a right to restrain the publication of *unpublished* compositions; but when a work is once published, its protection depends on the statutes regulating copyright. The leading case on the subject of unpublished works is *Prince Albert v. Strange* (1849), 2 De G. & Sm. 652. Copies of etchings by Queen Victoria and Prince Albert, which had been lithographed for private circulation, fell into the hands of the defendant, a London publisher, who proposed to exhibit them, and issued a catalogue entitled *A Descriptive Catalogue of the Royal Victoria and Albert Gallery of Etchings*. The court of chancery restrained the publication of the catalogue, holding that property in mechanical works, or works of art, does certainly subsist, and is invaded, before publication, not only by copying but by description or catalogue. This protection includes news (*Exchange Telegraph Co. v. Central News*, 1897).

As a matter of principle, the nature of copyright itself, and the reasons why it should be recognized in law, have, as already stated, been the subject of bitter dispute. It was attacked

**Nature of right.**

as constituting a monopoly, and it has been argued that copyright should be looked upon as a doubtful exception to the general law regulating trade, and should be strictly limited in point of duration. On the other hand, it is claimed that copyright, being in the nature of personal property, should be perpetual. A man's own work, in this view, is as much *his* as his house or his money, and should be protected by the state. Historically, and in legal definition, there would appear to be no doubt that copyright, as regulated by statute, is strictly a monopoly. The parliamentary protection of works of art for the period of fourteen years by an act of 1709 and later statutes appears, as Blackstone points out, to have been suggested by the exception in the Statute of Monopolies 1623. The object of that statute was to suppress the royal grants of exclusive right to trade in certain articles, and to reassert in relation to all such monopolies the common law of the land. Certain exceptions were made on grounds of public policy, and among others it was allowed that a royal patent of privilege might be granted for fourteen years "to any inventor of a new manufacture for the sole working or making of the same." Copyright, like patent right, would be covered by the legal definition of a monopoly. It is a mere right to prevent other people from manufacturing certain articles. But objections to monopolies in general do not apply to this particular class of cases, in

which the author of a new work in literature or art has the right of preventing others from manufacturing copies thereof and selling them to the public. The rights of persons licensed to sell spirits, to hold theatrical exhibitions, &c., are also of the nature of monopolies, and may be defended on special grounds of public policy. The monopoly of authors and inventors rests on the general sentiment underlying all civilized law, that a man should be protected in the enjoyment of the fruits of his own labour.

#### LITERARY COPYRIGHT

2. *United Kingdom.*—On the invention of printing (see [PRESS LAWS](#)) the crown, or other sovereign powers, granted patents or licences with the object of restricting the right of multiplying copies of literary works, and this supervision of publication still has certain historical results. A special kind of what amounts to perpetual copyright in various publications has for various reasons been recognized by the laws (1) in the crown, and (2) in the universities and colleges. The various copyright acts, referred to below, except from their provisions the copyrights vested in the two English and the four Scottish universities, Trinity College, Dublin, and the colleges of Eton, Westminster and Winchester. Crown copyrights are saved by the general principle which exempts crown rights from the operation of statutes unless they are expressly mentioned. Among the books in which the crown has claimed copyright are the English translation of the Bible, the Book of Common Prayer, statutes, orders of privy council, proclamations, almanacs, Lilly's Latin Grammar, year books and law reports. The copyright in the Bible is rested by some on the king's position as head of the church; Lord Lyndhurst rested it on his duties as the chief executive officer of the state charged with the publication of authorized manuals of religion. The right of printing the Bible and the Book of Common Prayer is vested in the king's printer and the universities of Oxford and Cambridge. These copyrights do not extend to prohibit independent translations from the original. The obsolete copyright of the crown in Lilly's Latin Grammar was founded on the fact of its having been drawn up at the king's expense. The universities have a joint right (with the crown's patentees) of printing acts of parliament. Law reports were decided to be the property of the crown in the reign of Charles II.; by act of parliament they were forbidden to be published without licence from the chancellor and the chiefs of the three courts, and this form of licence remained in use after the act had expired. University and college copyrights were made perpetual by an act of George III., but only on condition of the books being printed at their printing presses and for their own benefit.

3. The first definite statute, or Copyright Act, in England was passed in 1709. The preamble states that printers, booksellers and other persons were frequently in the habit of printing, reprinting, and publishing "books and other writings without the consent of the authors or proprietors of such books and writings, to their very great detriment, and too often to the ruin of them and their families." "For preventing, therefore, such practices for the future, and for the encouragement of learned men to compose and write useful books, it is enacted that the author of any book or books already printed, who hath not transferred to any other the copy or copies of such book or books in order to print or reprint the same, shall have the sole right and liberty of printing such book or books for the term of one-and-twenty years, and that the author of any book or books already composed, and not printed and published, or that shall hereafter be composed, and his assignee, or assignees, shall have the sole liberty of printing and reprinting such book or books for the term of fourteen years, to commence from the day of first publishing the same, and no longer." The penalty for offences against the act was declared to be the forfeiture of the illicit copies to the true proprietor, and the fine of one penny per sheet, half to the crown, and half to any person suing for the same. "After the expiration of the said term of fourteen years the sole right of printing or disposing of copies shall return to the authors thereof, if they are then living, or their representatives, for another term of fourteen years." To secure the benefit of the act registration at Stationers' Hall was necessary. In section 4 was contained the provision that if any person thought the price of a book "too high and unreasonable," he might complain to the archbishop of Canterbury, the lord chancellor, the bishop of London, the chiefs of the three courts at Westminster, and the vice-chancellors of the two universities in England, and to the lord president, lord justice general, lord chief baron of the exchequer, and the rector of the college of Edinburgh in Scotland, who might fix a reasonable price. Nine copies of each book were to be provided for the royal library, the libraries of the universities of Oxford and Cambridge, the four Scottish universities, Sion College, and the faculty of advocates at Edinburgh.

It was believed for a long time that this statute had not interfered with the rights of

authors at common law. Ownership of literary property at common law appears indeed to have been recognized in some earlier statutes. The Licensing Act 1662 prohibited the printing of any work without the consent of the *owner* on pain of forfeiture, &c. This act expired in 1679, and attempts to renew it were unsuccessful. The records of the Stationers' Company show that the purchase and sale of copyrights had become an established usage, and the loss of the protection, incidentally afforded by the Licensing Act, was felt as a serious grievance, which ultimately led to the statute of 1709. That statute, as the judges in *Millar v. Taylor* (1769, 4 Burr. 2303) pointed out, speaks of the ownership of literary property as a known thing. Many cases are recorded in which the courts protected copyrights not falling within the periods laid down by the act. Thus in 1735 the master of the rolls restrained the printing of an edition of the *Whole Duty of Man*, published in 1657. In 1739 an injunction was granted by Lord Hardwicke against the publication of *Paradise Lost*, at the instance of persons claiming under an assignment from Milton in 1667. In the case of *Millar v. Taylor* the plaintiff, who had purchased the copyright of Thomson's *Seasons* in 1729, claimed damages for an unlicensed publication thereof by the defendant in 1763. The jury found that before the statute it was usual to purchase from authors the perpetual copyright of their works. Three judges, among whom was Lord Mansfield, decided in favour of the common law right; one was of the contrary opinion. The majority thought that the act of 1709 was not intended to destroy copyright at common law, but merely to protect it more efficiently during the limited periods. *Millar v. Taylor*, however, was speedily overruled by the case of *Donaldson v. Beckett* in the House of Lords in 1774. The judges were called upon to state their opinions. A majority (seven to four) were of opinion that the author and his assigns had at common law the sole right of publication in perpetuity. A majority (six to five) were of opinion that this right had been taken away by the statute of 1709, and a term of years substituted for the perpetuity. The decision appears to have taken the trade by surprise. Many booksellers had purchased copyrights not protected by the statute, and they now petitioned parliament to be relieved from the consequences of the decision in *Donaldson v. Beckett*. A bill for this purpose actually passed the House of Commons, but Lord Camden's influence succeeded in defeating it in the House of Lords. The result is that from that time on ordinary copyright has been recognized except in so far as it is sanctioned by statute. The university copyrights were, however, protected in perpetuity by an act passed in 1775.

By an act of 1801 the penalty for infringement of copyright was increased to threepence per sheet, in addition to the forfeiture of the book. The proprietor was to have an action on the case against any person in the United Kingdom, or British dominions in Europe, who should print, reprint, or import without the consent of the proprietor, first had in writing, signed in the presence of two or more credible witnesses, any book or books, or who knowing them to be printed, &c., without the proprietor's consent should sell, publish, or expose them for sale; the proprietor to have his damages as assessed by the jury, and double costs of suit. A second period of fourteen years was confirmed to the author, should he still be alive at the end of the first. Further, it was forbidden to import into the United Kingdom for sale books first composed, written, or printed and published within the United Kingdom, and reprinted elsewhere. Another change was made by the act of 1814, which in substitution for the two periods of fourteen years gave to the author and his assignees copyright for the full term of twenty-eight years from the date of the first publication, "and also, if the author be living at the end of that period, for the residue of his natural life."

4. The Copyright Act of 1842 repealed the previous acts on the same subject, and is the basis of the existing law. Its preamble stated its object to be to encourage the production of "literary matter of lasting benefit to the world." The principal clause is the **Act of 1842.** following (§ 3): "That the copyright in every book which shall after the passing of this act be published in the lifetime of its author shall endure for the natural life of such author, and for the further term of seven years, commencing at the time of his death, and shall be the property of such author and his assignees; provided always that if the said term of seven years shall expire before the end of forty-two years from the first publication of such book the copyright shall in that case endure for such period of forty-two years; and that the copyright of every book which shall be published after the death of its author shall endure for the term of forty-two years from the first publication thereof, and shall be the property of the proprietor of the author's manuscript from which such book shall be first published and his assigns." The benefit of the enlarged period was extended to subsisting copyrights, unless they were the property of an assignee who had acquired them by purchase, in which case the period of copyright would be extended only if the author or his personal representative agreed with the proprietor to accept the benefit of the act. By section 5 the judicial committee of the privy council may license the



republication of books which the proprietor of the copyright thereof refuses to publish after the death of the author. The sixth section provides for the delivery within certain times of copies of all books published after the passing of the act, and of all subsequent editions thereof, at the British Museum. And a copy of every book and its subsequent editions must be sent *on demand* to the following libraries: the Bodleian at Oxford, the public library at Cambridge, the library of the faculty of advocates in Edinburgh, and that of Trinity College, Dublin. Other libraries (the libraries of the four Scottish Universities, King's Inns, Dublin, and Sion College) entitled to this privilege under the earlier acts had been deprived thereof by an act passed in 1836, and grants from the treasury, calculated on the annual average value of the books they had received, were ordered to be paid to them as compensation. A book of registry is ordered to be kept at Stationers' Hall for the registration of copyrights, to be open to inspection on payment of one shilling for every entry which shall be searched for or inspected. And the officer of Stationers' Hall shall give a certified copy of any entry when required, on payment of five shillings; and such certified copies shall be received in evidence in the courts as prima facie proof of proprietorship or assignment of copyright or licence as therein expressed, and, in the case of dramatic or musical pieces, of the right of representation or performance. False entries shall be punished as misdemeanours. The entry is to record the title of the book, the time of its publication, and the name and place of abode of the publisher and proprietor of copyright. Without making such entry no proprietor can bring an action for infringement of his copyright, but the entry is not otherwise to affect the copyright itself. Any person deeming himself aggrieved by an entry in the registry may complain to one of the superior courts, which will order it to be expunged or varied if necessary. A proprietor may bring an action on the case for infringement of his copyright, and the defendant in such an action must give notice of the objections to the plaintiff's title on which he means to rely. No person except the proprietor of the copyright is allowed to import into the British dominions for sale or hire any book first composed or written or printed and published in the United Kingdom, and reprinted elsewhere, under penalty of forfeiture and a fine of £10. The proprietor of any encyclopaedia, review, magazine, periodical work, or work published in a series of books or parts, who shall have employed any person to compose the same, or any volumes, parts, essays, articles, or portions thereof, for publication on the terms that the copyright therein shall belong to such proprietor, shall enjoy the term of copyright granted by the act.<sup>1</sup> But the proprietor may not publish separately any article or review without the author's consent, nor may the author unless he has reserved the right of separate publication. Where neither party has reserved the right they may publish by agreement, but the author at the end of twenty-eight years may publish separately. Proprietors of periodical works shall be entitled to all the benefits of registration under the act, on entering in the registry the title, the date of first publication of the first volume or part, and the names of proprietor and publisher.

The interpretation clause of the act defines a book to be every volume, part, or division of a volume, pamphlet, sheet of letter-press, sheet of music, map, chart, or plan separately published.

5. During the last quarter of the 19th century the question of copyright became continually more prominent, and a considerable extension was given by judicial interpretation to the scope of the act of 1842. "Literary matter of lasting benefit to the world" came to include every publication (not being illegal) which could be described as "literary" or "original," the criterion as to the latter qualification being, in the last resort, whether (see *Trade Auxiliary Co. v. Middlesborough Association*, 1889, 40 Ch.D. 425) the author or compiler has really put his own brain-work into it.

6. The most marked and certain progress has been in the application of the law of copyright to the periodical press, in order to protect within reasonable limits the labour and expenditure of newspapers that obtain for the public the earliest news and arrange it for publication. It is settled law since 1881 (*Walter v. Howe*, 17 Ch.D. 708, overruling *Cox v. Land & Water Journal Co.*, 1869), that a newspaper is a book within the meaning of the act, and can claim all rights that a book has under the Copyright Act. Thus, leading articles, special articles, and even news items are protected (*Walter v. Steinkopff*, 1892, 3 Ch. 489; *Exchange Telegraph Co. v. Gregory and Co.*, 1896, 1 Q.B. 147). Current prices of stocks and shares, translations, the compilation of a directory, summaries of legal proceedings, and other similar literary work, so far as the literary form, the labour and money are concerned, are equally protected. In short, the test may now be broadly stated to be, whether labour of the brain and expenditure of money have been given for the production; whilst the old requirement of original matter is very broadly interpreted. The leading case on the subject is *Walter v. Lane* (decided in the House

of Lords, 6th August 1900). The question there raised was, whether or not copyright applied under the act of 1842 in respect of *verbatim* reports of speeches. Four law lords, viz. Lord Chancellor Halsbury, Lord Davey, Lord James of Hereford and Lord Brampton upheld the claim to copyright in such cases, whilst Lord Robertson was the sole dissident.

Apart from newspapers, protection has been extended to publications having no literary character; Messrs Maple's furniture catalogue, and the Stock Exchange prices on the "tape" have been awarded the same protection as directories. The courts have declined to protect works which are mere copies of railway time-tables, or the "tips" of a sporting prophet, or mechanical devices with no independent literary matter, such as patterns for cutting ladies' sleeves.

7. The publication of lectures without consent of the authors or their assignees is prohibited by the Lecture Copyright Act 1835, which reinforces the common law against publication of "unpublished" matter, and gives a copyright for 28 years.

**Lectures.**

This act, however, excepts from its provisions: (1) lectures of which notice has not been given two days before their delivery to two justices of the peace living within 5 m. to the place of delivery (an impracticable condition), and (2) lectures delivered in universities and other public institutions. Sermons by clergy of the established Church are believed to fall within this exception. The leading cases are *Nicols v. Pitman*, 1884, 26 Ch.D. 374, and *Caird v. Sime*, 1887, 12 A.C. 326.

8. The writer of private letters sent to another person may in general restrain their publication. It was urged in some of the cases that the sender had abandoned his property in the letter by the act of sending; but this was denied by Lord Hardwicke

**Private letters.**

(*Pope v. Curl* in 1741), who held that at most the receiver only might take some kind of joint property in the letter along with the author. Judge Story, in the American case of *Folsom v. Marsh*, 2 Story (Amer.) 100, states the law as follows: "The author of any letter or letters, and his representatives, whether they are literary letters or letters of business, possess the sole and exclusive copyright therein; and no person, neither those to whom they are addressed, nor other persons, have any right or authority to publish the same upon their own account or for their own benefit." But there may be special occasions justifying such publication. See also the English case of *Macmillan v. Dent* (1905).

9. The question of what is an infringement of copyright has been the subject of much discussion. It was decided under the statute of 1709 that a repetition from memory was not a publication so as to be an infringement of copyright. In the case of *Reade*

**Test of infringement.**

*v. Conquest*, 1861, 9 C.B., the same view was taken. The defendant had dramatized the plaintiff's novel *It's Never too Late to Mend*, and the piece was performed at his theatre. This was held to be no breach of copyright; but the circulation of copies of a drama, so taken from a copyright novel, whether gratuitously or for sale, is not allowed. Then again it is often a difficult question to decide whether the alleged piratical copyright does more than make that fair use of the original author's materials which the law permits. It is not every act of borrowing literary matter from another which is piracy, and the difficulty is to draw the line between what is fair and what is unfair. Lord Eldon put the question thus,—whether the second publication is a legitimate use of the other in the fair exercise of a mental operation deserving the character of an original work. Another test proposed is "whether you find on the part of the defendant an *animus furandi*—an intention to take for the purpose of saving himself labour." No one, it has been said, has a right to take, whether with or without acknowledgment, a material and substantial portion of another's work, his arguments, his illustrations, his authorities, for the purpose of making or improving a rival publication. When the materials are open to all, an author may acquire copyright in his selection or arrangement of them. Several cases have arisen on this point between the publishers of rival directories. Here it has been held that the subsequent compiler is bound to do for himself what the original compiler had done. When the materials are thus *in medio*, as the phrase is, it is considered a fair test of piracy to examine whether the mistakes of both works are the same. If they are, piracy will be inferred. Translations stand to each other in the same relation as books constructed of materials in common. The *animus furandi*, mentioned above as a test of piracy, does not imply deliberate intention to steal; it may be quite compatible with ignorance even of the copyright work. Abridgments, moreover, of original works appear to be favoured by the courts—when the act of abridgment is itself an act of the understanding, "employed in carrying a large work into a smaller compass, and rendering it less expensive." Lord Hatherley, however, in *Tinsley v. Lacy*, 1863, 1 H. & M. 747, incidentally expressed his disapproval of this feeling—holding that the courts had gone far enough in this direction,

and that it was difficult to acquiesce in the reason sometimes given that the compiler of an abridgment is a benefactor to mankind by assisting in the diffusion of knowledge. A mere selection or compilation, so as to bring the materials into smaller space, will not be a bona fide abridgment; "there must be real substantial condensation, and intellectual labour, and judgment bestowed thereon" (Justice Story). A publication professing to be *A Christmas Ghost Story, Reoriginated from the Original by Charles Dickens, Esq., and Analytically Condensed expressly for this Work*, was found (*Dickens v. Lee*, 1844, 8 Jur. 183) to be an invasion of Charles Dickens's copyright in the original.

10. There can be no copyright in any but innocent publications. Books of an immoral or irreligious tendency have been repeatedly decided to be incapable of being made the subject of copyright. In a case (*Lawrence v. Smith*, 1 Jac. 471) before Lord Eldon in 1822, an injunction had been obtained against a pirated publication of the plaintiff's *Lectures on Physiology, Zoology, and the Natural History of Man*, which the judge refused to continue, "recollecting that the immortality of the soul is one of the doctrines of the Scriptures, and considering that the law does not give protection to those who contradict the Scriptures." The same judge refused in 1822 to restrain a piracy of Lord Byron's *Cain*, and *Don Juan* was refused protection in 1823. Compare also *Cowan v. Milbourn*, 1867, L.R. 2 Ex. 230, in which a contract to let a room for lectures of an irreligious character was held not to be binding.

**Injurious works.**

11. The quasi-copyright in titles of books, periodicals, &c. is founded on the desirability of preventing one person from putting off on the public his own productions as those of another. This is, however, not copyright, but a question of ordinary fraud. The name of a journal (if sufficiently established) is a species of trade-mark in which the law recognizes what it calls a "species of property," provided any misleading of the public is involved. Thus, the *Wonderful Magazine* was invaded (1803) by a publication calling itself the *Wonderful Magazine, New Series Improved*. *Bell's Life in London* was pirated (1859) by a paper calling itself the *Penny Bell's Life*. The proprietors of the *London Journal* got an injunction (1859) against the *Daily London Journal*, which was projected by the person from whom they had bought their own paper, and who had covenanted with them not to publish any *weekly* journal of a similar nature. A song published under the title of *Minnie*, sung by Madame Anna Thillon and Miss Dolby at Monsieur Jullien's concerts, was invaded (1855) by a song to the same air published as *Minnie Dale, Sung at Jullien's Concerts by Madame Anna Thillon*. On the other hand, the *Sphere* and *Spear*, titles of misleading similarity, assumed by two weekly periodicals that appeared almost simultaneously in London in 1900, could not successfully attack each other, because neither had an established reputation when first adopted.

**Titles of works.**

12. Dramatic and musical compositions stand on this peculiar footing, that they may be the subject of two entirely distinct rights. As writings they come within the general Copyright Act, and the unauthorized multiplication of copies is a piracy of the usual sort. This was decided to be so even in the case of musical compositions under the act of 1709. The Copyright Act of 1842 includes a "sheet of music" in its definition of a book. Separate from the copyright thus existing in dramatic or musical compositions is the stage-right or right of representing them on the stage; this was the right created by the Dramatic Copyright Act of 1833, in the case of dramatic pieces. This act gave the owner of the stage-right (right of representation) a period of twenty-eight years, or the duration of the author's life if longer. The Copyright Act 1842 extended this right to musical compositions, and made the period in both cases the same as that fixed for copyright. And the act expressly provides (meeting a contrary decision in the courts) that the assignment of copyright of dramatic and musical pieces shall not include the right of representation unless that is expressly mentioned. The act of 1833 prohibited representation "at any place of public entertainment," a phrase which was omitted in the act of 1842, and it may perhaps be inferred that the restriction is now more general and would extend to any unauthorized representation anywhere. A question has also been raised whether, to obtain the benefit of the act, a musical piece must be of a dramatic character. The dramatization of a novel, *i.e.* the acting of a drama constructed out of materials derived from a novel, is not necessarily an infringement of the copyright in the novel (supposing it to be possible to do it without making any sort of colourable copy of the literary form), but to publish a drama so constructed has been held to be a breach of copyright (*Tinsley v. Lacy*, 1863, 1 H. & M. 747, where defendant had published two plays founded on two of Miss Braddon's novels, and reproducing the incidents and in many cases the language of the original). Where two persons dramatize the same novel, what, it may be asked, are their respective rights? In *Toole v. Young*, 1874, 9 Q.B. 523, this point actually arose. A, the author of a published novel, dramatized it and assigned the drama to the plaintiff, but it was

**Drama and music.**

never printed, published or represented upon the stage. B, ignorant of A's drama, also dramatized the novel and assigned his drama to the defendant, who represented it on the stage. It was held that any one might dramatize A's published novel, and that the representation of B's drama was not a representation of A's drama. This case may be compared with *Reade v. Lacy* (1861).

In the "Little Lord Fauntleroy" case (1888) the person who dramatized the novel of another without his consent, an operation up to that time believed to be unassailable in law, was attacked successfully, by preventing him from using printed or written copies of the play, either to deposit with the lord chamberlain or as prompt-books. In every case where much of the original dialogue of the novel is taken, this stops the production of the dramatization.

In music, statutes of 1882 and 1888 have prevented the use of the provisions inflicting penalties for the performance of copyright songs for purposes of extortion, by allowing the court to inflict a penalty of one farthing and make the plaintiff pay the costs, if justice requires it. Authors reserving the right of public performance are required to print a notice to that effect on all copies of the music.

An important decision (which appears to be a grave injustice) on musical copyright is the case of *Boosey v. Whight* (1899; followed in other cases—see *Mabe v. Conner*, 1909), in which it was held that the reproduction of copyright tunes on the perforated slips for an Aeolian or other mechanical instrument is not an infringement of copyright. In Germany it has been decided (*Lincke v. Gramophone Co.*) that the reproduction of copyright music on a gramophone is an infringement, and an injunction was granted. It has also been held in France that the production of copyright *words* (but not music) was an infringement, while in the United States the Copyright Act of 1909 extended copyright control to mechanical reproductions, and gave the copyright proprietor power to exact royalties.

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The copyright in music was subject to serious injury in England from the selling of pirated copies in the streets by hawkers; and in 1902 an act was passed enabling summary proceedings to be taken for having such copies seized and destroyed. But this act had various practical defects, which still left publishers largely at the mercy of the pirates. In 1905 the evil had become so serious that the chief music publishers announced their intention of not producing any further works till the law was altered; but the new Musical Copyright Bill of that year was obstructed and talked out in the House of Commons. In November 1905 an important prosecution, instituted by Messrs Chappell on behalf of the associated music-publishers and composers, was brought against a coterie of pirates. In the session of 1906 another attempt, this time successful, was made to pass a Musical Copyright Bill. This act (the Musical Copyright Act 1906) made it a criminal offence, punishable with fine and imprisonment, to reproduce or sell, or to possess plates for the production of, pirated copies of musical works. The act also gave power to a constable to arrest without warrant any person who in any public place exposes for sale or has in his possession for sale, or canvasses or personally advertises pirated copies, provided that the apparent owner of the copyright signs an authority requesting such arrest at his own risk. Also a court of summary jurisdiction may grant a search warrant, if there is reasonable ground for believing that an offence against the act is being committed on any premises.

13. The right of foreigners under the English copyright acts produced at one time an extraordinary conflict of judicial opinion. A foreigner who during residence in the British dominions should publish a work was admitted to have a copyright therein.

**Rights of foreigners.**

The question was whether residence at the time of publication was necessary. In *Cocks v. Purday*, the court of common pleas held that it was not. In *Boosey v. Davidson*, the court of queen's bench, following the decision of the court of common pleas in *Cocks v. Purday*, held that a foreign author might have copyright in works first published in England, although he was abroad at the time of publication. But the court of exchequer, in *Boosey v. Purday*, refused to follow these decisions, holding that the legislature intended only to protect its own subjects,—whether subjects by birth or by residence. The question came before the House of Lords on appeal in the case of *Boosey v. Jeffreys* (1854), in which the court of exchequer had taken the same line. The judges having been consulted were found to be divided in opinion. Six of them held that a foreigner resident abroad might acquire copyright by publishing first in England. Four maintained the contrary. The views of the minority were affirmed by the House of Lords (Lord Chancellor Cranworth and Lords Brougham and St Leonards). The lord chancellor's opinion was founded upon "the general doctrine that a British senate would legislate for British subjects properly so called, or for such persons who might obtain that character for a time by being resident in this country, and therefore under allegiance to the crown, and

under the protection of the laws of England.” Lord Brougham said that

“The statute of Anne had been passed for the purpose of encouraging learned men, and with that view that act had given them the exclusive right in their publications for twenty-one years. This, however, was clear, they had no copyright at common law, for if they had there would have been no necessity for the passing of that statute. It could scarcely be said that the legislature had decided a century and a half since that act was to be passed to create a monopoly in literary works solely for the benefit of foreigners. In the present case he was clearly of opinion that the copyright did not exist, and therefore that foreign law should not prevail over British law where there was such diversity between the two.”

Against the authority of this case, however, must be set the opinion of two great lord chancellors—Lord Cairns and Lord Westbury. In the case of *Routledge v. Low*, L.R. 3 H. L. 100, 1868, Lord Cairns said,

“The aim of the legislature is to increase the common stock of the literature of the country; and if that stock can be increased by the publication for the first time here of a new and valuable work composed by an alien who has never been in the country, I see nothing in the wording of the act which prevents, nothing in the policy of the act which should prevent, and everything in the professed object of the act and in its wide and general provisions which should entitle such a person to the protection of the act, in return and compensation for the addition he has made to the literature of the country.”

And Lord Westbury said, in the same case,

“The case of *Jeffreys v. Boosey* is a decision which is attached to and depends on the particular statute of which it was the exponent, and as that statute had been repealed and is now replaced by another act, with different enactments expressed in different language, the case of *Jeffreys v. Boosey* is not a binding authority in the exposition of this later statute. The act appears to have been dictated by a wise and liberal spirit, and in the same spirit it should be interpreted, adhering of course to the settled rules of legal construction. The preamble is, in my opinion, quite inconsistent with the conclusion that the protection given by the statute was intended to be confined to the works of British authors. The real condition of obtaining its advantages is the first publication by the author of his work in the United Kingdom. Nothing renders necessary his bodily presence here at the time, and I find it impossible to discover any reason why it should be required, or what it can add to the merit of the first publication. If the intrinsic merits of the reasoning on which, *Jeffreys v. Boosey* was decided be considered, I must frankly admit that it by no means commands my assent.”

These conclusions might follow also from the Naturalization Act of 1870, which enacts that real and personal property of every description may be taken, acquired, held, and disposed of by an alien in the same manner in all respects as by a natural born British subject. At the present time the International Copyright Act has largely removed the question from the area of conflict.

14. *International Copyright*.—Books published in one country and circulated in another depend for their protection in the latter upon international copyright. Until 1886 international copyright in Great Britain rested on a series of orders in council, made under the authority of the International Copyright Act 1844 (superseding acts of 1820 and 1826), conferring on the authors of a particular foreign country the same rights in Great Britain as British authors, on condition of their registering their work in Great Britain within a year of first publication abroad. A condition of the granting of each order was that the sovereign should be satisfied that reciprocal protection was given in the country in question to British authors. As the result of conferences at Bern in 1885 and 1887, this system was simplified and made more general by the treaty known as “The Bern Convention,” signed at Bern on the 5th of September 1887. The contracting parties were the British Empire, Belgium, France, Germany, Italy, Spain, Switzerland, Tunis and Hayti. Luxemburg, Monaco, Norway and Japan afterwards joined. Austria and Hungary have a separate convention with Great Britain, concluded on the 24th of April 1893. The notable absentees among European powers are Holland and Russia. So far as the United States is concerned, the matter is regulated by the American copyright acts, which are dealt with separately below.

The basis of the Bern convention was that authors of any of the countries of the Union, or the publishers of works first published in one of them, should enjoy in each of the other countries of the Union the same rights as the law of that country granted to native authors. The only conditions were that the work should comply with the necessary formalities, such as registration, in the country where it was first published, in which case it was exempt from all such formalities elsewhere; and that the protection required from any country should not

exceed that given in the country of origin. The rights conferred included the sole right of making a translation of the work for ten years from its first publication. The convention was retrospective; that is to say, it applied to copyright works published before its coming into existence, each country being allowed to protect vested interests, or copies already made by others, as it should think best.

The rights of foreign authors in Great Britain rest on legislation giving effect to the Bern convention, namely, the International Copyright Act of 1886, and an order in council made under that act, dated 28th November 1887. These confer on the author or publisher of a work of literature or art first published in one of the countries which are parties to the convention, after compliance with the formalities necessary there, the same rights as if the work had been first published in the United Kingdom, provided that those rights are not greater than those enjoyed in the foreign country.

The rights of British authors in foreign countries rest in each country on the domestic legislation by which the particular country has given effect to its promise contained in the Bern convention, and are enforced by the courts of that country. The Bern convention was revised in minor details not affecting its broad principles by a conference meeting in 1896 in Paris, and Great Britain adopted the results of their labours by an order in council dated 7th March 1898. A further simplification in the international law of copyright was expected to result from the efforts of the international conference at Berlin in 1908, July 1910 being the latest date at which ratification by the states concerned might take place, but it cannot here be stated to what extent legislation may give effect to the decisions arrived at. So far as these decisions affect Great Britain, the greatest alterations of existing law would be in establishing throughout the Union protection of musical copyright, especially with regard to singing and talking machines, and also in the matter of newspaper copyright. The conference adopted a threefold division of newspaper matter: (1) serial stories, tales and all other work, literary, scientific and artistic, which is to have absolute protection; (2) all newspaper matter, except the foregoing and mere items of general news (*faits divers*), of which reproduction is to be permitted on acknowledgment of the source, unless such reproduction is expressly forbidden; (3) news of the day and simple facts, to which no protection is given. An endeavour was also made to have a uniform period throughout the Union for copyright of the author's life and 50 years.

15. *Colonial Copyright.*—Under English copyright, books of the United Kingdom were formerly protected in the colonies by the Colonial Copyright Act of 1847, and copies of them printed or reprinted elsewhere could not be imported into the colonies. In 1876 a royal commission was appointed to consider the whole question of home, colonial and international copyright; and various recommendations were made. But the matter now rests on the English International Copyright Act 1886, which contains provisions designed to extend the benefit of the British copyright acts to works first produced in the colonies, while allowing each colony to legislate separately for works first produced within its own limits. The colonies at present are all included in the system of international copyright established by the Bern convention.

In 1875 an act was passed (re-enacted in 1886 in the revised Canadian statutes) to give effect to an act of the parliament of the Dominion of Canada respecting copyright. An order in council in 1868 had suspended the prohibition against the importation of foreign reprints of English books into Canada, and the parliament had passed a bill on the subject of copyright as to which doubts had arisen whether it was not repugnant to the Order in Council. It was also enacted that, after the bill came into operation, if an English copyright book became entitled to Canadian copyright, no Canadian reprints thereof should be imported into the United Kingdom, unless by the owner of the copyright. The following points in the Canadian act are worth noting:—Any person printing or publishing an unprinted manuscript without the consent of the author or legal proprietor shall be liable in damages (§ 3). Any person domiciled in Canada, or in any part of the British possessions, or being a citizen of any country having an international copyright treaty with the United Kingdom, who is the author of any book, map, &c., &c., shall have the sole right and liberty of printing, reprinting, publishing, &c., for the term of twenty-eight years. The work must be printed and published, or reprinted or republished in Canada, whether before or after its publication elsewhere: and the Canadian privilege is not to be continued after the copyright has ceased elsewhere. And “no immoral or licentious, or irreligious, or treasonable, or seditious literary, scientific or artistic work” shall be the subject of copyright (§ 4). A further period of fourteen years will be continued to the author or his widow and children. An “interim copyright” pending publication may be obtained by depositing in the office of the minister of agriculture (who keeps the register of copyrights) a copy of the title of the work;

and works printed first in a series of articles in a periodical, but intended to be published as books, may have the benefit of this interim copyright. If a copyright work becomes out of print, the owner may be notified of the act through the minister of agriculture, who, if he does not apply a remedy, may license a new edition, subject to a royalty to the owner. Anonymous books may be entered in the name of the first publisher. In 1889 an amending Canadian act was passed, which led to a long controversy with the Mother Country,—the imperial government refusing to sanction it,—till in 1900 a compromise was effected, and a further act amending that of 1886 became law. It applies only to books copyright in Canada, and, subject to certain reservations, allows the minister of agriculture to prohibit the importation, without consent of the licensees, of any copies printed elsewhere of books published in the British dominions licensed by the owners to be reproduced in Canada.

The Australian states all have copyright laws modelled on the English. New Zealand provides for a term of 28 years, or the author's life. In Cape Colony the term for books is the author's life and 5 years, or a minimum of 30 years. The Indian act of 1847 is modelled on the English.

16. *Other Countries.*—The following notes give the general terms of the copyright law in other countries of importance. For details reference must be made to text-books. We only deal specifically with the history and particulars of American copyright.

**Foreign law.**

*Austria*, by a law of 1895, gives copyright for thirty years after author's death.

*Belgium.*—Copyright formerly perpetual, now limited to the life of the author, and 50 years thereafter.

*France.*—Copyright in France is recognized in the most ample manner. Two distinct rights are secured by law—1st, the right of reproduction of literary works, musical compositions, and works of art; and 2nd, the right of representation of dramatic works and musical compositions. The period is for the life of the author and fifty years after his death. After the author's death the surviving consort has the usufructuary enjoyment of the rights which the author has not disposed of in his lifetime or by will, subject to reduction for the benefit of the author's protected heirs if any. The author may dispose of his rights in the most absolute manner in the forms and within the limits of the Code Napoléon. Piracy is a crime punishable by fine of not less than 100 nor more than 2000 francs; in the case of a seller from 25 to 500 francs. The pirated edition will be confiscated. Piracy also forms the ground for a civil action of damages to the amount of the injury sustained—the produce of the confiscation, if any, to go towards payment of the indemnity (Penal Code, Art. 425-429).

*Germany.*—Period fixed in 1837 at ten years; but copyright for longer periods was granted for voluminous and costly works, and for the works of German poets. Among others the works of Schiller, Goethe, Wieland, &c., were protected for a period of twenty years from the date of the decree in each case. In 1845 the period was extended in all cases to the author's life and thirty years after. The present law rests on a Codifying Act of 1901, the term being the author's life and 30 years, or not less than 10 years in any case.

*Greece.*—Copyright is for fifteen years from publication.

*Holland.*—Fifty years, or author's life, whichever is longer.

*Hungary.*—by a law of 1884, gives a copyright for the author's life and 50 years after.

*Italy.*—Life of author, or 40 years from date of publication; and afterwards a further period of 40 years, subject to a right in others to reproduce on payment of 5% on each copy.

*Japan.*—Author's life and 30 years after.

*Norway*, by a law of 1893, gives protection for author's life and 50 years after.

*Portugal.*—Author's life and 50 years after.

*Russia.*—Author's life and 50 years.

*Spain.*—Author's life and 80 years thereafter.

*Sweden and Denmark* provide for a term of the author's lifetime and 50 years after.

*Switzerland.*—Author's life and 30 years after.

*Turkey.*—Author's life, or 40 years, whichever is the longer.

17. *United States.*—American copyright is provided for by an act of March 1909, which

replaced acts of July 1870 and March 1891, both of which had introduced important modifications in the original act of 1790. Under all acts preceding that of 1891, copyright had been granted to "citizens or residents of the United States," the term "resident" having been, in decisions prior to 1891, construed to mean a person domiciled in the United States with the intention of making there his permanent abode. The works of foreigners could thus be reproduced without authorization, and they were so reproduced in so far as there was prospect of financial gain. The leading publishers, however, had from the earliest times made terms with British authors, or with their representatives, the British publishers, for producing authorized American editions. But at most they were only able to secure by this means an advantage of a few weeks' priority over the unauthorized editions, and the goodwill of the conscientious buyer; so that if they paid the author any considerable sum, the price of the authorized editions had to be made so high that it was not easy to secure a remunerative sale. The unauthorized editions had the further advantage in competition, that for the purpose of being manufactured more promptly and more economically, they could be and often were issued in an abbreviated and garbled form, an injury which to not a few writers seemed more grievous than the lack of pecuniary profit. In Great Britain, during the first half of the 19th century, the copyright law had been so interpreted as to secure recognition of the rights of American authors for such works as were produced there not later than in any other country, so that authors like Washington Irving and Fenimore Cooper secured for a time satisfactory returns; but after 1850 the conditions became the same as in the United States. Unauthorized editions were published, and were often incomplete and garbled.

As from decade to decade the books produced on either side of the Atlantic, which possessed interest for readers of the other side, increased in quantity and in importance, the evil of these unrestricted piracies increased. The injury to British authors was greater only in proportion as the English books were more numerous. The pressure from Great Britain during the last half of the 19th century for international copyright was continuous; and in America it was recognized by authors, by representative publishers, and by the more intelligent people everywhere, that the existing conditions were of material disadvantage. The loss to American authors was direct; and the loss to legitimate American publishers was also clear, in that better returns could be secured by adequate payments for rights that could be protected by law than by "courtesy" payments for authorizations that carried no legal rights. An injury was being done to American literature; for, when authorized editions of American works had to compete against unauthorized and more cheaply produced editions of English works, the business incentive for literary production was seriously lessened. In fiction particularly, authors had to contend against a flood of cheaply produced editions of "appropriated" English books. Equally to be condemned were the ethics of a relation under which one class of property could be appropriated while other classes secured legal protection. On these several grounds efforts had long been made to secure international copyright. Between 1843 and 1886 no less than eleven international copyright bills were drafted, for the most part at the instance of the copyright associations or copyright leagues. They were one after the other killed in committee. In 1886 the twelfth international copyright bill was brought before the Senate by Senator Jonathan Chace of Rhode Island, and was referred to the committee on patents. In 1887 the American Publishers' Copyright League (succeeding the earlier American Publishers' Association) was organized, with William H. Appleton as president and G. H. Putnam as secretary. The executive committee of this league formed, with a similar committee of the Author's Copyright League, a conference committee, under the direction of which the campaign for copyright was continued until the passage of the act of March 1891. Of the Authors' Copyright League James Russell Lowell was the first president, being succeeded by Edmund Clarence Stedman. The secretary during the active work of the league was Robert U. Johnson. Under the initiative of the conference committee copyright leagues were organized in Boston, Chicago, St Louis, Cincinnati, Minneapolis, Denver, Colorado City and other places. The Chace Bill was introduced in the House in March 1888. In May 1890 this bill, with certain modifications, came before the House, and was there defeated. In March 1891 the same measure, with certain further modifications, secured a favourable vote in the House during the last hour of the last day of the session, was passed by the Senate, and was promptly signed by President Harrison. Thus, after a struggle extending over fifty-three years, the United States accepted the principle at all events of international copyright.

18. The act of 1891 was criticized in several respects: (1) A condition was that books or works of art must be "manufactured" in America; consideration not being given to books originally produced in some language other than English. (2) It required publication in the



United States simultaneously with that in the country of origin. (3) The term of copyright (28 years, with an extension of 14 years to the author if alive, or to widow or children) was shorter than that accorded under the law of any other literature-producing country, excepting Greece. Minor amending acts were passed in 1893, 1895 and 1897, that of Feb. 19, 1897, establishing as the copyright department of the library of Congress a Bureau of Copyrights, the head of which bears the title of Register of Copyrights. Eventually, after hard work by the American Authors' Copyright League and the Publishers' Copyright League, and after sittings extending to a period of three years, a new bill submitted to Congress by the two Committees on Patents of the House of Representatives and the Senate was successfully passed. It came into force on the 1st of July 1909. Its provisions may be briefly summarized as follows:—

**Provisions of Act of 1909.**

Copyright is granted to authors for twenty-eight years from the date of first publication, whether the copyrighted work bears the author's true name or is published anonymously or under an assumed name. A further term of twenty-eight years is granted to the author if at the expiration of the first term he be still living, or to his widow and children if he be dead. If the author's widow and children be dead an extension is granted to the author's executors, or in the absence

**Term of copyright.**

of a will, to his next of kin. Applications for renewal and extension must be made to the copyright office and duly registered therein within one year prior to the expiration of the existing term. To any work in which copyright subsists at the time the act went into force the act extends renewal for a period of twenty-eight years at the expiration of the time provided for under the previously existing law (first period 28 years, renewal period 14 years). The works for which copyright may be secured under the act "Shall include all the writings of an

**Definition of copyright.**

author." For purposes of registration the act classifies (1) books, including composite and cyclopaedic works, directories, gazetteers and other compilations; (2) periodicals, including newspapers; (3) lectures, sermons, addresses, prepared for oral delivery; (4) dramatic or dramatico-musical compositions; (5) musical compositions; (6) maps; (7) works of art; models or designs for works of art; (8) reproductions of a work of art; (9) drawings or plastic works of a scientific or technical character; (10) photographs and (11) prints and pictorial illustrations. But compilations or abridgments, adaptations, arrangements, dramatizations, translations or other versions of copyrighted works, when produced with the consent of the proprietors of the copyrighted work are, under the 1909 act, new works subject to copyright. A citizen or subject of a foreign state can secure copyright only when he is domiciled within the United States at the time of the first publication of his work, or when the foreign state or nation of which he is a subject grants, either by treaty, convention, agreement or law, to citizens of the United States the benefit of copyright on substantially the same basis as to its own citizens, or copyright protection equal to that secured by the foreign author under the United States act, or when the foreign state is a party to an international agreement providing for reciprocity in the granting of copyright, and the United States may, by the terms of that agreement, become a party thereto. After copyright has been secured by publication of a work, two complete copies of the best edition published must be "promptly" deposited in the copyright office, or mailed to the register of copyrights, the postmaster, on request, giving a receipt and mailing the books without cost. If the work be a contribution to a periodical, one copy of the issue containing it must be sent, or if it be a work not reproduced in copies for sale, a copy, print, photograph or other identifying reproduction must accompany the claim. Prior to 1891 the works of authors could be put into print on either side of the Atlantic. The act of 1891 laid down that, in order to secure copyright, all editions of the works of all authors, resident or non-resident, must be entirely manufactured within the United States, the term "manufactured" including the setting of

**"Manufacture" clause.**

type as well as printing and binding. This manufacturing condition was insisted on by the typographical unions. There is no logical connexion, however, between the right of an author or artist to the control of his production and the interests of American workmen; the attempt to legislate for them jointly must bring about no little confusion and inequity. If American working-men cannot secure a living in competition with labourers on the other side of the Atlantic, their needs should be cared for under the provisions of the protective tariff. It is, however, the belief of a large number of those who are engaged in the manufacturing of books that, with his advanced methods of work, the skilled American labourer has no reason to dread the competition of European craftsmen. With this manufacturing condition out of the way, there would be nothing to prevent the United States from becoming a party to the Bern Convention. This would place intellectual property on both sides of the Atlantic on the same footing. The power of the unions was sufficiently strong to prevent this condition being eliminated from the act of 1909, but the just claims were met of authors whose books are originally produced in some language other than English, the "original text of a book of foreign

**Exemption of**

origin in a language or languages other than English" being exempted

**text of  
foreign book.**

from the requirements as to type-setting in the United States. On the other hand the manufacturing condition is extended by the act of 1909 to illustrations within a book, and also to separate lithographs or photo-engravings, "except where in either case the subjects represented are located in a foreign country and illustrate a scientific work or reproduce a work of art." The notice of copyrights required by the act consists either of the word "copyright" or by the abbreviation "Copr.," accompanied by the name of the copyright proprietor, and in the case of printed literary, musical or dramatic works, the notice must include also the year in which the copyright was secured by publication. In the case of works specified in 6 to 11 inclusive, of the classification given above, the copyright notice may consist of the letter C enclosed within a circle, thus: ©, accompanied by the initials, monogram, mark or symbol of the copyright proprietor, provided that on some accessible portion of the copy or of the margin, or on the back or pedestal his name appears.

The act of 1909 gives an *interim* protection to a book published abroad in the English language before publication in the United States, the deposit in the copyright office, not later than thirty days after its publication abroad, of one complete copy of the foreign edition, with a request for the reservation of the copyright and a statement of the name and nationality of the author and copyright proprietor, securing copyright for thirty days from the date of deposit. Any person infringing a copyright work is liable to an injunction, and to pay such damages as the copyright proprietor may have suffered by the infringement; in lieu of actual damages and profits the courts may award such damages as appear to be just, and in assessing them may, at its discretion, allow the amounts mentioned below, except that in the case of a newspaper reproduction of a copyrighted photograph such damages must not exceed the sum of two hundred and fifty dollars nor be less than fifty dollars, and in no other case must the damages be more than five thousand dollars or less than two hundred and fifty dollars: (1) In the case of a painting, statue or sculpture, ten dollars for any infringing copy made or sold or found in the possession of the infringer or his agents or employees; (2) in the case of any work enumerated in the classification given before, except a painting, statue or sculpture, one dollar for every infringing copy; (3) in the case of a lecture, sermon or address, fifty dollars for every infringing delivery; (4) in the case of dramatic or dramatico-musical or a choral or orchestral composition, one hundred dollars for the first and fifty dollars for every subsequent infringing performance; in the case of other musical compositions, ten dollars for every infringing performance; all infringing copies and devices must also be delivered up for destruction. The act gives full control over his compositions to a musical composer, and the right to make any arrangement or setting of it, or of the melody of it, in any system of notation or form of record from which it may be read or reproduced. His right to control the reproduction of his music by mechanical instruments is restricted (1) to cover only music published and copyrighted after the act went into effect; (2) to include a musical composition by a foreign composer only in the case of a citizen of a foreign state that grants to citizens of the United States similar rights; (3) where the owner of a musical copyright has permitted the use of his work upon parts of instruments serving to reproduce the composition mechanically, permission for a similar use of such work must be accorded to any other person on the payment of a fixed royalty of two cents on each part manufactured. The act makes a clear distinction between the property in the copyright and that in the material object representing the copyright, and enacts that the sale or conveyance of the material object shall not of itself constitute a transfer of the copyright. Transfer of copyright in the United States is to be effected by an instrument in writing signed by the proprietor of the copyright, or the copyright may be bequeathed by will. Assignment of copyright executed in a foreign country must be acknowledged by the assignor before a consular officer of the United States. Every assignment of copyright must be recorded in the copyright office within three calendar months after its execution in the United States or within six months without the limits of the United States. The importation into the United States is forbidden of any piratical copies of a copyrighted book or of any copies not produced in accordance with the manufacturing provisions of the act (although authorized by the author or proprietor), but importation is allowed to any society or institution incorporated for educational, literary, philosophical, scientific or religious purposes, or for the encouragement of the fine arts, or to any State school, college, &c., or to free public libraries, when importation is for use and not for sale. The act of 1891 allowed "two copies in any one invoice" to be imported, but by the act of 1909 not more than *one* copy is to be imported in one invoice.

**Interim  
protection.**

**Infringement.**

**Musical  
compositions.**

**Transfer and  
assignment  
of copyright.**

**Importation  
of copyright  
works.**

The provisions having to do with international copyright become operative in the case of a foreign state only when the president proclaims that the state has fulfilled the condition of

reciprocity. The act of 1891 was put into force with foreign states as follows:—1st of July 1891, Great Britain, Belgium, France, Switzerland; 8th of March 1892, Germany (by separate treaty); 31st of October 1892, Italy; 8th of May 1893, Denmark; 15th of July 1895, Spain; 20th of July 1895, Portugal; 27th of February 1896, Mexico; 13th of April 1896, Sweden and Norway; 25th of May 1896, Chile; 19th of October 1899, Costa Rica; 20th of November 1899, the kingdom of the Netherlands. In the case of each state the territory covered by the provisions of the law included the possessions, dependencies, &c. The copyright agreement with Great Britain therefore covered the crown colonies of the empire, including India and the self-governing dominions and states, such as Canada, Australia, &c. An American work duly entered for copyright in Great Britain secures, as a British publication secures, the protection of copyright under the provisions of the Bern convention throughout the territory of the several states that are parties to that convention.

#### ARTISTIC COPYRIGHT

19. Literary authors had protection for their literary work much earlier than artists for their artistic productions. Pictures and illustrations, when included in books or newspapers, are protected by the law which applies to the latter, but that is a separate question. It was not until the reign of George II. that the legislature in England afforded any protection for the work of artists. The English law on artistic copyright is alone considered in this account, the American having been included in the section *United States* above (18), while for other countries the details are so various that it is only possible to refer the reader to the leading text-books.

The first Artists' Copyright Bill was passed in the interest of William Hogarth, one of the greatest of English painters, who was engraver as well as painter, and who devoted a considerable portion of his time to engraving his own works. No sooner, however, were these published than his market was seriously damaged by the issue of inferior copies of his engravings by other publishers. To protect Hogarth from such piracy the Engraving Copyright Act 1734 was passed, which provided that "every person who should invent and design, engrave, etch, or work in mezzotinto or chiaroscuro, any historical or other print or prints, should have the sole right and liberty of printing and representing the same for the term of fourteen years, to commence from the day of the first publishing thereof, which shall be truly engraved with the name of the proprietor on each plate, and printed on every such print or prints." The penalty for piracy was the forfeiture of the plate and all prints, with a fine of 5s. for every pirated print.

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In 1766, in the reign of George III., a second Engraving Copyright Act was passed "to amend and render more effectual" the first act, and "for vesting and securing to Jane Hogarth, widow, the property in certain prints," which extended the protection beyond the designer, who was also engraver, to any person who, not being himself a designer, made, or caused to be made, an engraving from any picture or other work of art. Jane Hogarth, the widow of the painter, found herself nearing the termination of the fourteen years' term of copyright grant by the first act, with the probability that immediately on its expiry the engravings of her husband then on sale, and on which her livelihood depended, would be immediately pirated. It was mainly to save her from the loss of her livelihood that this second Copyright Bill extended the term of the copyright to twenty-eight years.

The engravers and publishers of the day were not over-scrupulous, and they sought to evade the penalties of the copyright acts by taking the designs, and adding to them or taking from them, or both, and producing fresh engravings, seeking to make it appear that they were producing new works. These practices assumed such proportions that it became necessary, in 1777, to call upon parliament to put through another short measure still further to protect the engraver, by prohibiting the copying "in whole or in part" (a clause not contained in the previous acts), by varying, adding to, or diminishing from, the main design of an engraving without the express consent of the proprietor or proprietors. These three acts remain in force to the present day. In 1852, in an international copyright act, it was declared that the Engraving Copyright Acts collectively were intended to include prints taken by lithography or any other mechanical process.

20. In May 1814 the Sculpture Copyright Act was passed to give protection to sculptors. The term of copyright for sculptors was a peculiar one. It was to last for fourteen years, with the proviso that, should the author be still alive, he should enjoy a further period of fourteen years, the copyright returning to him for the second fourteen should he have disposed of it for the first period. It is a condition of copyright with the sculptor that the author must put his name with the date upon every

work before putting it forth or publishing it. A curious and interesting point in the interpretation of this act is, that according to the opinion of eminent jurists it is necessary to an infringement of the copyright of a piece of sculpture that the copy of it must take the form of another piece of sculpture; that a photograph, drawing, or engraving of a piece of sculpture is not to be considered a reproduction of it, and is therefore not an infringement of the sculptor's copyright.

21. Strange as it may seem, painting was the last branch of the arts to receive copyright protection. The cause of the painters was taken up by the Society of Arts, who endeavoured, in the first instance, to pass an amendment and consolidation bill dealing with engraving, sculpture and painting; but, failing in their first effort, they limited their second to an attempt to pass a bill in favour of painting, drawing and photography. It was in the year 1862 that this act, having passed through parliament, came into force. The absence of any antecedent protection for the painter is clearly stated in its preamble, which reads as follows: "Whereas by law as now established, the authors of paintings, drawings, and photographs have no copyright in such their works, and it is expectant that the law should in that respect be amended. Be it, therefore, enacted," &c. This preamble makes it clear that there is no copyright in any paintings, drawings, or photographs executed and dealt with before the year 1862—to be exact, 29th July of that year. The duration of the term of copyright in this act of 1862 differs from its predecessors, by being made dependent on the life of the author, to which life seven years were added. In the Literary Copyright Act there are two terms—the life of the author and seven years, or forty-two years, whichever may prove the longer. In taking a fixed term like forty-two years it is necessary to have something to start from, and with a literary work it was easy to start from the date of publication. But pictures are not published. They may pass from the studio to the wall of the purchaser without being made public in any way. The difficulty was evidently before the author of this act, and the artist's term was made his life and seven years after his death without any alternative. This term applies equally to photographers. Perhaps no bill which ever passed through parliament ostensibly for the purpose of benefiting a certain set of people has failed so completely as has this bill to accomplish its end. It started by proposing to give copyright to authors of paintings, drawings and photographs, and it would seem that no difficulty ought to have arisen as to whom such copyright should rightly belong; but the following clause of the act has introduced confusion into the question of ownership:—

Provided that when any painting, or drawing, or the negative of any photograph, shall for the first time after the passing of this act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or valuable consideration, the person so selling or disposing of, or making or executing the same, shall not retain the copyright thereof unless it be expressly reserved to him by agreement in writing, signed at or before the time of such sale or disposition, by the vendee or assignee of such painting or drawing, or such negative of a photograph, or by the person on whose behalf the same shall be so made or executed; but the copyright shall belong to the vendee or assignee of such painting or drawing, or such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to such copyright unless at or before the time of such sale or disposition an agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorized, shall have been made to that effect.

That is to say, after promising the author copyright in his work for life and seven years, the act stipulates that in order to get it the author must, at the time of the first sale or disposition of his picture, obtain a document in writing from the purchaser of the picture, reserving the copyright to the author, and the act goes on to say that if he does not take this step the copyright becomes the property of the purchaser of the picture, but with the proviso, in order to secure it to him, he must have a document signed by the artist assigning the copyright to him; but if neither of these things is done, and no document is signed, the copyright does not belong to either the artist who sells or the client who buys, and the act is silent as to whom it does belong to. It has disappeared and belongs to no one. There is no copyright existing in the work for any one. It has passed into the public domain, and any one who can get access to the work may reproduce it. Now, as most purchases are made from the walls of exhibitions, in ninety-nine cases out of a hundred the copyright is absolutely lost. And where the sale is arranged directly between the artist and his client, the difficulty experienced by the artist in raising the question as to whom the copyright shall belong to is so great, owing to the dread lest the mere mention of the signing of a document should cause the selling of the picture to fall through, that in numerous such cases the copyright lapses and becomes public property. Photographers are not affected by this clause, because

they do not as a rule sell the negatives they produce, and with them the copyright lies in the negative. They carry on their trade in prints without the question of the negative arising. The picture-dealer, also, who buys a picture and copyright is not subjected to the same disability as the painter. The picture-dealer can sell a picture without saying a word to his client as to the copyright, which he, nevertheless, retains intact; the provision is applicable only to the *first* sale of the work, which, therefore, throws the whole of the disability upon the painter.

The act gives the copyright of every work executed on commission to the person by whom it is commissioned. It makes it compulsory upon every owner of a copyright that he should register it at Stationers' Hall before he can take any action at law to protect it. The copyright does not lapse if unregistered, but so long as it remains unregistered no action at law can be taken on account of any infringement. A copyright can be registered at any time, even after an infringement, but the owner of the copyright cannot recover for any infringement before registration. The act provides for both penalties and damages in the following cases:—(1) For infringing copyright in the ordinary way by issuing unlawful copies. (2) For fraudulently signing or affixing a fraudulent signature to a work of art. (3) For fraudulently dealing with a work so signed. (4) For fraudulently putting forth a copy of a work of art, whether there be copyright in it or no, as the original work of the artist. (5) For altering, adding to, or taking away from a work during the lifetime of the author if it is signed, and putting it forth as the unaltered work of the author. (6) For importing pirated works.

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The incongruities of this act were so apparent that its promoters desired to stop it, feeling that it would be better to have no bill at all than one which conferred so little upon the people it was intended to benefit; but Lord Westbury, the lord chancellor, who had charge of the bill in the House of Lords, advised them to let it go through with all its imperfections, that they might get the right of the painter to protection recognized. This advice was followed, and the bill had no sooner become law than a fresh effort was started to have it amended. Year by year the agitation went on, with the exception only of a period when Irish affairs took up all the attention of parliament, and domestic legislation was rendered impossible. But in 1898 the Copyright Association of Great Britain promoted a bill, which was introduced into the House of Lords by Lord Herschell. It was a measure designed to deal with all forms of copyright—literary, musical, dramatic and artistic—and was remitted by the House of Lords for consideration to a committee, which, having sat for three sessions, decided not to proceed with Lord Herschell's measure, but to treat literature and art in separate bills. It had under its consideration an artistic bill, drafted for and presented by the Royal Academy, and a literary bill and an artistic bill drafted by the committee itself. The main proposals in the latter were to give copyright to the author of any artistic work or photograph for a period of life and thirty years, unless the work be commissioned, in which case the copyright was to be the property of the employer, except in the case of sculpture intended to be placed in a street or public place. The bill provided summary remedies for dealing with pirated works. It omitted altogether any reference to registration, and it provided for international copyright.

22. To sum up the position of artistic copyright in 1909, we find five British acts, three dealing with engraving, one with sculpture, and one with painting, drawing and photography, and between them very little relation. We have three terms of duration of copyright—28 years for engraving, 14 for sculpture, with a second 14 if the artist be alive at the end of the first, life and 7 years for painting, drawing or photography. There are two different relations of the artist to his copyright. The sculptor's right to sell his work and retain his copyright has never been questioned so long as he signs and dates it. The painter's copyright is made to depend upon the signing of a document by the purchaser of his work. The engraver and the sculptor are not required to register; but the author's name, and the date of putting forth or publishing, must appear on his work. The painter cannot protect his copyright without registration, but this registration as it is now required is merely a pitfall for the unwary. Designed to give the public information as to the ownership and duration of copyrights, the uncertainty of its operation results in the prevention of information on these very points.

The Berlin Convention of 1908 led to the appointment of a British committee to deal with its recommendations, and their report in 1909 foreshadowed important changes in the law both of literary and of artistic copyright, whenever Parliament should give its attention seriously to the subject.

Difficult and complicated as is the whole subject of artistic copyright, it is perhaps not to be wondered at that ignorance of the law on the subject is very widespread, even amongst those who are most interested in its action. One of the commonest beliefs

**Practical difficulties.**

amongst artists is, that all they have to do to secure copyright is to register a picture at Stationers' Hall; but the authorities at Stationers' Hall ask no questions, and simply enter any particulars submitted to them on their printed form. Some artists make a practice, when they send a picture away to exhibition, to fill up one of these forms, reserving the copyright by their entry to themselves, in the belief that, if accompanied by the fee required by the Hall, its entry will reserve the copyright to them, oblivious of the fact that the only thing which can reserve the copyright to them is the possession of a document assigning the copyright to them by the purchaser of the picture. Another useless method of attempting to reserve artists' copyrights is that adopted by the promoters of public exhibitions, with whom it is an almost constant practice to print on some portion of the catalogue of the exhibition a statement that "copyrights of all pictures are reserved," the impression apparently prevailing that a notice of this kind effectively reserves the copyright for the artist while selling his picture from the walls. It, of course, does no such thing, and the copyright of any picture sold in these circumstances, without the necessary document from the purchaser, must be lost to the artist, and pass irrevocably into the public domain.

In a work of art the work itself and the copyright are two totally distinct properties, and may be held by different persons. The conditions differ materially from those of a work of literature, in which as a rule there is no value apart from publication. There is a value in a work of art for its private enjoyment quite apart from its commercial value in the form of reproductions; but when the two properties exist in different hands, the person holding the copyright has no power to force the owner of the work of art to give him access to it for purposes of reproduction; this can only be effected by private arrangement. It has been argued that, as the two properties are so distinct, the owner of the copyright ought to have the right of access to the picture for the purpose of exercising his right to reproduce it. But it is easy to see that it would destroy the value of art property if proprietors knew that at any moment they might be forced to surrender their work for the purpose of reproduction, though for a time only.

There is often a strong sympathy between the artist and the person who buys his picture, and it is not at all unusual, when application is made to the owner of the picture for access to it, for him to submit the question of reproduction to the artist. Although the latter may really have no right in it, it is felt, as a practical matter, that he is largely interested in the character of the reproduction it is proposed to make. Hence the courtesy which is usually extended to him.

Owing also to the increased facilities of reproduction, the practice has become very common of splitting up copyrights and granting licences in what may be described as very minute forms. It would, of course, be impossible for a publisher to pay an artist the sum at which he values his entire copyright, simply that he might reproduce his picture in the form of a black-and-white block in a magazine, and it has consequently become quite common for the artist to grant a licence for any and every particular form of reproduction as it may be required, so that he may grant the right of reproduction in one particular form in one particular publication, and even for a particular period of time, reserving to himself thus the right to grant similar licences to other publishers. This is apparently not to the injury of the artist; it is probably to his advantage, and it certainly promotes business.

23. The great obstacle in the way of securing a really good Artistic Bill has been the introduction into it of photography. It was by a sort of accident that the photographer was given the same privileges as the painter in the bill of 1862. The promoters of the bill thought that the photographer would be protected by the Engraving Acts which covered prints; but since the photographers feared that, as their prints were of a different character from the prints from a plate, the Engraving Acts might not protect them, it was at the last moment decided to put photography into the Art Bill. The result of this was that the painter lost his chance of copyright on all works executed on commission. Legislators feared that if photographers held copyright in all their works the public would have no protection from the annoyance of seeing the photographs of their wives and daughters exhibited and sold in shop windows by the side of "professional beauties" and other people, and made articles of commerce. So in the case of commissioned works the copyright was denied to both painters and photographers.

The royal commission which reported on the subject in 1878 proposed two distinct terms of copyright for painting and photography. The term for the painter was dependent on his life; that for the photographer was a definitely fixed term of years from the date of publication of his photographs; and there can be little doubt that this is the right way to deal with the two branches of copyright. The artist who paints a picture signs it, and there is no

difficulty in knowing who is the author of a painting and in whom the term of copyright is vested. In a very large number of cases a photograph is taken by an employee, who is here to-day and gone to-morrow, and even his employer knows nothing of his existence. Of course, it may suit an employer to be able to maintain secrecy as to the authorship of his negative, inasmuch as it enables him to go on claiming copyright fees indefinitely; but it is not to the public interest. In most countries on the continent of Europe a photographer has the fixed term of five years' copyright in an original photograph dating from its publication, which date, together with the name and address of the photographer, has to be stamped on every copy issued. In the public interest this is a good method of dealing with photographs.

24. The "authorship" of a photograph has been much debated in the law courts; and "author" was defined in *Nollage v. Jackson* (1883) as "the man who really represents or creates, or gives to ideas, or fancy, or imagination, true local habitation—the man in fact who is most nearly the effective cause of the representation" (*per* Lord Justice Bowen). He is not necessarily the owner of the camera, or the proprietor of the business; it depends on the circumstances. He is essentially the person who groups and effectively superintends the picture. When a photographer takes a portrait without fee, the copyright vests in him and not in the sitter, who cannot prevent its publication; but if the photograph is commissioned and paid for by the sitter the copyright—in the absence of contrary stipulations—vests in him, and he can restrain exhibition or multiplication of copies; "the bargain includes, by implication, an agreement that the prints taken from the negative are to be appropriated to the use of the customer only" (Mr Justice North in *Pollard v. Photographic Co.*, 1888). And this applies even when the sitter is not the actual purchaser of the negative (*Boucas v. Cooke*, 1903). But in several cases the "celebrity" who has *sat* to a photographer at his request and without payment has not been allowed to distribute his photograph to newspapers for reproduction without the photographer's consent. The fact that a sitter pays the photographer for prints, though he has not commissioned the sitting, would not vest the copyright in him.

25. The "Living Pictures" case in 1894 (*Hanfstångel v. Empire Palace*) was a curious one. The Empire music-hall in London produced some *tableaux vivants*, representing certain pictures, of which Messrs Hanfstångel owned the copyright, and an action was brought by them for an injunction. The courts of chancery and of appeal decided against the plaintiffs, on the ground that a reproduction of a painting must be by a painting or something cognate; but in an action for infringement, though the view already given was confirmed, the plaintiffs succeeded so far as the backgrounds to the grouping were concerned. Meanwhile two newspapers had published sketches of the same *tableaux vivants*, and Messrs Hanfstångel brought actions for infringement (*Hanfstångel v. Newnes*, and *v. Baines*, 1894). Mr Justice Stirling found for the plaintiffs, but on appeal, and finally in the House of Lords, this decision was reversed.

26. *Copyright in Designs*.—An act of 1787 first gave protection to printed designs on linen and cotton fabrics; and in 1839 a further act included designs on animal fabrics, or mixed animal and vegetable fabrics; while in the same year another act protected **Designs.** designs for manufactured articles. These acts had been preceded in France by laws of 1737 and 1744 creating a property by law in manufacturers' designs. The British law, which in various acts established a copyright (a) in ornamental and (b) useful designs, was in 1883 consolidated in the Patents, Designs and Trade Marks Act, with amending acts up to 1888; and these acts were further consolidated and amended by an act of 1905. See [TRADE-MARKS](#) and [PATENTS](#).

#### BRITISH IMPERIAL COPYRIGHT BILL OF 1910

The consolidation of the British copyright law, not only in the United Kingdom but in the Dominions, and its amendment so as to include the recommendations of the Berlin International Convention of 1908, were the objects of a government bill introduced into parliament by the president of the Board of Trade on the 26th of July 1910, discussion on which was reserved for a later period in the year. The passing of this bill, though the date of it was uncertain owing to the peculiar circumstances of English politics at the moment, was practically assured by the facts that, apart altogether from the crying need for a revision of the English law, the draft had previously been considered and accepted, not only by a Board of Trade Committee which reported unanimously in favour of the recommendations of the Berlin Convention, but also by an Imperial Conference. The bill for the first time brought British copyright entirely under statutory law and consolidated and amended all previous enactments; it adopted the suggestions of the Imperial Conference (attended by

representatives of Canada, Australia, South Africa, New Zealand and Newfoundland, other interests being covered by home representatives of the Foreign Office, India Office, Colonial Office and Board of Trade) as to providing for its extension by their declaration to the Dominions; and with its enactment a great simplification of the British law of copyright came in sight, though for historical reasons the details given above of the law as unamended must still remain of value.

Briefly, the new points of importance, apart from the placing of all copyright on a purely statutory basis and the inclusion of literary and artistic copyright within one arrangement, were as follows. All compulsory formalities of registration were abolished. The length of the period for which copyright lasted was extended to the life of the author and 50 years after. This reform was qualified, however, by a clause intended to protect the public from its abuse, and providing that after the author's death, if the work was withheld from the public or published at too high a price, or if the reasonable requirements of the public were not satisfied, a licence might be granted to publish or perform it. These changes applied to all the subject-matters of copyright, which were now put on the same level and treated uniformly. In certain cases, already discussed above, protection was extended: *e.g.* translations and lectures, original adaptations and arrangements, works of artistic novelty, including architectural designs; and the right to dramatize a novel or "novelize" a drama was conferred in each case on the author. Musical works were protected against unauthorized reproduction by mechanical means without payment; but protection was also extended to the mechanical record when authorized.

In including all sorts of intellectual product the bill followed the recommendation (resolution 6) of the Imperial Conference as to the definition of copyright (Parl. Paper Cd. 5272): "the Conference is of opinion that, subject to proper qualifications, copyright should include the sole right to produce or reproduce a work, or any substantial part thereof, in any material form whatsoever and in any language, to perform, or in the case of a lecture, to deliver, the work or any substantial part thereof in public, and, if the work is unpublished, to publish the work, and should include the sole right to dramatize novels and vice versa, and to make records, &c., by means of which a work may be mechanically performed." As to architecture and artistic crafts the Conference recommended (resolution 9) that "an original work of art should not lose the protection of artistic copyright solely because it consists of, or is embodied in, a work of architecture or craftsmanship; but it should be clearly understood that such protection is confined to its artistic form and does not extend to the processes or methods of reproduction, or to an industrial design capable of registration under the law relating to designs and destined to be multiplied by way of manufacture or trade."

As to the application of the new period of copyright to existing works, the Conference recommended (resolution 10) "that existing works in which copyright actually subsists at the commencement of the new act (but no others) should enjoy, subject to existing rights, the same protection as future works, but the benefit of any extension of terms should belong to the author of the work, subject, in the case where he has assigned his existing rights, to a power on the part of the assignee at his option either to purchase the full benefit of the copyright during the extended term, or, without acquiring the full copyright, to continue to publish the work on payment of royalties, the payment in either case to be fixed by arbitration if necessary."

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The Conference was also of opinion (resolution 4a) that, under the new Imperial Act, copyright should subsist only in works of which the author was a British subject or bona fide resident in one of the parts of the British Empire to which it extended; and that copyright should cease if the work were first published elsewhere than in such parts of the Empire.

The sensible basis on which the new bill was framed, and the authority it represented, commended it, in spite of many controversial points, to the acceptance both of the public and of the various parties concerned. But nobody who had ever wrestled with all the difficulties of international copyright, as complicated by the law in the United States, would suppose that it was the last word on the subject. What the bill did was to bring British legislation into better shape, and to amend it on certain points which had worked unjustly. The great distinction between the requirements for British and for American copyright still remained, namely, the American manufacturing clause. Perhaps the most notable innovation was the clause enabling a licence to be granted for the publication of a copyright work where the owners of the copyright had not exercised it for the "reasonable requirements" of the public. Some such clause was clearly called for when the period of monopoly was being extended; but the interpretation to be put upon the occasions which would justify such interference might well be difficult. It may perhaps be suggested that this innovation



pointed to a reconsideration of the true relations of “publishers” and “authors” (in the widest sense) in respect of copyright, which sooner or later might be approached from a different point of view. The new clause was intended for the protection of the public from the mishandling of an author’s work after his death, while greater protection was given him during his life. From a purely business point of view, the question might well be whether a publisher or other party not the author should have a copyright at all, and whether equity would not be satisfied if copyright vested solely in the author and his family, with liberty to any one to “publish” on fair terms, consideration being had to an original publisher’s reasonable claims and existing contracts. The advisability of any such advance on the principle now asserted must depend rather on experience of actual business and the working of the clause; but even under the procedure provided by the bill of 1910 it would equally be imperative for a publisher who owned a deceased author’s copyright to show that he had given or was giving the public valuable consideration for his monopoly, in order to uphold it against any one willing, on payment of a reasonable royalty, to serve the public better.

AUTHORITIES.—For special points see W. A. Copinger’s *The Law of Copyright in Works of Literature and Art*, 4th ed., by J. M. Easton (1904); or T. E. Scrutton’s *Law of Copyright* (3rd ed., 1896). See also E. J. MacGillivray, *A Treatise on the Law of Copyright* (1902); Richard Winslow, M.A., LL.B., *The Law of Artistic Copyright* (London, 1889); A. Birrell, *Copyright in Books* (London, 1899); B. A. Cohen, *Law of Copyright* (London, 1896); L. Edmunds, *Copyright in Designs* (London, 1908); Knox and Hind, *Copyright in Designs* (London, 1899); W. Briggs, *Law of International Copyright* (1906); W. M. Colles and H. Hardy, *Playright and Copyright in all Countries* (1906).

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