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Title: Scientific Studies; or, Practical, in Contrast with Chimerical Pursuits

Author: Henry Dircks

Release date: September 28, 2013 [EBook #43841]

Language: English

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CONTRAST WITH CHIMERICAL PURSUITS ***

Transcriber's Notes

Changes to the text (in the case of corrections to typographical errors) are listed at [the end of the book](#).

On page [45](#), in the reference "Beccheri's Physica Subterranea, Lipsiæ, 1738 (with supplement), 8vo., 1681-80;", no satisfactory explanation of "1681-80" has been found. Note that the publication date of Physica Subterranea is 1669.

On pages [83](#) & [84](#) in the explanation of Plate III, a single quote is used to denote the decimal point: this convention has been retained.



**EDWARD SOMERSET, SIXTH
EARL AND SECOND MARQUIS
OF WORCESTER.**

From a Bust by Mr. James Loft, Sculptor, exhibited at the Royal Academy, 1867; and now in the Sculpture Gallery of the Crystal Palace, Sydenham.

**SCIENTIFIC STUDIES:
OR**

PRACTICAL, IN CONTRAST WITH CHIMERICAL PURSUITS; EXEMPLIFIED IN TWO POPULAR LECTURES.

I.

THE LIFE OF EDWARD SOMERSET,
SECOND
MARQUIS OF WORCESTER,
INVENTOR OF THE STEAM ENGINE.

II.

CHIMERAS OF SCIENCE:
ASTROLOGY, ALCHEMY, SQUARING THE CIRCLE,
PERPETUUM MOBILE, ETC.
With Illustrative Diagrams.

BY

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LONDON:

E. & F. N. SPON, 48, CHARING CROSS, S.W.
1879.

INTRODUCTION.

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It forms a necessary part of popular lectures that they should possess breadth with brevity, and interest without too great profundity. It is possible to see a large extent of country from a lofty tower without being cognizant of every blade of grass, the perfume of blossoms, or the notes of the sweetest songsters of the groves. In like manner the popular lecturer has to present only so much to the eye of the mind as will give the prominent features of his theme, omitting those details over which the scholar, or the true lover of his subject, dwells with the affection of a fond parent over a darling child.

We must look with astonishment at a man of noble birth, who in a period of civil commotion, with a monarch for his friend, and a court at his command, secluded himself during his youth in a stately ancient tower, engaged in abstruse studies and wonderful mechanical operations; and who, late in life, amidst the terrors of civil war was found turning his inventive faculties, like another Archimedes, to the construction of means of defence, and terrible weapons of offence. But it is only those who become immersed in studies, whether of theology, philosophy, or kindred mental pursuits, who can appreciate the growing appetite for what appears to unlettered men as the driest of all dry occupations. The mere pleasure-seeker knows not how much is lost, and how little is gained by sharing the most brilliant gaieties of fashionable life.

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Look at the ancient astrologers, whose pursuits were once as pure and noble as those of modern astronomers. Amidst wild theories, superstitious beliefs, empirical systems, and pagan divination, a rupture became inevitable: one side adopted stellary divination or Astrology, the other Astronomy, or the simple and true study of the stars.

Whatever a man's intellectual pursuits may be, he has the advantage over the mere man of fashion of being engaged in employments which the longest life cannot exhaust.

But intellectual pursuits partake either of the negative or the positive; they are useful or useless, and when useless they fritter away and render nugatory the talent that might have been better employed.

The Marquis of Worcester affords an eminent example of genius of a high order, grandly and effectively directed towards the advancement of man's political and social position. His contemporary, Dr. John Dee, the Astrologer, together with his friend Kelly, the Alchemist, may be appropriately distinguished as representing a class chimerically inclined, and hurtful to the well-being of society; while a less eminent and less blameable section of chimerical labourers are those of whom the worst we can say is, that they waste much valuable time, energy, and fortune, through attaching themselves to mathematics, mechanics, and other learned pursuits, only in search of marvellous, instead of useful applications.

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All chimeras are built on assumptions, and so far are "castles in the air;" in many forms they are

simply ridiculous; but when they pretend to the supernatural they are pernicious and often wicked.

In the two lectures now presented for his perusal, the reader will find both these topics illustrated by suitable lives and authentic evidence.

H. D.

London, February, 1869.

I.

Lecture
ON
THE LIFE OF EDWARD SOMERSET,
SECOND
MARQUIS OF WORCESTER.

"He was a man, take him for all in all,
We shall not look upon his like again."

DELIVERED AT
THE LITERARY INSTITUTION, GREENWICH,
16TH FEBRUARY, 1864.

LECTURE I.

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The Biographer of Edward, second MARQUIS OF WORCESTER, naturally finds some difficulty in rendering prominent the political position that nobleman enjoyed in the 17th century; or of impressing the minds of his hearers or readers with a just sense of the wonderful genius of the author of the "Century of Inventions," even although the fact be established of that remarkable man being also the true and first inventor of a veritable steam engine.

When we consider the eventful period in which he lived, (from 1601 to 1667,) and his personal character, together with the social, political, and romantic incidents of his life, the career of the Marquis of Worcester cannot fail to interest and instruct us. He was at once the most fortunate and unfortunate of men, living in times of mingled enlightenment, superstition, and civil discord, and finally finding himself cast on the tender mercies of a corrupt Court; the possessor of a high order of mechanical genius, yet proscribed politically and theologically; most loyal, yet falling the victim of puritanism; and closing his life neglected by a Sovereign whose father had been the chief ruin of his patrimony.

Descended from the Plantagenets, Edward Somerset, second MARQUIS OF WORCESTER, is supposed to have been born about, or soon after 1601, the records to establish his natal year being wanting. His father, Henry Somerset, created first Marquis of Worcester by Charles I., was married on the 16th June, 1600, at Blackfriars; Queen Elizabeth, attending in great state, graciously danced at the wedding ball; and the festivities of the occasion were continued for three days.

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We obtain little information respecting the Marquis of Worcester until about the twenty-seventh year of his age, when he married Elizabeth, daughter of Sir William Dormer, eldest son of Lord Dormer of Weng, and sister of Robert, Earl of Carnarvon. It is not known where he was educated, but it was certainly neither at Oxford nor Cambridge. Mention is made of his preceptor, Mr. Adams, at Raglan Castle, the baronial seat of the lords of Raglan, in Monmouthshire. There is every probability, however, that he finished his education at some foreign university. His son and heir, Henry, born in 1629, was created by Charles II. the first Duke of Beaufort, and from him the present Duke of Beaufort is the eighth of that rank in lineal descent.

It was during the first or second year of his married life that he engaged the services of Caspar Kaltoff, whom he employed as a practical assistant, to work out his numerous mechanical experiments, and whom he extols as an "unparalleled workman, both for trust and skill."^[1] There are still to be seen on one side of the Keep—or citadel of Raglan Castle, the remains of grooves in the wall, probably for the insertion of large metal pipes, in some way or other connected with the waterworks which are known to have been erected there, and which were most likely carried out by Kaltoff, under his master's directions.

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Becoming a widower in 1635, his lordship married in 1639, his second wife, Margaret, second daughter and co-heir of Henry O'Brien, Earl of Thomond.

It must have been about this period of his life that the Marquis of Worcester made one of his most singular and perplexing mechanical experiments, which he exhibited at the Tower before Charles I., several of his Court, some foreign ambassadors, and the lieutenant of that fortress. As he names Sir William Balfour (who held the latter appointment from 1630 to 1641) we can arrive at an approximate date. The mechanical surprise which he states he thus presented to gratify his royal master, was no other than a gigantic wheel, 14 feet in diameter, weighted with 40 weights of 50 lbs. each, equal to 2000 lbs., by means of which we are left to infer that the wheel maintained a rotatory motion, without assistance from any external aid whatever; that it was in

fact, a realization of that long sought for curiosity—perpetual motion. As he wrote deliberately a statement of this circumstance fifteen years later, or more, which he afterwards printed, we are left without any grounds to suppose otherwise than that he deceived himself, or was deceived, from interested motives, by persons in his employment. The circumstance is scarcely worth notice except as a singular proof that such a hallucination could exist in the mind of the same genius that perfected the first practical steam-engine. We can only say that if the mystery could be cleared up, although it would be of little or no value to mathematics or mechanics, it would go far to elevate the scientific character of the Marquis, though he was not the only celebrity of his time infatuated with a thorough belief in the possibility of solving the paradox.

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The Marquis of Worcester, born at the close of Queen Elizabeth's reign, is not mentioned as appearing at the Court of James I; his courtier life most likely commenced later, in the reign of Charles I, who was about his own age, and with whose career, the fortunes of both the Marquis of Worcester, and his father, family, and friends, were unhappily but too intimately interwoven.

It requires a visit to Raglan Castle fully to realise the grandeur, nobleness, and strength of that romantically situated, and almost regal stronghold. It wears all the solemnity that antiquity can bestow, it is so gothic, so solid, and embowered, as it were, in a constant dubious shade. Then it is so extensive in its bounds, its apartments are so capacious, and its massy walls so lofty and so finely chiseled and proportioned, that when we consider there is no quarry within any reasonable distance, nor any river or stream for conveyance, the whole structure assumes the mystery of absolute romance. Its historic associations also rivet the attention of every beholder who is acquainted with the part it played in determining the fate of that great struggle between the Crown and the Parliament, which commenced in 1640, and ended with the establishment of a Commonwealth.

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The county of Monmouth is eminently distinguished for its scenery, its green hills and dales presenting a beautifully wooded and highly picturesque landscape from every point of view. The village of Raglan is a small unpretending hamlet, principally remarkable for its parish church, which contains the chapel of the Beauforts, the resting place of several members of the Somerset family. Peering above lofty neighbouring trees, the Donjon, Keep, or Citadel of Raglan Castle is a conspicuous object; itself very lofty and standing on a considerable eminence, it commands a most delightful and extensive panoramic view of the surrounding country in that fertile district.

The Castle may be described as consisting of two portions, distinguished by two courts and two fortified arched entrances. The grand entrance, between two hexagonal towers, leads to the paved court, with the closet tower or library to the right, a withdrawing or ball-room overhead, and a banqueting or stately hall to the left, which last apartment attracts much notice from its great size and remarkable state of preservation. Externally situated is the Citadel or Tower of Gwent, surrounded with a broad moat over which there appears to have been a drawbridge on one side, and on the other, adjoining the castle a permanent stone bridge.

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During his youth, the Marquis of Worcester, as Lord Herbert, resided at the Castle, and may have had his laboratory, workshop, and study conveniently situated in the Citadel; at all events, in connection with his early career, the ruined remains of the family mansion cannot be visited without intense interest. His father was a noble minded, hearty, generous man, living in princely state; an extensive and wealthy landed proprietor, and in case of need capable of defending his Citadel against any foe whatever. This last necessity made itself conspicuous between the years 1640 and 1641, when the civil war broke out. After the fatal battle of Naseby, 14th June, 1645, Charles I. three times rested at the Castle, staying there in all twenty-seven days. The strength of that fortress enabled it to resist the Parliamentary arms longer than any other stronghold—its surrender following very shortly after that of Pendennis Castle.

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When civil war was raging in this country, when King and Parliament were in opposition, when Puritan, Protestant, and Papist sought for mastery, when cavaliers met roundheads in mortal conflict, and every man stood in fear of his neighbour, the Marquis of Worcester could no longer remain a mere student of mechanism and of mathematical problems: if like Archimedes in one sense, he was now seen, unlike him, buckling on his armour, raising troops, and doffing the student's gown to become the soldier. Alas! his military career forms no brilliant page in the annals of his country's history. He was essentially neither a statesman, nor a military man. He was bold, courageous, and energetic, but he could neither be fierce nor ferocious on occasion. He tampered with opponents, lost means of surprise, and was ever being tricked by the cunning and chicanery of adversaries not over-scrupulous in their promises or proceedings. His very goodness of heart, urbanity and uprightness were the sources of his utter ruin. Himself incapable of deceit, he was perpetually being made the victim of it: those who appeared his assured friends, and had every reason to be so, proving in any emergency shallow, empty, and worthless. Flattered by Charles I. he became instrumental in assisting that Prince from his parent's private fortune; and when that was exhausted, the King sapped the property of the son, repaying both with titles, promises, and valueless bonds. He created the Marquis of Worcester Earl of Glamorgan, during his father's life-time; and, inducing him to raise Irish troops to fight against English subjects, he completed the Earl's ruin; for, that untoward enterprise failing, and being followed by the fall of Raglan Castle, and the victories of the Cromwellian army, the Marquis of Worcester had to quit his native land to seek refuge, with many other political refugees, at the Court of France. His wife, who had been residing at Raglan Castle, obtained leave from the Parliament in 1646 to flee to Paris, where the Marquis also arrived in 1648.

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The Marquis was proscribed both as a Papist and a rebel. Throughout his political career the religion of his father and himself had made many weak-minded men their enemies; but that his loyalty should be considered rebellion was nothing more than might be expected from the

dominant party of those troubled times: although undoubtedly the result of that great moral earthquake benefited our nation.

His only son, Henry, sat in the Cromwellian Parliament, and this fact may, in part, explain the circumstance that most probably induced the Marquis of Worcester to visit London in 1652; for he must have been well-advised before committing such an apparently rash act. He was immediately incarcerated in the Tower, from which he was released in two years and a quarter, no doubt on his parole, as in 1655 a warrant was signed by Cromwell to pay the Marquis of Worcester the sum of *three pounds per week* for his maintenance.

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He was utterly beggared; what was he to do? It seems to have occurred to him to turn his mechanical ingenuity to account, the Pretender's monetary consideration being insufficient for the purpose intended. This high-minded nobleman in the same year wrote his remarkable "Century of Inventions," although it was not printed until eight years afterwards. The title-page declared its production to have been "at the instance of a powerful friend," who was, as we have reason to think, no other than Colonel Christopher Copley, or Copley, who had served in the Parliamentary army of the North, under the command of General Fairfax; for agreements were drawn up between them to secure a participation in any benefits arising from introducing the steam engine, or water-commanding engine, as it was then called.

It is not to the historic page, but to the calm unobtrusive volumes of scientific record, that we must turn to be enlightened with respect to the mental and mechanical achievements of the Marquis of Worcester; and we must at the same time not overlook the fact, that many branches of science were, in his day, but just emerging from that thralldom of empiricism, which had for centuries clouded every department of philosophical research.

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The Marquis of Worcester was so essentially a scientific, and not a literary man, that Horace Walpole acted most inconsistently in classing him among his *Royal and Noble Authors*. That brilliant cynic, however, had a purpose to serve, and although he found in the Marquis a vein of pursuit of which he was totally ignorant, he presumed to criticise the "Century," and to question its author's veracity; a charge which, if established, even in a minor degree, would serve a political purpose, by proving the Marquis to be unreliable in other respects, and thus weakening his authority in religion and politics. But the dilettante Walpole, a connoisseur in paintings and works of *vertu*, was, in matters of science, more ignorant of the Marquis of Worcester's worth, than was the equally satirical Voltaire of Shakspeare's genius. Hume, the historian, attracted by the sparkling wit of Walpole, adopted without examination, his plausible criticism, unconscious of its superficiality and absolute untruthfulness in every respect.

We would here notice the probable cause of the Marquis's indefatigable study of, and attention to, practical mechanics. As in the time of Charles II., so also during the reign of his father, there is reason to believe that some distinguished public officer was appointed to superintend Government works connected with the army and navy, and that they were situated at Vauxhall. It was probably a department similar to that held in 1661, by Sir Samuel Morland, designated Master of Mechanics. Otherwise how are we to account for the Marquis of Worcester's devoting his time, his energies, and his very fortune to inventions affecting mechanical appliances generally, and particularly to those connected with naval and military affairs, and hydraulic engines?

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One of his inventions (No. 56) he exhibited to Charles I. at the Tower, and of another (No. 64) being an improvement in fire-arms, he observes it was "tried and approved before the King (Charles I.), and an hundred Lords and Commons." Then his great invention, the "Water-commanding Engine," was set up at Vauxhall in 1663, where it was certainly at work in 1667, or probably three years later. All these circumstances wear the aspect of royal patronage, of public employment, and of the possession of influence suitable to the holder of a dignified position.

This view of the high and honourable public official position held by the Marquis is also borne out by the petition of William Lambert, about 1664, to be found in the State Paper Office. It was addressed to Charles II. and sets forth:—"That your petitioner was founder to his late Majesty of blessed memory, in Vauxhall, under the Marquis of Worcester, for gun and water-work, or any other thing founded in brass." Nothing surely can be more certain than that the Marquis's was a public situation, and his "Century" affords ample evidence of his aptitude in *that* respect for the post which he filled; nor can we better account for his numerous improvements in fire-arms, cannon, sailing vessels, fortifications, and embankments.

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His "Century of Inventions" is the mere syllabus or outline of a proposed larger work, for he concludes with the statement of his—"meaning to leave to posterity a book, wherein under each of these heads the means to put in execution and visible trial all and every of these inventions, with the shape and form of all things belonging to them, shall be printed by brassplates,"—the usual substitute at that time for copperplates. It is most unfortunate that he did not live to complete his projected publication. But in common candour let it not be forgotten that, the promise thus placed before us was published in 1663, not long before the devastating plague, which almost depopulated the metropolis in 1665, and the terrible conflagration of 1666, which laid waste the city of London; and that it was in the midst of the accumulated calamities thus inflicted on society, that his health appears to have suddenly given way; aged, harassed, disappointed, and dismayed, he was prematurely called to his long rest on the 3rd of April, 1667; but whether he died at Vauxhall, at the family town mansion, Worcester House, in the Strand, or at some other place is unknown; so little was he understood or esteemed for his intellectual capacity at the period of the Restoration. As though it were not a sufficient infliction to be ruined, dishonoured, oppressed, and neglected while living, it would almost appear that events conspired

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to lessen, if possible, the lustre of his memory by the dark shades of apocryphal history; which ascribed the invention of the steam-engine to the pretended fact of the Marquis while in imprisonment, having seen a pot lid blown off by the expanding steam; made out against him a false case of political forgery; and, worse than all, scandalously forged a letter in Paris to make it appear that in 1641 the Marquis borrowed his idea of the steam engine from Salomon De Caus, during a visit to the Bicêtre, at Paris. The fact that this same De Caus died at Paris, and was buried in the Church of La Trinité, in February, 1626;^[2] shows how requisite it is for rogues to remember historical dates.

On the 3rd of June, in 1663, the Parliament passed an Act securing to the Marquis of Worcester the full benefit and profit of his "Water-commanding Engine," for the term of ninety-nine years. And in the same year he printed his memorable "Century," in the Dedication of which he alludes to the above Act, as one by which he feels "sufficiently rewarded."

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The "Century" is little more than a Catalogue Raisonné, although each matter of invention is as fully and intelligibly stated as was required in the Patent office specifications of the period. To give some idea of its contents, we shall enumerate only the first twenty-five. 1. Seals abundantly significant; 2. private and particular to each owner; 3. a one line cipher; 4. reduced to a point; 5. varied significantly to all the 24 letters; 6. a mute and perfect discourse by colours; 7. to hold the same by night; 8. to level cannon by night; 9. a ship-destroying engine; 10. how to be fastened from aloof and under water; 11. how to prevent both; 12. an unsinkable ship; 13. false destroying decks; 14. multiplied strength in little room; 15. a boat driving against wind and tide; 16. a sea-sailing fort; 17. a pleasant floating garden; 18. an hour-glass fountain; 19. a coach-saving engine; 20. a balance waterwork; 21. a bucket fountain; 22. an ebbing and flowing river; 23. an ebbing and flowing castle clock; 24. a strength increasing spring; and 25. a double drawing engine for weight.

We find in the "Century" that three of the articles refer to improved seals and watches; two to games; two to arithmetic and perspective; six to automata, or self-acting mechanical contrivances; no less than twenty-three to ciphers, correspondence, and signals: in short, secret writing and telegraphs; ten to useful appliances in domestic affairs; nine are wholly mechanical; upwards of thirty-two were intended for use in naval and military affairs; and thirteen, including his Water-commanding Engine, were connected with hydraulics. It is singular that he professes "to have *tried and perfected* all these," words of great import in all matters of novel invention.

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That age was fond of patronizing what we should now-a-days be disposed to call "nic-nacs." Ingenious automata, curious toys and works of art, small fountains, singing birds, and similar curiosities attracted the serious attention of the virtuosi of the 17th century; so that we need not feel surprised that the Marquis set up a speaking Brazen Head; or that it should be of gigantic proportions, for he was always regardless of cost in such matters, and was never small where he could be great in developing his resources of ingenious contrivance. Wherever it was possible, he was magnificent—fortifications, embankments, ships rowing against wind and tide, great floating baths, and gardens, large cannon, in short, he was princely in his expenditure of his private fortune on whatever he undertook to perform, whether in war or in peace. It was thus he spent, lent, and lost for his King and country £918,000. He particularly notices that he laid out on buildings and experiments at Vauxhall, the sum of £59,000. But these items are far from representing his actual expenditure, although they indicate the scale of his operations; and taken at their value two centuries back such sums manifest marvellous munificence.

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We have no certain key to any of his inventions, if we except two specimens of his cipher writing. One exists in the British Museum,^[3] and there is a deciphered letter in the Bodleian Library, Oxford.^[4]

His noblest invention, that which must for ever embalm his memory in the breasts not alone of Englishmen, but of all classes throughout the civilized world, was in operation at Vauxhall from 1663 to 1667, during his life time, and appears to have been working as late as 1670. It was ordered by the Act granted him, "that a model thereof be delivered to the Lord Treasurer or Commissioners for the Treasury for the time being, at or before the 29th of September, 1663; and to be put into the Exchequer, and kept there." And in the 98th article of the "Century," alluding to this same engine he says—"I call this a *semi*-omnipotent engine, and do intend that a model thereof be buried with me." Yet, strange to say, neither the one model nor the other, although zealously searched for, has come to light: and so little attention did this invention, notwithstanding its surprising utility, excite in the 17th century, that all the account we have of it, besides that by the inventor himself, is the briefest possible notice given by two foreign travellers, Sorbière in 1663-4, and Cosmo the third, Grand Duke of Tuscany, in 1669. It is satisfactorily ascertained, however, that upwards of seventeen persons, all living in 1663, were more or less acquainted with the Marquis's mechanical operations at Vauxhall, and must have seen the great water-engine at work, if only as a novelty, and a matter of curiosity.

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Returning to the "Century of Inventions," we find it to be a journal of the fruits of its noble author's study of mechanical philosophy for nearly forty years, so that in it we may almost trace the youth and age of his mental capacity. Viewed through a modern medium we might feel disposed to discredit the genius of a man who could contrive so many curious alphabets for secret writing as those he mentions, but such systems were extensively practised in political and private correspondence during the Civil war period to baffle the curiosity of political opponents. What may be called mechanical tricks were also much in vogue, such as singing and flying birds, artificial figures and horses, and curiously contrived watches, cabinets, locks, and keys. Unless we bear in mind the taste of the age, we shall read with surprise such an announcement as the

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following, in the 88th article in the "Century":—

"How to make a brazen or stone head, in the midst of a great field or garden, so artificial and natural, that though a man speak never so softly and even whispers into the ear thereof, it will presently open its mouth, and resolve the question in French, Latin, Welsh, Irish, or English, in good terms uttering it out of his mouth, and then shut it until the next question be asked."

No doubt the Marquis had in mind the history of the renowned Brazen Head attributed to Friar Bacon. The authors of the works on mechanical subjects published down to the 17th century, did not disdain to describe the way to manufacture automatic men, animals, and birds, with suitable joints, springs, weights, and bellows; and therefore, the Marquis did really no more than express the character of the times, without lowering his own superior intelligence. He was seeking the patronage of royalty, parliament, and the public, and if he offered occasionally such trifles as commanded the attention of the multitude, he never in the whole course of his chequered life lost sight of his more important occupations, the conceptions of a mind far in advance of that dismal and dark period. At the same time, that his age neglected to uphold applied science, and pertinaciously opposed whatever appeared to savour of innovation on time-honoured manufactures and trades, we cannot overlook the anomalous fact that it gave birth to Shakspeare, Bacon, and Milton; Sir Thomas Brown, Wallis, Hook, Newton, and Boyle, together with a brilliant constellation of luminaries who adorned every department of our general literature. Science alone stagnated, and the construction of public works was chiefly conducted by foreign aid. The establishment of the Royal Society in 1660, however, gave promise of that improvement which has steadily gone on year by year to the present day.

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We have thus before us a broad outline of the Marquis of Worcester's birth, education, studies, and scientific pursuits. His tastes and employments were not suited to a successful political or military career, at a time when the rupture between the Crown and the Parliament rendered it necessary for every man to take the side either of the Cavaliers or the Roundheads. Both father and son displayed unbounded loyalty, although professing the Roman Catholic faith. Had they, like many other noble families, adopted the policy of taking opposite courses, the family might eventually have retained estates which were forfeited when the King was deposed, and were principally enjoyed by Cromwell. Raglan Castle was demolished, all that could be carried away was sold, the strong tower or citadel was partially blown up, its ditch left dry, and all that could be most readily spoiled was mutilated, even to the marble and alabaster monuments in Raglan Church, raised to the memory of ancestors of the family. Such ruthless destruction and pillage has failed, however, to obliterate the towers, walls, arches, chambers, and numerous vaults of that once princely residence.

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From the year 1601 to 1641, (forty years of his life) was a period to which he refers as his "Golden Age" in the dedication of his "Century." While that from 1641 to 1647-8, (when he fled from Ireland to France,) was the most exciting, exhausting, and disastrous of his whole existence, and closed with utter ruin to himself and his family. He had then living his second wife, Henry, his son and heir, and two daughters. The family town mansion, Worcester House in the Strand, partly used as a State Paper Office, was eventually granted to the Marchioness of Worcester for her residence. The wearisomeness and distress attendant on his residence as a refugee in France during four years, was embittered by above two years imprisonment in the Tower, the result of his venturing to revisit London while proscribed by the Parliament as "an enemy and traitor to the Commonwealth," all such being threatened that they shall "die without mercy, whenever they shall be found within the limits of this nation." Burton, in his interesting Diary of Oliver Cromwell's Parliament, says in reference to the case of the Marquis on this occasion:—"It was urged he was an old man, had lain long in prison, and the small-pox then raging under the same roof where he lay; and he had not, as was said, done any actions of hostility, but only as a soldier; and in that capacity had always shown civilities to the English prisoners and Protestants. It was therefore ordered that he should be bailed out of prison." He was probably then about fifty-three years of age, but so harassed and so worn down by fatigue that he might well appear to be a prematurely "old man." He was not, however, too old to write his "Century" in 1655, and to re-write and publish it in 1663; to apply for and obtain an Act of Parliament for his great invention of a steam water-raising engine; and to get a working engine set up at Vauxhall, and project a public company for obtaining funds sufficient to extend its utility to the supply of towns, and canals, and for draining mines and marsh lands.

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The Marquis of Worcester was sincerely impressed with the capabilities and great value of his invention; and it affords a striking proof of his high estimation and correct knowledge of the magnitude of his discovery, that he should have bowed himself before his Maker in humble adoration, acknowledging in a solemnly sublime strain his sense of obligation to the Supreme Source of all intelligence, for permitting him to become instrumental in the development of so great a mystery of nature. It is so short and significant that no apology can be required for quoting it entire:

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"The Lord Marquis of Worcester's ejaculatory and extemporary thanksgiving prayer when first with his corporal eyes, he did see finished a perfect trial of his Water-commanding Engine, delightful and useful to whomsoever hath in recommendation either knowledge, profit, or pleasure.

"Oh! infinitely omnipotent God whose mercies are fathomless, and whose knowledge is immense and inexhaustible, next to my creation and redemption I render Thee most humble thanks even from the very bottom of my heart and bowels, for thy vouchsafing me (the meanest in understanding), an insight in so great a secret of nature beneficial to all mankind, as this my Water-commanding Engine. Suffer me not to be puffed up, O Lord, by the knowing of it, and

many more rare and unheard of, yea unparalleled inventions, trials, and experiments, but humble my haughty heart, by the true knowledge of my own ignorant, weak, and unworthy nature, prone to all evil. O most merciful Father, my Creator, most compassionating Son, my Redeemer, and Holiest of Spirits, the Sanctifier, three Divine persons and one God! grant me a further concurring grace with fortitude to take hold of thy goodness, to the end that whatever I do, unanimously and courageously to serve my king and country, to disabuse, rectify, and convert my undeserved, yet wilfully incredulous enemies, to reimburse thankfully my creditors, to remunerate my benefactors, to re-encourage my distressed family, and with complacency to gratify my suffering and confiding friends may, void of vanity or self-ends, only be directed to thy honour and glory everlastingly. Amen."

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Judging of the Marquis of Worcester's personal appearance from two family portraits, one when he was probably about twenty-five years of age, by Vandyck; the other when between forty and fifty years old, by Hanneman; he must have been rather of a delicate frame, and in stature somewhat under the average height; his face oval, with sharp bright eyes, and wearing a cheerful benignant aspect. His dress was, of course, the costume of the period of Charles the Second's reign, but its character has not been observed in either of the portraits just named, one of which represented him in armour, and the other, as was not then unusual with artists, attired as a Roman general. We infer that he laboured under a defect in his speech, from his remarking in a memorial addressed to the King that he penned it—"To ease your Majesty of a trouble incident to the prolixity of speech, and a *natural defect of utterance* which I accuse myself of." It might be interesting to speculate how his sense of deficiency in physical strength, in eloquence of speech, and volubility of language might have contributed to the fostering of that disposition for intense application to scientific studies which became to him like a second nature.

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During the first two years of the Restoration, the Marquis was in pretty regular attendance on his Parliamentary duties. In 1661, he was obliged to seek protection so that proceedings might not be taken against him by his creditors; and about the same time his forfeited estates were restored to him, but so encumbered and impoverished as to yield him a very insufficient income, if any. It was in the midst of such distractions as these that this talented inventor and noble benefactor to his species had to maintain his social position; and, at the same time, endeavour to convince the bigoted age in which he may be said rather to have existed than to have flourished, that he was master of a power of such magnitude for the abridging of human labour, as the mind of man had never before conceived.

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It may be freely conceded that, *stupendous* as he himself pronounced the parent engine to be, it was but as the acorn compared to the time-honoured monarch of the forest. Just as the existence of the plant is dependent on that of the seed, so if the Water-commanding Engine, the great Fire Water-work he constructed had never existed, we might have been unacquainted, to this day, with the mechanical application of steam, and should have been deprived in consequence of the manifold blessings it bountifully bestows on mankind.

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ADDENDUM.

Evidence of the Marquis of Worcester's claim to the Invention of the Steam Engine.

1. His personal claim to have written a statement respecting it in 1655; his MS. being afterwards lost.
2. The Act of Parliament^[5] which was granted him for the term of ninety-nine years, and which received the royal assent on the 3rd June, 1663.
3. His "Century of Inventions," printed from a re-written copy of his lost notes of 1655; and which names in the Dedication, the granting of the above Act.

The following list^[6] comprises upwards of seventeen persons all living in 1663:—

4. CASPAR KALTOFF, a confidential workman, engaged by the Marquis as his engineer in 1628, who died about 1664, and is honourably mentioned in the "Century."
5. MARTHA KALTOFF, wife of Caspar Kaltoff, who is named in letters patent dated 1672, *as lately deceased*. Her family was—

- CATHARINE, married to Claude Denis.
- CASPAR KALTOFF, and his unmarried sister—
- ISABEL KALTOFF.

6. PETER JACOBSON, a sugar refiner, who married one of Kaltoff's daughters, had a portion of the buildings at Vauxhall, where the Water-commanding Engine was erected, and in operation from 1663, till at least to the year 1669, if not some years later.

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7. WILLIAM LAMBERT, another workman, a founder at Vauxhall, in the reign of Charles I., "under the Marquis of Worcester, for gun and waterwork, or any other thing founded in brass," in 1647, and who was living in 1664-5.

8. CHRISTOPHER COPLEY, who had been a Colonel in the Parliamentary service, and was probably an iron master, having been the proprietor of four Iron Works. He assisted the Marquis at an early period and held a pecuniary interest in his invention of a Water-commanding Engine. Indeed it is highly probable that he was the "powerful friend" at whose instigation the "Century" was written in 1665.

9. The EARL OF LOTHERDALE, written to in January, 1660, had a copy of the "Definition" of the Engine sent to him, and is promised an ingeniously contrived box or cabinet. He was appointed as late as March, 1665, to be one of a Commission to report on the affairs of the Marquis, and must, therefore, have been familiar with all matters relating to the noble inventor.

10. DR. ROBERT HOOK, the eminent mathematician, was acquainted with Caspar Kaltoff, and early in 1667, went purposely to see the engine working at Vauxhall, having read the "Definition."

11. THE HONOURABLE ROBERT BOYLE received from Dr. Hook a copy of the "Definition," sent to him with a letter on the subject.

12. LORD BRERETON is specially mentioned by Dr. Hook, as being so confirmed in his doubts of the excellence of the Marquis's engine, that he had laid a wager on the subject. [Pg 36]

13. HENRY SOMERSET, Lord Herbert, afterwards created first Duke of Beaufort, by Charles II., must have frequently seen the engine in operation. He died in 1699.

14. JAMES ROLLOCK, who wrote a poetic eulogy on the Engine about 1663, speaks of himself as "an ancient servant," having known his lordship forty years, dating back to 1623.^[7]

15. SAMUEL SORBIÈRE visited the works at Vauxhall, and published particulars of the engine he saw there in 1663.

16. LORD JOHN SOMERSET, the Marquis's eldest brother, appears latterly to have lived at Vauxhall, according to a warrant dated September, 1664; and would certainly be admitted into his brother's confidence. [Pg 37]

17. COSMO THE THIRD, Grand Duke of Tuscany, in his Diary exactly describes the engine he saw at Vauxhall in 1669, "considered to be of *greater service to the public* than the other machine near Somerset House."

18. WALTER TRAVERS, a Roman Catholic priest, names the engine in a letter which he wrote to the Dowager Marchioness of Worcester, in 1670.

19. DR. THOMAS SPRAT, F.R.S., published in 1665, a critical work on "M. Sorbière's Voyage into England," and could not therefore be ignorant of the Marquis's engine, as it was named by the French traveller, although Sprat omitted to notice it specially in his own "Observations."

20. Among his other contemporaries were Sir Samuel Morland, Dr. Wallis, Sir Christopher Wren, Sir Isaac Newton, and many more, who, however, (so far as is at present known,) are silent in regard to all matters relating to the Marquis.

[1] Dedication to "The Century of Inventions."

[2] See *Worcesteriana*, 8vo. 1866, page 257.

[3] See engraving and account of it in *The Life, Times, and Scientific Labours of the Marquis of Worcester*, 8vo. p. 398. 1865.

[4] *Ibid*, page 180.

[5] For lists of the names of members on the several Committees appointed on the occasion of this Act being applied for, see—"The Life, Times, &c.," 8vo. 1866, pages 254-5.

[6] From "Worcesteriana," 8vo. 1866, page viii.

[7] He was the author of a pamphlet now very rare, and which is absurdly enough attributed by Horace Walpole to the Marquis of Worcester. A reprint will be found in "The Life, Times, and Scientific Labours of the Marquis of Worcester," 8vo. 1866, page 559. It contains the following intimation to the reader:—

"I think it not amiss to give further notice in his Lordship's behalf, that he intends within a month or two, to erect an Office, and to entrust some very responsible and honourable persons with power to treat and conclude with such as desire at a reasonable rate, to reap the benefit of the same Water-commanding Engine."

So that it is manifest a public company was intended to be established in 1663-4, to extend operations with the engine then actually raising water at Vauxhall.

II.

LECTURE
DELIVERED ON THE 5TH NOVEMBER, 1868:
BEING THE FIRST OR INAUGURAL LECTURE
OF THE
FREE LECTURES,
AT THE CRYSTAL PALACE, SYDENHAM,
ON
CHIMERAS OF SCIENCE:
ASTROLOGY, ALCHEMY,
SQUARING THE CIRCLE,
PERPETUUM MOBILE,
ETC.

"A little knowledge is a dangerous thing,
Drink deep, or taste not the Pierian spring;
There shallow draughts intoxicate the brain,
But drinking largely sobers us again."—POPE.

PREFACE.

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The present Lecture, embodying a variety of subjects, under the general title of CHIMERAS OF SCIENCE, not only reviews them in succession, but expresses sentiments with regard to each which result from a long acquaintance with ancient and modern scientific authors; supported by an experimental, and, not unfrequently, by a practical acquaintance with several branches of natural philosophy. The consequence of this intimacy with various scientific studies, has been a thorough conviction of the necessity of possessing a knowledge of elementary principles, before professing a belief in new doctrines, whose only recommendation is their novelty, extravagance, and inutility. Without absolutely pretending to any golden road, or short path to learning, superficial but ambitious scholars are the first to seize on first impressions, build up some grand theory, lay down certain postulates, seek proselytes, and display a wonderful amount of enthusiasm in creating systems which, however beautiful in appearance, can boast of no solid foundation. Imperfectly educated, and shallow, but not unfrequently highly imaginative, men, if not themselves absolute charlatans, are the easily led dupes, who become the admirers and abettors of every "new wind of doctrine."

Every age has been sensational. Man delights in mystery, and mysticism is a certain sign of imperfect knowledge. A classic age was not proof against the tricks and deceitful practices of the oracles, soothsayers and jugglers. The dark ages only served to keep alive the human desire for sensation; and less than a century ago, poor, simple, half idiotic women, were burnt at the stake as witches. The Mahometans had their prophet, and so have the Mormons. Mesmer had his disciples, and so have many modern Spiritualists. The Astrologer of the 17th century, is presented to us in a modern dress by the seer Zadkiel. Jacob Behmen and Emanuel Swedenborg, but represent a class that is continually dying out, yet is as continually reproduced; the authors of pious romances, theological enigmas, scientific spiritualisms, and spiritualized transcendental philosophisms. Swedenborg introduces us to the inhabitants of the moon; they are short, the size of a youth of seven years of age; and they speak with a thunderous voice for want of an atmosphere, and not from the mouth, but from the abdomen! But many persons admire such wanderings of a pretended inward and prophetic light.

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There are still living a few faithful believers in *Alchemy*, who earnestly look forward to the coming of the day when the grand, the glorious secret, shall be fully revealed; not, however, to the vulgar crowd, but to the noble, true, and virtuous adept,—to him, and him only.

A class of *Mathematicians* still continues to publish papers and pamphlets on squaring, cubing, and trisecting. On this subject, the reader might find some amusement in the critiques of Professor De Morgan, who wrote several papers in the *Athenæum*, 1865, under the title of *A Budget of Paradoxes*.

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Mechanics are still living who firmly believe in the possibility of realizing a mechanical perpetual motion,—to spin, pump, or drive carriages or machinery, by means of a constantly descending weight. And, year by year, many such schemes, find their final resting place in the archives of the Patent Office.

It is melancholy to reflect on the waste of mental energy, inflicted on society by such vanities as Astrology, Alchemy, and their kindred empirical employments. Look at the centuries wasted, and worse than wasted, in studying such intellectual abortions, and in writing thousands of volumes of inanity to uphold falsehood and delude the unwary. What the sword has done physically, the pen and the wand of the sorcerer have done mentally, in prostrating the intellectuality of mankind.

It would tend to promote the progress of society at large, if education were so far general that the acquirements of the middle and lower classes should act on the upper classes as a stimulant to the pursuit of those higher branches of study, which mostly fall to the lot of the nobility and men of fortune: whose birth and ample means otherwise relieve them from all incitements other than such as are fostered by the necessities of public office. With title and fortune, and no ambition to hold public employment, any education is thought to be sufficient that serves to obtain the usual dignities, and to give that polish which completes the accomplished gentleman. To the spread of education alone, can we look with any reliance for the downfall, or at least the diminishing of the hold on the human mind which Chimeras of every order usurp in our own, in common with every other country.

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Among other works that might be consulted by the curious in such matters, in the Libraries of the British Museum, the Patent Office, Chetham College Manchester, &c.; may be named, on ASTROLOGY,—B. Porta's Works, folio, 1616;—The Compost of Ptolomeus, Prince of Astronomie, 1645;—W. Ramsey's Vox Stellarum, 8vo., 1652;—The Geomancie of Maister Christopher Cattan, 4to., 1608;—Dr. John Dee's Work on Spirits, folio, 1659;—J. Goad's Astro-Meteorologica, folio,

1686;—Godfridus's Work on the Effects of the Planets, &c., 1649;—M. Manilius's System of the Ancient Astronomy and Astrology, &c., 8vo., 1697;—John Merrifield's Catastasis Mundi, 4to., 1684;—Jo. Holwells's Catastrophe Mundi, 4to., 1682;—with many others of modern date.

On ALCHEMY,—Ashmole's Theatrum Chemicum Britannicum, 4to., 1652;—Dr. John French's Art of Distillation;—Four Books of J. S. Weidenfeld, 4to., 1685;—A Philosophicall Epitaph, in Hieroglyphicall Figures, 1673;—George Ridley's Compound of Alchemy, 1591;—Roger Bacon's Art and Nature, (in French,) 1557; his Mirror of Alchemy, 1597; his Philosopher's Stone, or Grand Elixir, 8vo., 1739; Theatrum Chemicum, 6 vols., 8vo., 1659-61;—Sandivogius's New Light of Alchymie, 4to., 1650;—Opuscula quædam Chemica, 8vo., 1514;—The Works of Geber, 1678;—Hermes Trismegistus's Works, collected in Theatrum Chemicum, 4 vols.;—Raimond Lully's De Secretis Naturæ, 1541;—Crollius's Philosophy Reformed and Improved, in four profound Tractates, 1657;—Beguinus (J.) Trocinium Chymicum, or Chymical Essays, 8vo., 1669;—Artis Auriferae, Quam Chemiam Vocant (a collection of treatises), woodcuts, 2 vols. 8vo. 1593;—Balduinus's Aurum Superius et Inferius Hermeticum, plates, 1675; Beccheri's Physica Subterranea, Lipsiæ, 1738 (with supplement), 8vo., 1681-80; with many others, ancient and modern. Interesting compendious treatises will be found in Dr. Thomas Thomson's History of Chemistry, ("The National Library,") 2 vols., 12mo., 1830; Justus von Liebig's Familiar Letters on Chemistry, edited by Dr. Blyth, 8vo., 1859. And—

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On MATHEMATICAL and MECHANICAL Chimeras, many popular notices may be found in Encyclopædias; and particularly in Dr. Hutton's Mathematical Dictionary, 2 vols., 4to.; and the Author's "Perpetuum Mobile; or, History of the Search for Self-Motive Power; with an Introductory Essay," post 8vo., 1861; to which work, a second series will shortly be added.

CHIMERAS OF SCIENCE.

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INTRODUCTION.

Although the present lecture seems to require some introductory remarks, they must necessarily be brief—our time being limited and this discourse rather discursive; yet it is sufficiently condensed to suit the present occasion, and illustrates fully the truthfulness of the axiom that—*A little learning is a dangerous thing*: from its tendency to inspire its possessors with vanity rather than with the humility which always accompanies profound knowledge.

You are no doubt all, or most of you, well acquainted with the use made of Astrology and Alchemy in the dramas of Shakspeare—"The Antiquary" of the "Wizard of the North"—the "Strange Story" of Lord Lytton—the "Faust" of Goëthe; and are probably familiar with the more instructive works of Scott on Demonology, and of Brewster on Natural Magic. Now we always find that fiction is more suitable than truth for romantic writings; truth is circumscribed, but the fictions whether of Astrology, Alchemy, or any other pseudo-philosophy are erratic, the delight of poets and romance writers, being the comets and *ignes fatui* of many popular compositions in our light literature.

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There is no end of fabulous writings of the class we call novels and romances, and no end of deceptions which we patronize as tricks of legerdemain; the one gratifies our imagination and fancy, the other takes our common sense by surprise; but all these are harmless because only presented to us for our amusement.

Delusion, however, assumes a startling character when romance in the form of mystic writings, and jugglery in the form of pretended communication with the spirit-world demand our respect and serious attention, by claiming to have a divine origin. But hallucination of the human intellect, as we shall see, is not confined to such remote visionary speculations, and it is not unimportant to remark that in mathematics, as in physics, and in other branches of investigation, there is a singular persistency in upholding errors.

A contemporary astrologer, assuming the pseudonym of Zadkiel, tauntingly observes in his preface to a recent publication: "*This is the age of inquiry*; and yet prejudice continues to press down her leaden foot upon the neck of examination in this matter"—that is, Astrology. Now with this reproof before us we hope to discuss the subject with becoming propriety.

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ASTROLOGY.

The splendour of the sun by day, the glories of the firmament by night, together with the sublimity of all celestial phenomena, attract alike the attention of the most simple and the most intellectual among mankind. The distance, the magnitude, and the grandeur of the entire planetary system while exciting emotions of awe, reverence, and devotion among the mass of the human race, have at the same time been studied from the earliest period of man's history to the present time superstitiously by one class of observers, and scientifically by another.

As the telescope was not invented before the 17th century, it is evident that the study of Astronomy without that instrument must previously have been pursued under amazing difficulties; and we might have expected that when first used by Galileo at Venice in 1609, its introduction would have been hailed without a dissentient voice. Such, however, was not the fact, according to Sir David Brewster,^[8] who says:—

"The principal Professor of Philosophy at Padua resisted Galileo's repeated and urgent entreaties to look at the moon and planets through his telescope; and he even laboured to convince Cosmo de Medici, the Grand Duke of Tuscany, that the satellites of Jupiter could not possibly exist. Sizzi, an astronomer of Florence, maintained that as there were only *seven* apertures in the head—*two* eyes, *two* ears, *two* nostrils, and *one* mouth—and as there were only *seven* metals, and *seven* days in the week, so there could only be *seven* planets. He seems (eventually), however, to have admitted the visibility of the four satellites through the telescope; but he argues, that as they are invisible to the naked eye, they can exercise no influence on the earth; and being useless they do not exist."

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Such being the crude state of astronomical science in the 17th century, it must have been comparatively imperfect throughout all preceding centuries; and open to mystical appropriation and abuse by Egyptians, Chaldeans, Hindus, Chinese, and European and other ancient astrologers. Among that motley group the most learned were found strangely associated with ignorant impostors, and their activity in writing and travelling served to spread their different systems over the entire civilized world. It was not until late in the 17th century that Astrology could be absolutely declared to be in its decline. In England, William Lilly, the Sidrophel of Hudibras, and the most famous astrologer of his time, died in 1681, leaving behind him his *Introduction to Astrology*, together with many other works of the same character.

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Astrology is merely a philosophism, being empirical, wholly visionary, a mere fanciful system compounded of incongruous mixtures of astronomical with human events, of mythology with theology, and of facts with pure fiction. It has been variously designated Judicial, Hororary, Atmospherical, and Mundane, Astrology. It has also many off-shoots subservient to Magic or the black art, Sorcery, Witchcraft, and other pretended mysticisms ostentatiously styled occult philosophy.

We may first observe that Astrology lays no claim to inspiration, but affects a very ancient unknown origin, tracing back to a dark, heathenish, and superstitious age, in the very infancy of traditional knowledge, when the boldest assertions of the seer were received as the authority of an oracle, no one daring to question their validity. Whatever is remotely possible the Astrologer accepts as a fact; while ignorant of much around him, he assumes with the utmost complacency an intimate acquaintance with the sun and planets thousands upon thousands of miles off; yea with the sun 969,272 miles in diameter, while he himself inhabits a globe only 7,916 miles in diameter; from which the moon is 237,000 miles distant, and the sun 400 times that distance.^[9]

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And these immense bodies revolving millions on millions of miles away in immeasurable space are described by him as fashioning an infant's nose, directing the fortunes or misfortunes of lovers, ordering the property of traders, meting out diseases, and improving or deranging man's mental faculties. And as if such puerile influences were not sufficiently preposterous we are informed by the modern seer, Zadkiel, that the 12 signs of the Zodiac not only rule the several parts of the human frame, but also those of a ship, as *Aries*, the bows; *Taurus*, the cutwater; *Gemini*, the rudder; *Cancer*, the bottom; *Leo*, the upper works; *Virgo*, the hold; *Libra*, parts above the water's edge; *Scorpio*, the seamen's berths; *Sagittarius*, the seamen; *Capricorn*, the ends of the vessel; *Aquarius*, the Captain; *Pisces*, the oars in galleys, the wheels in steam vessels, and the sails in others; but these latter being above water, we are left in doubt about the ruler of the submerged screw propeller.

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To show what a modicum of learning, and how trifling an acquaintance with matters of natural philosophy will serve the Astrologer, we will turn to a modern treatise published in the year 1801, by Francis Barrett, (styling himself a student of Natural and Occult Philosophy) a quarto volume of upwards of 370 pages, entitled, "The Magus, or Celestial Intelligencer," which affords a pretty clear insight into the nature of the superstitions which from an ancient period even to that date obtained credence and were popular with the multitude.

Treating of the wonders of Natural Magic previous to entering on the main topic of his treatise, he adduces a few of what he conceives to be ordinary matters of fact, assuring us that:—

If any one shall, with an entire new knife, cut asunder a lemon, using words expressive of hatred, contumely, or dislike, against any individual, the absent party, though at an unlimited distance, feels a certain inexpressible and cutting anguish of the heart, together with a cold chilliness, and failure throughout the body;—likewise of living animals, if a live pigeon be cut through the heart, it causes the heart of the party intended, to be affected with a sudden failure;—likewise fear is induced by suspending the magical image of a man by a single thread;—also death and destruction by means similar to these; and all these from a fatal and magical sympathy.

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The loadstone, (he observes), possesses an eminent medical faculty against many violent and implacable disorders;—the back of the loadstone, as it repulses iron, so also it removes gout, swellings, rheum, &c. that is of the nature or quality of iron. Likewise the wearing the loadstone eases and prevents the cramp, and such like disorders and pains.

The influences of the stars appear to be as intimately known to Astrologers as though they had walked among, and carefully examined and fully realized their occult properties, for example:—

In every work observe Mercury, for he is a messenger between the higher gods and the infernal gods; when he goes to the good, he increases their goodness—when to the bad, he hath influence on their wickedness. It is an unfortunate sign or planet, when it is by the aspect of Saturn or Mars especially, apposite or quadrant, for these are the aspects of enmity; but a conjunction, a trine, and a sextile aspect, are of friendship; but yet if you do already behold it through a trine, and the planet be received, it is accounted as already conjoined. Now all planets are afraid of the

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conjunction of the sun, rejoicing in the trine, and sextile aspect thereof.

They say of the Sun and Moon:—

The Sun is the lord of all elementary virtues;—it disposes even the very spirit and mind of men.

The Moon (says Barrett) measures the whole space of the Zodiac in the time of 28 days, hence it is that the wise men of the Indians, and most of the ancient astrologers have granted 28 mansions to the Moon, which, being fixed in the eighth sphere, do enjoy divers names and properties, from the various signs and stars which are contained in them; through which, while the Moon wanders, it obtains many other powers and virtues; but every one of these mansions, according to the opinion of Abraham, contained twelve degrees, and fifty-one minutes, and almost twenty-six seconds. In the first quarter of these mansions the 1st conduces to discords and journies; the second to the finding of treasures, and to the retaining of captives; the 3rd to benefit sailors, huntsmen, and alchemists; the 4th the destruction and hindrances of buildings, fountains, mills, gold mines, the flight of creeping things, and begets discord; the 5th to help the return from a journey, the instruction of scholars, and confirms edifices, gives good health and good will; the 6th to hunting and besieging towns, and revenge of princes, destroying harvests and fruits, and hinders the operation of the physician; the 7th to confirm gain and friendship; is profitable to lovers, and destroys magistracies.

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In a similar manner the remaining three quarters have the characters of their several mansions allotted to them with equal exactness, and of course indisputable veracity also.

We have here a fair example of the arrogant assumptions of ancient and indeed of all astrologers, magicians, and sorcerers, men who are incompetent to elucidate the ordinary phenomena of nature in the animal or vegetable creation, and yet with unbounded effrontery affect to build up an empirical system, delivered in a language of their own invention, a pompous parade of jargon made up of the most incomprehensible materials—which if wholly due to antiquity partakes of ancient simplicity, credulity, deceit, and superstition; and if somewhat polished and refined to suit the advances of literature and science, has never been able to prove the correctness of its groundwork, or afford a solitary instance of its possessing any meritorious quality beneficial to mankind; while on the other hand its evil consequences have been many, by destroying the peace and happiness of thousands, encouraging deceit, and misapplying in its ignoble pursuit the time and labour and property of its ardent but deluded admirers.

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In Judicial Astrology it is not thought requisite to consider more than a certain number of the planets, after a method simplified by antient astrologers or astronomers, which is found to be so compact and so complete in governing the destinies of the human race that modern intelligence has failed to enlarge the field of heavenly influences. Varley notes that:—the antients discovered that the circle of the Zodiac, about 16 degrees in width, and through the middle of which runs the Ecliptic, or sun's path through the 12 signs, contains the heavenly bodies, named planets, and the principal fixed stars, and nearly the whole of the materials or signifiers, from which predictions are obtained.

He remarks that:—In forming a horoscope, this circle is divided into 12 equal parts, corresponding with the spaces containing the 12 hours. These 12 divisions are called houses; and they always remain fixed, while the Zodiac with the 12 signs, and all the heavenly bodies belonging to it, are considered to be moving through them all, every 24 hours. The *lord* of the ascendant is the planet which rules the signs rising at birth. In drawing horoscopes it is usual to make the figure square instead of round. (See [Plate 1](#), Fig. 1.)

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The various significations arising from the aspects of the starry heavens at the time of birth are so exceedingly numerous, that we must refer the curious in such matters to the works themselves, in which all these pretended revelations are minutely recorded.

Mankind rank astrologically as being of four temperaments.

1. One class is said to answer to the fiery trigon, also called diurnal, masculine, and choleric, consisting of Aries, Leo, and Sagittarius, which contains the spirited, generous, magnanimous, and princely natures.
2. We have next the earthy trigon, being nocturnal, feminine, and melancholic, consisting of Taurus, Virgo, and Capricorn, containing the careful, sordid, and penurious qualities.
3. Thirdly, the aërial trigon, which is diurnal, masculine, and sanguine, consisting of Gemini, Libra, and Aquarius, contains the humane harmonies, and courteous principles. And—
4. Fourthly, the watery trigon, which is nocturnal, feminine, and phlegmatic; namely, Cancer, Scorpio, and Pisces, including the cold, prolific, cautious and severe qualities.

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Take as a brief illustration of the manner in which Astrologers presumptuously assign to the planets their several offices relating to human nature the following:—

Those born when Aries ascends are born under the sign Aries and planet Mars. This is the diurnal, fair, and masculine house of Mars, and partakes also largely of the nature of the magnanimous Sun, and the benevolent and moral Jupiter, who rule the fiery trigon, of which Aries is the first sign.

As affecting physiognomy we are assured that:

The Scorpio noses are more aquiline than those of Aries, and are more frequently conspicuous for a sort of bracket shape beneath, which prevents the under part of the nose from forming a right angle with the upper lip; while the under lip, both being usually small, recedes in a greater

degree, as if drawn tightly against the teeth; so that the mouth appears in the act of pronouncing the word SEVERE. [Pg 60]

When we meet in volume after volume with page after page of such composition as this, when we reflect on the sublimity of the heavens and the paltriness of such combinations as are here given of the planets with mundane affairs, we ask the reasons for arriving at such judgments. To be told that it is so because it is so; or because it was an ancient belief, and is to be found in the writings of Ptolemy, Nostradamus, Dr. John Dee, William Lilly, or Zadkiel; or because it has often proved as true in its predictions as the telling fortunes by means of a pack of cards, is no evidence whatever; yet the Astrologer boasts of his very paralogisms.

Zadkiel, in prefacing a work by Lilly, says:—If a proposition of *any nature* be made to any individual, about the result of which he is anxious, and, therefore, uncertain whether to accede to it or not, let him but note the hour and minute when it was *first* made, and erect a figure of the heavens, (See [Plate 1](#), Fig. 1.)—and his doubts will be instantly resolved. He may thus, in five minutes, learn infallibly whether the affair will succeed or not; and, consequently, whether it is prudent to adopt the offer made or not.

Such is the belief of this sound, intelligent man, as we fully believe him to be in other respects. But we say it is not given to man to assign special influences to the stars, to select one portion and discard all the rest, or to be more intimately acquainted with the starry heavens above him, than with the stony earth he inhabits, and with his fellow creatures around him. [Pg 61]

The works claiming to expound this pretended Occult Philosophy prescribe such childish processes that one naturally wonders how in the midst of so much impudent imposture Astrology and its kindred pursuits ever found or retained any honest partizans.

Take, for example, the use of fumigations, such as of frankincense, &c. to Saturn; of cloves, &c. to Jupiter; of odoriferous woods to Mars; of all gums to the Sun; of roses, violets, &c. to Venus; of cinnamon, &c. to Mercury; of the leaves of vegetables to the Moon; of all or any of which there must be a good perfume, odoriferous, and precious, in good matters; but in evil ones quite the contrary.

The Zodiac is also favourably affected by proper suffumigations.

Astrologers in their Demonology profess to be able to ascertain the characters and seals of spirits,^[10] and according to the Cabalists, tables are given of many of these in their books, in the so-called Theban Alphabet; in characters of Celestial Writing; in that called Mallachim; or in the writing called Passing the River. [Pg 62]

They affect to have suitable bonds by which spirits can be bound, invoked, or cast out.

Of Necromancy they pretend to two kinds, one of which is raising the body of a deceased person, which it is said cannot be done without blood;—the other sciomancy, which is the production of a mere shade or shadow.

The exorcisms and conjurations of Magicians are so audaciously profane and blasphemous as to be unworthy of even a passing notice.

ALCHEMY.

We shall now proceed to consider Alchemy, another but very different chimerical pursuit, which was early cultivated in the East, and is generally ascribed to Hermes Trismegistus, although its more enthusiastic admirers pretend to trace a knowledge of it to Adam. From the earliest periods of history man was acquainted with gold, silver, and other metals, with bitumen, sulphur, sea salt, sal-ammoniac, gums, and resins, together with other varieties of substances and liquids common to modern chemistry. For the compounding and heating of certain of these materials a multiplicity of means were adopted requiring furnaces, crucibles, and distillatory apparatus. The first workers in these experimental operations formed a body of investigators into the nature and properties of all manner of substances, whether animal, vegetable or mineral, the members of which were distinguished as adepts, alchemists, and later in their career as common chemists. The most esteemed branch of the art however was Alchemy, a pseudo-science which ultimately took three forms. First, the Hermetic Art for the discovery of the Philosopher's stone; and the Alkahest, or universal solvent;—Second, a Medical Alchemy;—and Third, a Theological Alchemy pretending to conceal divine mysteries under an allegorical form, treating of the spiritual while apparently describing alchemical discoveries. [Pg 63]

Our principal business, however, is with the so-called Hermetic Philosophy, treating of vaunted methods of transmuting the base metals into gold. It is doubtful whether this particular delusion of the adepts can be referred to a date earlier than the 8th century, but even then we cannot refrain from surprise at the fallibility of the human intellect, which could be swayed by a belief in the pretended *lapis philosophorum* for upwards of ten centuries. It was believed to be so secret and rare that its possession was never ascribed at any time to more than two or three favourite adepts, who transmitted it to some single favoured individual after his taking the sacrament, and going through certain prescribed religious ceremonies, preparatory to being entrusted with a verbal recipe for the composition of a peculiar smelling red powder, of which it was affirmed that when projected on heated mercury or any solid metal, it would at once change it into pure gold. Ashmole gravely assures us that Dr. John Dee and his associate Kelly, having in some way procured this precious substance, Kelly—to use Ashmole's own words—"made projection with one small grain thereof, in proportion no bigger than the least grain of sand, upon one ounce and a [Pg 64]

quarter of common mercury, and it produced almost an ounce of pure gold." With equal simplicity and earnestness, Ashmole asserts that this same Kelly was often seen to make these extraordinary transmutations,—and in particular (he adds) upon a piece of metal cut out of a warming-pan, and without touching or handling it, or melting the metal, only warming it in the fire, the elixir being put thereon, it was transmuted into pure silver. The warming-pan and this piece of it, was sent to Queen Elizabeth by her Ambassador who then lay at Prague, that by fitting the piece into the place whence it was cut, it might exactly appear to be once part of the warming-pan."

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Among the adepts there were no doubt a select few who employed themselves in their prolonged labours in all sincerity, and who were not unfrequently repaid with remarkable, and unexpected results. Brass, being the result of copper combined with zinc, would appear a singular transformation. Many stones, or more properly, ores, would yield sulphur and metals; sulphur would be found apparently to dissolve iron; and certain salts, when distilled, would yield corrosive acids. Alchemy thus presented to the ancient adepts many of the ordinary wonders of modern chemistry; in short, the latest adept of the present century is no other than an unlettered chemist. It was peculiar to the Alchemists to treat all their operations as secrets; which, when recorded, were described partly by symbols and partly in a novel nomenclature, invented to conceal their mysteries from vulgar gaze or imitation. Thus, to prepare the philosopher's stone, we have merely to—"Take of moisture, an ounce and a half; of meridional redness, that is the soul of the sun, a fourth part, that is, half an ounce; of yellow seyr, likewise half an ounce; and of auripigmentum, a half ounce; making in all three ounces. Know that the vine of wise men is extracted in threes, and its wine at last is completed in thirty." To the incredulous in these matters, Ashmole offers the admonition that, he knows "*Incredulity is given to the world as a punishment!*" However, when the Alkahest, or pretended Universal Solvent, was alluded to by the modern chemist Kunckel, he could not refrain from incredulously enquiring—"If it dissolves all substances, in what vessel can it be contained?"

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Alchemical writings are very numerous, it might be impossible to procure a complete bibliographical list of them, but they may be estimated at from 3000 to 4000 works, and an astonishing number of manuscripts. Their authors indulge in such terms as the Ph[oe]nix, to indicate the quintessence of Fire; Realgar, for the fume of minerals; Guma, also Luna Compacta, for quicksilver; Hadid, for iron; Aurum potable, for liquor of gold; Anathron, for saltpetre; Malek, for salt; Terra fidelis, for silver; Tinkar, for borax; and in a similar strain for all matters and operations; so that Dr. Johnson was justified in deriving the word Gibberish from the mysterious jargon employed by Geber, a celebrated Alchemist; who has, nevertheless, been appropriately styled the Pliny of the 8th century.

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Weidenfeld, in an Alchemical Treatise, published in 1685, addressing students, says:—

"Under heaven is not such an art, more promoting the honour of God, more conducing to mankind, and more narrowly searching into the most profound secrets of nature, than is our true and more than laudable Chymy."

And at the conclusion of his address he observes:

"Nothing remains but upon our bended knees to return most humble thanks to the Father of Lights, in vouchsafing us this art by the writings of his servants, and the high priests of Nature; without which, it would be beyond the power of man to arrive at so great a degree of knowledge."

Some notion of the extravagance of the language employed may be obtained from his description of a Philosophical Wine, literally, rectified spirits of wine, or alcohol. He assures us that, on opening a vessel of it, "a wonderful scent" should arise: "so as that no fragranciness of the world can be compared to it; inasmuch as putting the vessel to a corner of the house, it can by an invisible miracle draw all that pass in to it; or, the vessel being put upon a tower, draws all birds within the reach of its scent, so as to cause them to stand about it. Then will you have, my son, our quintessence, which is otherwise called Vegetable Mercury, at your will, to apply in Magistry of the transmutation of metals."

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How ardent an adept this Alchemist was may be gathered from his exclamation:—"May the God of Heaven put prudence in the heart of evangelical men, for whom I compose this book, not to communicate this venerable secret of God to the reprobates."

Among the remarkable discoveries made by Alchemists, due to the carefully noted and carefully examined failures and accidents, as well as successes, of their endless combinations of matter, under the treatment of fire and water, the most distinguished is that of gunpowder, noted in a recipe left on record by Roger Bacon, who died in the year 1284. He clearly names the mixture of Saltpetre with Sulphur, but the third ingredient, Carbon, is concealed in the form of an anagram.

Lord Bacon, Luther, Spinoza, Leibnitz, and many eminent moderns, were impressed with a belief in the possibility of transmuting lead, tin, copper, or other metals, into gold; in short, as it was supposed there were only four elements, fire, water, earth, and air, it was probably assumed that a fifth might be found in the Philosopher's stone.

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But if ever any pursuit was more open to fraudulent practices than another, surely the pretended possession of a transmuting powder or elixir afforded a grand arena for their exercise. In this enlightened age, although we cannot fail to look with charity on the arduous labours of those adepts who honestly mixed devotional exercises with laborious experimental operations, selecting times and seasons for their alchemical work, and noting with accuracy the hours and days of fusions, sublimations, distillations, lixiviations, and so forth; still, it is scarcely possible to refrain from smiling at the docile simplicity of Ashmole in denouncing a certain class of

Alchemists, as pretended masters and adepts, seeing "they are mere practisers of legerdemain," while he himself gave credence to the story of the warming-pan, already named as being shown to Queen Elizabeth, which was clearly a flagrant piece of fraud practised by Kelly, a common adventurer, and from his youth remarkable only for his indifferent character.

An easily performed trick was effected by means of nails, or other light articles, made half of gold and half iron, but disguised, so as to appear to be of one metal and colour. Sometimes these knaves employed crucibles, having an interior false bottom, below which a small quantity of gold was placed, which, being reproduced, as was pretended from base materials, was offered as an example of success. Or, by having the gold in a hollow rod, stopped at one end with wax, used to stir up the materials, the gold would naturally enough appear in the crucible. Or, their materials being conveyed into charcoal, a similar result would be obtained on heating the crucible in a furnace. At other times, by the employment of amalgams, or solutions in acids, they could perform a species of electro-plating on common metals. The extent to which these nefarious practices were carried might appear incredible, considering the evident inconsistency of the owner of the pretended golden key to countless wealth, being in such comparative poverty as to be indebted to any one of moderate means for pecuniary assistance. But, it is some apology for such credulity when we call to mind the state of public morals, of education, of political institutions, and the prevalent superstition, not only among common people, but also the higher classes of all countries and creeds, down to the seventeenth century: representing a phase of the human mind, liable to be overawed by impostors, who boldly claimed supernatural aid in abetting their impositions. And the trickery of the designing was further aided by the close secrecy adopted by the adepts in their processes, their conversations, and their writings. Ashmole freely admits that—"Their chief study was to wrap up their secrets in fables, and spin out their fancies in 'vailles' and shadows, whose radii seem to extend every way, yet so that all meet in a common centre, and point only to one thing." It was this very secrecy, this continual mystery from beginning to end, that favoured deceptions of the grossest and most bungling character, as viewed by the light of modern chemistry.

Alchemy no doubt tended to improve Medical science, by the introduction of many new mineral and vegetable preparations, but the healing art treated after the manner of the Hermetic Art, was laid open to every description of quackery. It is not our intention, however, to enlarge on this department, which has steadily advanced at every stage of improvement in chemical science.

SQUARING THE CIRCLE.

Of Mathematical Problems, the most perplexing to ancient and modern mathematicians, although of late years said to be satisfactorily demonstrated, and no longer desiderata of Geometry, are—

1. The Quadrature or Squaring of the Circle;—
2. The Duplication, or doubling of the Cube;—and
3. The Trisection of the Angle.

In his "Popular Astronomy,"^[11] Professor Arago, treating on the surface of a circle, observes that,

—
It is mathematically equal to the product of the length of the circumference, multiplied by half the radius. To square a circle of a given diameter in metres, is the same as giving the number of squares, of a metre in each side, of which the surface is the equivalent. If, the diameter being given, the exact circumference were known by a sort of inspiration, the superficial extent of the circular space would be deducible from the two numbers, by the mere multiplication of the numerical length of the circumference by the fourth of the diameter, or half the radius.

But, the circumference being deducible from the diameter only by approximation, the surface alluded to cannot be computed with mathematical rigour; yet the result can be obtained with all desirable precision by the aid of the ratios usually given for such purpose; for instance, the area of the space included within a circle of thirty-eight millions of leagues radius, may be determined within such a degree of precision that the probable error shall not exceed the space of a mite.

"The sect of squarers then," Arago adds,— "are searching after a solution which is proved to be impossible, and which, moreover, would be of no practical use, even if their foolish hopes were crowned with success."

In the "Birds" of Aristophanes, the character is introduced of a geometer, who is going to make a square circle, showing how early this chimerical performance became an object of ridicule.

Thales, Anaxagoras, Pythagoras, Hippocrates, Plato, Apollonius, Ptolemy, with other ancient mathematicians, have given methods for approximating to the area of the circle; and many also among the moderns. In 1775, the Paris Academy of Science determined to discourage papers devoted to this subject, and their course in this respect was soon after adopted also by The Royal Society, it being found that there was among certain geometers a complete mania for settling this and similar problems, the solution of which was either unattainable, or if attained of very questionable value.

DUPLICATION OF THE CUBE.

The Duplication of the Cube it is asserted can readily be demonstrated. It is usually called the Delian Problem, from its having been suggested by the oracle of Apollo at Delphos, requiring that Apollo's cubical altar should be doubled.

It is something in its favour to say that the enquiry has had the attention of Newton and of

TRISECTION OF AN ANGLE.

Lastly, we shall notice among problems of this class—the Trisection of an Angle, which it is asserted can only be accomplished by means of the conic sections and some other curves.

A rule for the cubic equation by which the problem of trisection is solved has been given by Cardan.

The difficulty only arises when we attempt the trisection of any other than a right angle, its trisection being easily effected with a pair of compasses. [Pg 75]

On this subject it has been observed that, "there is no more trouble in trisecting an angle, not a right angle, than in finding a cube root."

These three celebrated problems have received the attention of mathematicians in every age and country, and led to many learned discussions, and controversial writings. But in point of litigiousness the Squarers of the Circle most decidedly carry off the palm, having frequently laid and lost heavy wagers, and even appeared in a Court of Justice to settle their monetary disputes. They are renowned for their pamphlets, in which philosophers of every class are charged with prejudice, conceit, and ignorance, and denounced for their want of candour and consistency in not giving audience to the projector of the last best demonstration.

PERPETUUM MOBILE.

To conclude this Lecture we shall offer a few remarks on Perpetuum Mobile, or the search for a means of obtaining a mechanical perpetual motion. As a mathematical problem it dates back some 2000 years or more, but we know nothing of any actual attempt earlier than the 14th century to construct a machine intended to be self motive, by containing within itself the means of continually overbalancing. External motive agency such as the tides, magnetism, and the like are not included; the only admitted agent being gravity. [Pg 76]

If we considered wear and tear the question would be settled at once, but this is allowed as the single exception, and therefore any machine constantly renewing the means that first moved it might be deservedly called a perpetual motion.

Until a history of the schemes invented by numerous ingenious mechanics was published in 1861, inventors of this class were continually though unconsciously reproducing obsolete contrivances, from taking up the ordinary idea that a wheel may be kept constantly over-weighted on one side, so as to raise the next weight which is to perform the same miracle of art. It is singular to observe this particular coincidence of the inventive faculty of man, and it shows next to a demonstration, that if all mechanical inventions were swept from the face of the earth they would be reproduced in some remote age.

A common error with those who toil at perpetual motion machinery is their aiming to produce a bottled-up power; or to apply the principles of the ordinary scale or balance to a wheel, overlooking the simple facts of friction on one side acting against their most ingenious contrivances, and of non-production on the other. Sooner or later, however, they discover the inertia of matter, that a pound will not raise a pound, and that they cannot invent mechanism to move independently of the laws of action and reaction. [Pg 77]

A ball descending a semicircular path, as suggested by Dr. Henderson, will only rise to the same height as that from which it fell; and will afterwards gradually diminish in velocity until it rests at the centre. If it would ascend to a height greater than that from which it descended, then indeed an inclined path might return the ball to repeat such evolutions until quite worn out.

And as regards the weighted wheels, it is always overlooked that they come to rest from the same fact, that the vertical line of descent and that of ascent are equal, however much the weights may on one side recede from the centre, while on the other side the weights are approaching the centre. (See [Plate 6](#), Fig. 1.)

The most famous perpetual motive schemes were those of the Marquis of Worcester made 1630-41; (See [Plate 6](#), Fig. 2,) and of Bessler, better known as Orfyreus, between 1712-19. [Pg 78]

The Marquis gives a brief notice of his plan, in his "Century of Inventions," a curious catalogue of his several ingenious schemes.

But of Orfyreus's wheel we know nothing more than was communicated by the eminent mathematician, 'S Gravesande, to Sir Isaac Newton, after an external view of it, while it was rotating in a chamber of the residence of the Prince of Hesse Cassel.

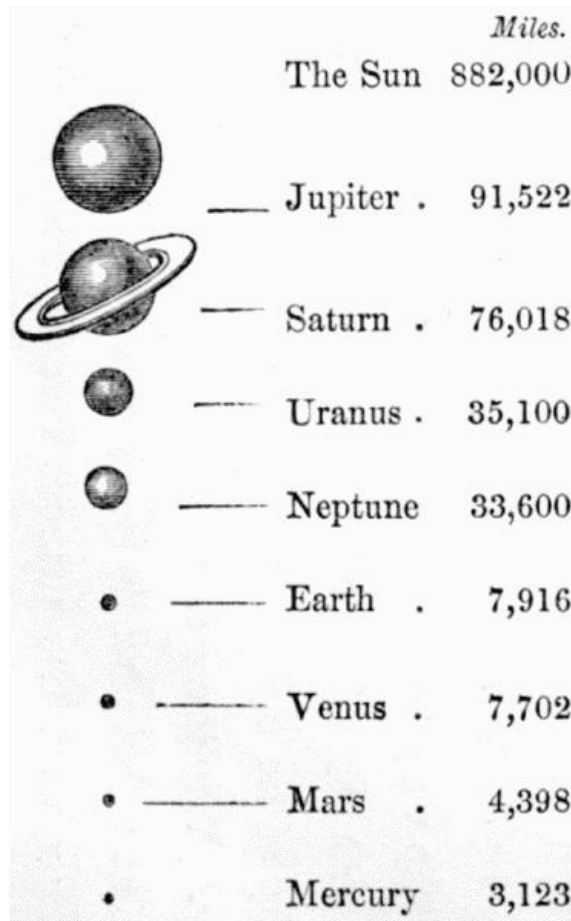
The most singular part of this strange delusion is the fact of its strong hold on the minds of its infatuated votaries. Once bewitched with the idea of at last succeeding in the attainment of his grand design, fortune, health, and reputation, are resolutely set at nought, in the delirium of delight that follows; and more unreasonable creatures can scarcely be found than such self-deluded individuals, for they cannot, or will not, be convinced that their utmost efforts can at best but produce an amazingly curious toy; and nothing can be more futile than to expect any higher application, assuming such a discovery were possible.

The best proof of the sincerity and earnestness of those who seek the attainment of a mechanical perpetual motion, is afforded by the variety and number of their patented schemes; the patentees having among them divines, doctors, lawyers, civil engineers, carpenters, draughtsmen, jewellers, watchmakers, shoemakers, confectioners, and all classes of professions and trades. It is not, as is generally supposed, only the wholly ignorant and designing who can be cajoled by these chimeras; there is in them a spice of mystery, of wonder, of singularity, and of simplicity combined with much subtle difficulty, which, being once fully imbibed, acts like an opiate draught.

We have thus reviewed summarily, chimeras which are mainly associated with Astronomy, Chemistry, Mathematics, and Mechanics, and which have swayed the human mind more or less from a period anterior to the Christian era. The list of this species of deceitful systems of pseudo-philosophy, and of profitless problems, might have been enlarged; but what has been advanced may suffice as a warning to the uninitiated to beware of blind guides and of visionary pursuits. Science has lost nothing by its professors exercising that degree of caution, which all classes of superficially learned men, affecting to possess original and valuable views on certain matters, call *prejudice*: which, in such cases, generally means no more than the natural aversion which the learned have for all attempts to place specious dogmas on a level with sound science. Such enthusiasts are generally men of no research or depth of thought, who obtain an imperfect acquaintance with subjects with which they are incompetent to grapple; and with whom it is, therefore, hopeless to contend. Delusion will have its day, and will as certainly decay, if not die out. Chimeras constantly spring up, and find ardent professors and crowds of easily led proselytes, even up to this very present time; so that although, undoubtedly with many — *Knowledge is power*: yet it is to be feared that far too large a proportion of mankind favour the delusion that — *Ignorance is bliss*.

[8] See his "*Martyrs of Science*."

[9] This portion of the subject was illustrated by means of a Diagram exhibiting the Diameters and Magnitudes of Planets, thus:—



The Moon's diameter is 2,160 miles; and its distance from the Earth is 237,000 miles.

[Text alternative to image:]

	<i>Miles.</i>
The Sun	882,000
Jupiter	91,522
Saturn	76,018
Uranus	35,100
Neptune	33,600
Earth	7,916
Venus	7,702

- [10] See the Table, [Plate I](#), Fig. 2, for distinguished names of their angels, spirits, or demons.
- [11] See Translation, by Admiral W. H. Smith, and Robert Grant, M.A., in 2 vols. 8vo. 1855, Vol. I., page 10.

EXPLANATIONS OF THE PLATES.

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[PLATE I.—FIGURE 1.](#)

Of the Twelve Houses.—The 1st, 4th, 7th, and 10th houses—*angular*.—These are of more durable signification than the others, denoting the wife or husband—a situation under Government, &c. &c.

The twelve houses have signification of all the various concerns of human life, and of nature at large.

For Example.—When the cusp of the first house is well aspected by, or has the presence of Jupiter or Venus, and these are not afflicted by the aspects of evil planets, they preserve life in infancy, and give health, and often an agreeable person.

But if their rays or presence (says Varley) should be thrown on the cusp of the second house, then the native will have success in concerns of property. The Sun in this house helps to disperse property; and if he be peregrine, that is, in the sign of a contrary nature to his own, where he has no dignities, and is without reception, then the native's property is dispersed in vainglorious expenses; but if the Sun be in Leo, his property in general will be ample enough to admit of instant acts of bounty and benevolence.

In a similar strain, Astronomers particularize the remaining eleven houses. It would be impossible, in any reasonable space, to describe further the operations of the planets in the several houses thus assigned to them.

As to when the Planets are most powerful.—Barrett says:—The planets are powerful when they are ruling in a house, or in exaltation, or triplicity, or term, or face, without combustion of what is direct in the figure of the heavens; but we must take care that they are not in the bounds or under the dominion of Saturn or Mars. The angles of the ascendant, and 10th and 7th are fortunate; as also the lord of the ascendant, and place of the Sun and Moon.

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The Moon is powerful if she be in her house, in exaltation, in triplicity, in face, or in degree convenient for the desired work, &c. &c.

[FIGURE 2.](#)

VARLEY'S TABLE OF SIGNS, HOUSES, EXALTATION, AND TRIPPLICITY.

The falls of the Planets are opposite to their Exaltations, and their Detriments opposite to their Houses.

Aries and Scorpio are the house of Mars	♂
Taurus and Libra are the house of Venus	♀
Gemini and Virgo are under the dominion of Mercury	☿
Cancer is the house of the Moon	☾
Leo is the house of the Sun	☼
Sagittarius and Pisces are the houses of Jupiter	♃
Capricorn is the house of Saturn	♄
And Aquarius is governed by the Herschel Planet	♅

[PLATE II.](#)

This table gives the usual symbols employed for indicating the several planets, and which are still retained in Astronomy for simplicity of expression, but which Astrologers venerate as possessing a cabalistic character.

Associated with these symbols are the names of certain principal angels, spirits, or demons, forming, however, but a small proportion of such airy nothings.

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The Astrological Symbols were also employed by the Alchemists to indicate the seven metals then known.

[PLATE III.—SQUARING THE CIRCLE.](#)

Mr. James Smith, of Liverpool, the most laborious among recent workers in this field of enquiry, claiming to have propounded several simple and exact methods, offers the following as sufficiently demonstrative:—

I construct my diagrams in the following way:—I draw two straight lines at right angles, making O the right angle. From the point O, in the direction OA, I mark off four equal parts together equal to OA, and from O, in the direction of OB, I mark off three of such equal parts together, equal to OB, and join AB. It is obvious, or rather self-evident, that AOB is a right-angled triangle, of which the sides that contain the right angle are in the ratio of 4 to 3, by construction. With A as centre and AB as interval, I describe the circle X, produce AO and BO to meet and terminate in the circumference of the circle at the points G and C, and join AC, CG, and BG, producing the quadrilateral ACGB. I bisect AG at F, and with O as centre, and OF as interval, describe the circle Z. The line OF is the line that joins the middle points of the diagonals in the quadrilateral ACGB; and it follows that,

$$\{AG^2 + CB^2 + 4(OF^2)\} = \{AC^2 + CG^2 + BG^2 + AB^2.\}$$

When AO = 4, we get the following equation:—

$\{5^2 + 6^2 + (4 \times 1'5^2)\} = \{5^2 + \sqrt{10^2} + \sqrt{10^2} + 5^2\}$, or, $\{25 + 36 + 9\} = \{25 + 10 + 10 + 25\} = 70$. From the points B and C, I draw straight lines at right angles to AB and AC, and therefore tangential to the circle X, to meet AG produced at D, and join BD and CD, producing the quadrilateral ACDB. I bisect AD at E, and with O as centre, and EO as interval describe the circle XY, and with E as centre, and EA or ED as interval describe the circle Y. [Pg 84]

Now, to square the circle, or, in other words, to get exactly equal in superficial area to the circle X, I will show how to find it. From the point G draw a straight line—say G *m*—perpendicular to ED, making G *m* equal GD. Produce GA to a point *n*, making G *n* equal to 2AG - GD, and join *n m*. The square on *n m* will be the required square. (I have indicated this square by dotted lines.) For example:—If AO = 4, then AG = 5, and GD = 1'25; therefore $\{2AG - GD\} = \{10 - 1'25\} = 8'75 = Gn$; and Gm = 1'25; therefore, $Gn^2 + Gm^2 = 3\text{-}1/8 (AB^2)$; that is, $\{8'75^2 + 1'25^2\} = 3\text{-}1/8 (5^2)$, or, $\{76'5625 + 1'5625\} = \{3'125 \times 25\}$; and this equation=Area of the Circle X; and area of the square on *n m* :: and it follows, that the area of every circle, is equal to the area of a square on the hypotenuse of a right-angled triangle, of which the sides that contain the right angle are in the ratio of 7 to 1, and the sum of these two sides equal to the diameter of the circle. In many ways I have proved this fact, by practical or constructive geometry.

PLATE IV.

Duplication of the Cube.—In his "Young Geometrician; or, Practical Geometry without Compasses," 1865, Mr. Oliver Byrne's 40th Problem is as follows:—

Let AB be the side of a given cube BD. It is required to find AC, the side of another cube CE, so that the solid contents of the cube CE are double the solid contents of the cube BD. [Pg 85]

Ancient and modern mathematicians (says Mr. Byrne) have in vain attempted to solve this problem geometrically, that is, by the ruler and compasses only.

Let AB = BG = GR = RQ = QP = QO = OR = VZ. The length of the shortest side of the lesser set square; a line of any other given length may be applied. Draw OP and VR parallel to it; then apply the set squares in close contact, the edge OV of OVT passing through the point O, while the points of V and Z of ZSV fall exactly on the lines RV, RZ. Then draw the line ZBC, cutting FA produced in C; then the cube on AC is double the cube on AB.

PLATE V.

Trisection of an Angle.—In his work entitled *Young Geometrician*, 1865, Mr. Oliver Byrne gives as the 39th Problem: To divide a given angle BAC into three equal angles:—

The line A *m* is made = *p q*, the least side of the lesser triangular ruler; by (II) *p m* is drawn parallel, and *m n* perpendicular to AB. Then both rulers are kept in motion, and at the same time in close contact, as represented in the figure, until *p* falls on the line *p m*, and *n* on the line *m n*; *r nA* passing through the angular point A.

Then the angle DAB is one-third of the angle CAB. Mr. Byrne asserts that this problem is not capable of solution by the straight line and circle. Mathematicians have in vain attempted to solve it geometrically, that is, by the ruler and compasses only. [Pg 86]

PLATE VI.—FIGURE 1.

Perpetuum Mobile. Desaguliers demonstrated the absurdity of attempting to raise weights enclosed in a cellular wheel, simply by providing for their approach in succession nearer to the centre on the ascending side, while they should be projected further from the centre on the descending side. He remarks:—

Those who think the velocity of the weight is the line it describes, expect that that weight shall be overpoised, which describes the shortest line, and therefore contrive machines to cause the ascending weight to describe a shorter line than the descending weight.

For example, in the circle A B D *a*, the weights A and B being supposed equal, it is imagined that, if by any contrivance whatever, whilst the weight A describes the arc A *a*, the weight B is carried in any arc, as B *b*, so as to come nearer the centre in its rising, than if it went up the arc B D; the said weight shall be overpoised, and consequently, by a number of such weights, a perpetual

motion produced.

Now the velocity of any weight is *not* the line which it describes in general, but the height that it rises up to, or falls from, with respect to its distance from the centre of the earth. So that when the weight describes the arc A a, its velocity is the line A C, which shows the perpendicular descent, and likewise the line B C denotes the velocity of the weight B, or the height that it rises to, when it ascends in any of the arcs B b, instead of the arc B D: so that, in this case, whether the weight B, in its ascent be brought nearer the centre or not, it loses no velocity, which it ought to do, in order to be raised up by the weight A.

[Pg 87]

Indeed, if the weight at B, could by any means spring as it were, or be lifted up to x, and move in the arc x b, the end would be answered, because then the velocity would be diminished, and become xC.

FIGURE 2.

In "The Life, Times, and Scientific Labours of the Marquis of Worcester," 1865, page 454, will be found a full account of the present diagram, which is intended to illustrate as far as possible, an approach to the probable construction of the wheel by the Marquis in the 56th article of his memorable "Century of Inventions."

If any likely-looking method, could, more than another, render hopelessness more hopeless, surely this mechanical demonstration must prove most efficient for that purpose. For here, we actually produce a wheel agreeing to the terms with which Desaguliers closes his demonstration, when he suggests the only likely method to effect the end proposed, namely, perpetual motion. We find the fallen weight is absolutely "lifted up" as he desires, and "moves in the arc" he describes, and yet although he declares that then "the end would be answered"—it absolutely is *not* answered in this instance.

It is not requisite to calculate throughout the effect of the Marquis's entire number of 40 weights; four will suffice, taking the vertical and horizontal spokes a a a, showing two rings a and b; one, b, 12 inches within the other, so that the wheel being, as the Marquis says, 14 feet diameter, the inner ring will be 12 feet diameter. Now let each weight D be attached in the centre of a cord or chain a', D, b', 2 feet long, and then secure one end, as a', so the extreme end of each spoke a', and the other end of the cord, as b', to place on one lesser ring, as at b, or 12 inches from each spoke.

[Pg 88]

We shall then find by admeasurement that the upper weight on the vertical spoke is 7 feet from the centre, and the lower weight 6 feet; while at the same time there appears to be a preponderance due to the superior length of the horizontal arm A'; but against this latter we have the rising weight b'D, 1 foot from the centre, which, added to the 6 feet on the horizontal spoke, neutralizes the hoped-for effect, and the wheel remains in *statu quo*.

THE END.

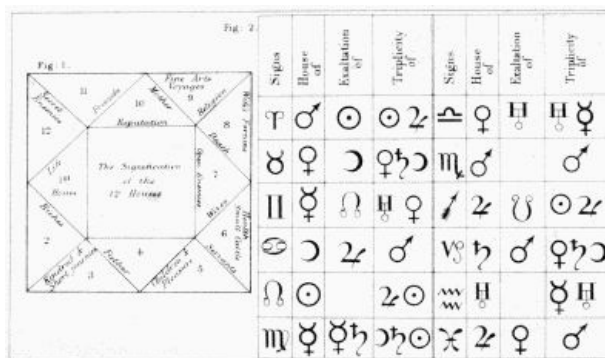


Plate 1.
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







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	Moon	Gabriel	Silver
	Saturn	Cassiel	Lead
	Jupiter	Sachiel	Tin
	Mars	Samael	Iron
	Venus	Anael	Copper
	Mercury	Raphael	Quicksilver
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	Caput	} Draconis	
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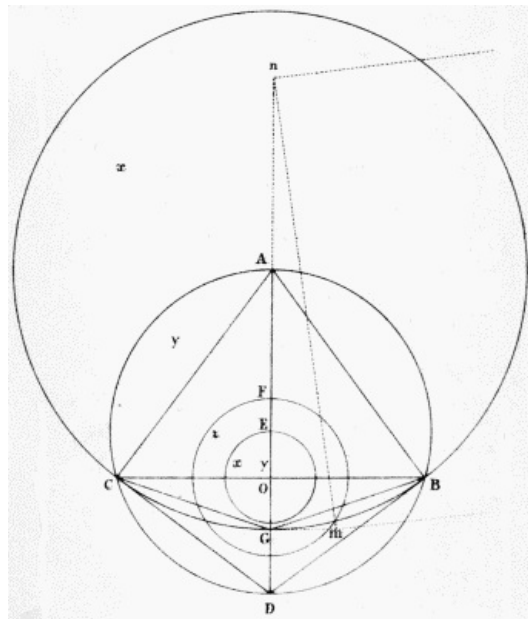


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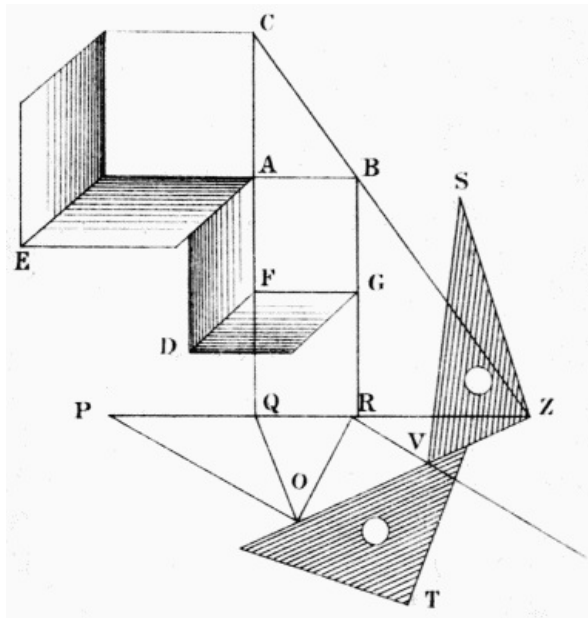


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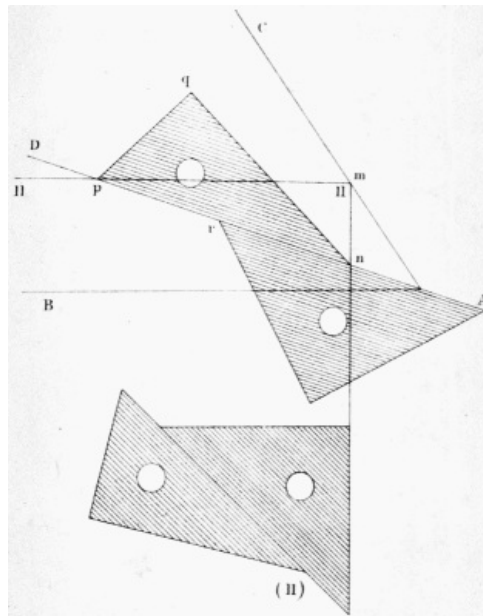


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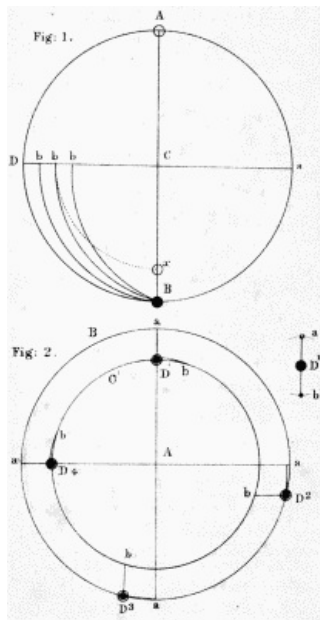


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Transcriber's Notes

Page 36: changed "Sorbiere" to "Sorbière" (15. Samuel Sorbière visited the works at Vauxhall)

Page 61: changed "Jupiper" to "Jupiter" (of cloves, &c. to Jupiter;)

Page 83: changed "BD²" to "BG²" ($\{AG^2 + CB^2 + 4(OF^2)\} = \{AC^2 + CG^2 + BG^2 + AB^2.\}$)

Page 83: changed " $\sqrt{10^2 + 5^2}$ " to " $\sqrt{10^2} + 5^2$ " ($\dots = \{5^2 + \sqrt{10^2} + \sqrt{10^2} + 5^2,\}$)

Page 84: changed closing parenthesis to closing braces ($\dots 9\} = \{25 + 10 + 10 + 25\} = 70$)

Page 84: changed "tangental" to "tangential" (tangential to the circle X)

Page 84: changed "Q" to "2" (making G n equal to 2AG - GD)

Page 84: added missing opening parenthesis in "(I have indicated this square by dotted lines.)"

Page 84: changed "+ 1'25}" to "× 25" ($\{76'5625 + 1'5625\} = \{3'125 \times 25\}$)

Page 84: changed "hypothenuse" to "hypotenuse" (the area of a square on the hypotenuse)

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