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LATEST PORTRAIT OF WILLIAM II. OF GERMANY

EMPEROR WILLIAM II. OF GERMANY.

Since William II. of Germany ascended the throne as German Emperor and King of Prussia, on June 15, 1888, the eyes of Europe have been fixed on him. He has always been rather an unknown quantity, and he is regarded by the powers as an *enfant* *terrible*. The press of the world delights in showing up his weak points, and the "war lord" undoubtedly has them, but, at the same time, he has qualities which are to be admired and which make him conspicuous among the rulers of Europe.

He is popular in Germany, and it is not surprising, for, in spite of being autocratic to the last degree, he is honest, courageous, ambitious, hard working, and, withal, a thorough German, being intensely patriotic. Indeed, if the people of the Fatherland had the right to vote for a sovereign, they would undoubtedly choose the present constitutional ruler, for, while the virtues we have named may seem commonplace, they are not so when embodied in an emperor. One thing which places William at a disadvantage is his excessive frankness, which is, in him, almost a fault, for if he couched his utterances in courtly or diplomatic phrases, they would pass unchallenged, instead of being cited to ridicule him. His mistakes have largely resulted from his impulsive nature coupled with chauvinism, which is, perhaps, justifiable, or, at least, excusable, in a ruler.

Since the time when William was a child he evidenced a strong desire to become acquainted with the details of the office to which his lofty birth entitled him. It is doubtful if any king since the time of Frederick the Great has studied the routine of the public offices and has made such practical inspections of industries of all kinds; indeed, there is hardly a man in Germany who has more general knowledge of the material development of the country.

In the army he has worked his way up like any other officer and has a firm grasp on all the multifarious details of the military establishment of the great country. He believes in militarism, or in force to use a more common expression, but in this he is right, for it has taken two hundred and fifty years to bring Prussia to the position she now holds, and what she has gained at the point of the sword must be retained in the same way. The immense sacrifices which the people make to support the army and navy are deemed necessary for self-preservation, and with France on one side and Russia on the other, there really seems to be ample excuse for it. To-day the German army is as ready as in 1870, when Von Moltke walked down the Unter den Linden, the day after hostilities were declared, looking in the shop windows.

No ruler, except possibly Peter the Great, ever gave so many *ex cathedra* opinions on so many different subjects in the same length of time, and of course it cannot be supposed that he has not made mistakes, but it shows that it is only by prodigious industry that he has been able to gather the materials on which these utterances are based. He is indeed the "first servant of the state," and long before his court or indeed many of the housemaids of Berlin are awake, he is up ind attending to affairs of all kinds.

He is a great traveler, and knows Europe from the North Cape to the Golden Horn; and while flying across country in his comfortable vestibuled train, he dispatches business and acquires an excellent idea of the country, and no traveler can speak more intelligently of the countries through which he has traveled, and this information is brought out with good effect in his excellent after-dinner speeches.

In speaking of the versatility of the Emperor, something should be said of him as a sportsman. He has given a splendid example to the Germans. He has tried to introduce baseball, football and polo, three American games. This may be traced to the time when Poultney Bigelow and J. A. Berrian were the Emperor's playmates. Fenimore Cooper was one of the favorite authors with the young scion of royalty. The Emperor is fond of hunting, yachting, tennis and other sports and is never so happy as when he stands on the bridge of the royal yacht Hohenzollern. He is a well known figure at Cowes and won the Queen's Cup in 1891.

William II. was born January 27, 1859, in Berlin, and until he was fourteen years old his education was intrusted to Dr. Hintzpeter, assisted by Major Von Gottberg, who was military instructor. At this time his corps of teachers was increased by the addition of Prediger Persius, who prepared him for his confirmation, which took place September 1, 1874, at Potsdam. As William was to lead an active life, it was thought best to send him to the gymnasium at Cassel.

Orders were given that he and his younger brother Henry, who accompanied him, should receive the same treatment as the other pupils, and this order was strictly obeyed. He graduated from this school January 24, 1877, just before his eighteenth birthday. After this his military career began with his entrance as an officer into the first Garde-regiment at Potsdam, that he might become thoroughly acquainted with practical service. The young prince was assigned to the company which his father had once commanded. After serving here for a short time he went to the university at Bonn, and from there he went back to the army again. Emperor William ascended the throne in June, 1888, upon the death of his father Frederick III.

In 1880 he was betrothed to Augusta Victoria, Princess of Schleswig-Holstein, and on February 9, 1881, they were married. The Empress is about a year younger than the Emperor, and makes an excellent mother to her four little sons, to whom she is devoted. Their oldest child, little Prince William, the present Crown Prince, was born at Potsdam, May 6, 1882. His father's devotion to the army will doubtless prompt him to make a soldier of his son at an early age; in fact, he wore the uniform of a fusilier of the Guard before he was six years old.

The imperial family consists of seven children. The eldest, the Crown Prince of Germany and Prussia, is Prince Friedrich-Wilhelm-Victor-August-Ernst, born May 6, 1882. The second child is Prince Wilhelm-Eitel-Friedrich-Christian-Karl, born July 7, 1883. The third is Prince Adalbert-Ferdinand-Berenger-Victor, born July 14, 1884. Prince August-Wilhelm-Heinrich-Victor was born January 29. 1887. The fifth child, Prince Oscar-Karl-Gustav-Adolf, was born July 27, 1888. The sixth child is Prince Joachim-Francois-Humbert. He was born December 17, 1890. The youngest is a girl, Princess Victoria-Louise-Adelaide-Mathilde-Charlotte. She was born September 13, 1892.

Our engraving is from the last portrait of the Emperor William, and we are indebted for it to the Illustrirte Zeitung.

MY RECENT JOURNEY FROM THE NILE TO SUAKIM.

By Frederic Villiers, in The Journal of the Society of Arts.

THE ADVANCE TO KHARTOUM.

The recent campaign in the Soudan was a bloodless one to the correspondent with the expedition, or, rather, on the tail of the advance. Yet I think, in spite of this little drawback, there is enough in the vicissitudes of my colleagues and myself during the recent advance of the Egyptian troops up the Nile to warrant me addressing you this afternoon. Especially as toward the end of the campaign the Sirdar, or Commander-in-Chief of the Egyptian army, Sir Herbert Kitchener, became more sympathetic with our endeavors to get good copy for our journals, and allowed us to return home by the old trade route of the Eastern Soudan, over which no European had passed since the revolt of the Eastern tribes in 1883. Unfortunately, the period for campaigning in the Soudan is in the hottest months in the year, on the rising of the Nile at the end of July, when the cataracts begin to be practicable for navigation. At the same time, in spite of the heat, it is the healthiest period, for the water, in its brown, muddy, pea soup state, is wholesomer to drink, and the banks of the river, which, when exposed at low Nile, give off unhealthy exhalations, are protected from spreading fever germs by the flood. To show you how much the people of Egypt depend for their very existence on this extraordinary river, the average difference between high and low Nile, giving favorable results, is 26 feet. Twenty-eight feet would cause serious damage by inundation, and the Nile as low as 20 feet would create a famine. The flood of the river depends entirely on the equatorial rains which cause the Upper

White Nile to rise in April and the Blue Nile early in June. The muddy Atbara, joining her two sisters about the same time, sends the flood down to Lower Egypt toward the end of August at the rate of 100 miles a day. The Blue Nile in the middle of September falls rapidly away, while the Atbara leaves the trio in October. The White Nile is then left by herself to recede slowly and steadily from a current of four knots an hour to a sluggish and, in many parts, an unwholesome stream. Flies and mosquitoes increase, and fever is rife.

I arrived in Cairo on a sweltering day in July, and found four colleagues, who had been waiting for a week the Sirdar's permission to proceed to the front, still waiting. Luckily, the day after my arrival a telegram came from headquarters, saying that "we might proceed as far as Assouan and their await further orders." This, anyhow, was a move in the right direction; so we at once started. It was rather a bustle for me to get things ready, for Sunday blocked the way and little could be done, even on that day, in Cairo. I procured a servant, a horse and two cases of stores, for the cry was "nothing to be had up country in the shape of food; hardly sufficient sustenance to keep the flies alive." My colleagues, who had the start of me, were able to procure many luxuries—a case of cloudy ammonia for their toilet, and one of chartreuse, komel and benedictine to make their after dinner coffee palatable, and some plum pudding, if Christmas should still find them on the warpath, were a few of the many items that made up the trousseau of these up-to-date war correspondents, though at least one of them had been wedded to the life for many years. Unfortunately I had no time to procure these luxuries, and I had to proceed ammonialess and puddingless to the seat of war. My comrades were quite right. Why not do yourself well if you can? One of them even went in for the luxury of having three shooting irons, two revolvers and a double-barrel slug pistol, so that when either of the weapons got hot while he was holding Baggara horsemen at bay, there was always one cooling, ready to hand. He also, which I believe is a phenomenal record with any campaigner, took with him thirteen pairs of riding breeches, a half dozen razors and an ice machine. Even our commander-in-chief, when campaigning, denies himself more than two shirts and never travels with ice machines. But the thirteen pairs impressed me considerably. Why thirteen, more than fifteen, or any other number? I came to the conclusion that my colleague must certainly be a member of that mystic body the "Thirteen Club," and as he had to bring in the odd number somewhere to keep the club fresh in his memory, he occasionally sat upon it.

I found, after all, there was some wisdom in his eccentricity, for, when riding the camel, mounted on the rough saddle of the country, I often wished that I had my friend's forethought, and I should have been glad to have supplemented mine with his odd number. No doubt my colleague's idea in having such a variety of nether garments was to use them respectively, on a similar principle to the revolvers, when he rode in hot haste with his vivid account of the latest battle to the telegraph office.

But, unfortunately, this recent campaign did not, after all, necessitate these elaborate preparations, for there were no dervishes for us to shoot at or descriptions of bloody battles to be telegraphed. At all events, the cloudy ammonia and the thirteen breeches, with the assistance of a silken sash—a different color for each day of the week—made the brightest and smartest looking little man in camp. However, when I reflect on this new style of war correspondent, who, I forgot to mention, also carried with him two tents, a couple of beds, sundry chairs and tables, a silver-mounted dressing case, two baths, and a gross of toothpicks, and I think of the severe simplicity of the old style of campaigning when a famous correspondent who is still on the warpath, and who always sees the fighting if there be any, on one arduous campaign took with him the modest outfit of a tooth brush and a cake of carbolic soap, I joyfully feel that with the younger generation our profession is keeping pace with the luxury of the times.

FROM BERBER TO SUAKIM.

Toward the end of the campaign four colleaguesMessrs. Knight, Gwynne, Scudamore, Maud—and myself, took this opportunity of traversing a country very little known to the outside world, and a route which no European had followed for fourteen years, from Berber to Suakim. Moreover, there was a spice of adventure about it; there was an uncertainty regarding an altogether peaceful time on the way—a contingency which always appeals strongly to Englishmen of a roving and adventurous disposition. Only quite recently raids organized by the apparently irrepressible Osman Digna had been successfully carried out a few miles north and south of Berber. At the moment General Hunter, with two battalions of troops, was marching along the banks of the River Atbara to hunt for Osman and his followers, but there was much speculation as to whether five-and-twenty dervish raiders were still this side of the river, and drawing their water from the wells on the Suakim road.

I was hardly prepared for this journey—one, probably, of twelve days—for my campaigning outfit, which I was compelled to leave on board my nugger on the Nile, had not yet arrived in Berber. Unfortunately, I could not wait for the gear, as the Sirdar insisted on our departure at once, for the road would be certainly insecure directly General Hunter returned from covering our right flank on the Atbara. I had no clothes but what I stood up in, and I had been more or less standing up in them without change for the last two weeks.

Our caravan of nineteen camels, with two young ones, quite babies, following their mothers, and a couple of donkeys, about seven in the evening of the 30th of October quitted the mud-baked town of Berber, sleeping in the light of a new moon, and silently moved across the desert toward the Eastern Star. Next morning at the Morabeh Well, six miles from Berber, our camels having filled themselves up with water, and our numerous girbas, or water skins, being charged with the precious liquid—till they looked as if they were about to burst—our loads were packed and we started on a journey of fifty-two miles before the next water could be reached.

We made quite a formidable show trailing over the desert. Probably it would have been more impressive if our two donkeys had restrained their ambition, and kept in the rear instead of leading the van. But animals mostly have their own way in these parts, and asses are no exception to this rule. The two baby camels commenced "grousing" with their elders directly we halted or made a fresh advance; they probably had an inkling of what was in store for them. After all, the world must seem a hard and unsympathetic place when, having only known it for two or three weeks, you are compelled to make a journey of 240 miles to keep up with your commissariat. One of these babies was only in its eighteenth day. In spite of its tender youth the little beast trotted by the side of its mother, refreshing itself whenever we came to a halt with a pull from her teats, and, to the astonishment of all, arrived in Suakim safe and sound after twelve days' marching.

To the uninitiated regarding the "grousing" of camels, I should explain that it is a peculiar noise which comes from their long funnel necks early or late, and for what reason it is difficult to tell. Sometimes the sound is not unlike the bray of an ass, occasionally it reaches the dignity of the roar of a lion with the bleating of a goat thrown in, then as quickly changes to the solemnity of a church organ. It is altogether so strange a sound that nothing but a phonograph could convey any adequate idea of it. It is a thing to be heard. No pen can properly describe it. After a long march, and when you are preparing to relieve the brute of his load, he begins to grouse. When he is about to start in the morning he grouses. If you hit him, he grouses; if you pat his neck gently, he grouses; if you offer him something to eat, he grouses; and if you twist his tail, he makes the same extraordinary noise. The camel evidently has not a large vocabulary, and he is compelled to express all his various sensations in this simple manner.

The first part of our journey was monotonous enough, miles and miles of weary sandy plains, with alternate stretches of agabas or stony deserts, scored with shallow depressions, where torrential rains had recently soaked into the sand, leaving a glassy, clay-like surface, which had flaked or cracked into huge fissures under the heat of the fierce sun. And at every few hundred yards we came to patches of coarse camel grass, which had evidently cropped up on the coming of the rain, and, by its present aspect, seemed to feel very sorry that it had been induced to put in an appearance, for its sustenance was now fast passing into vapor, and its green young life was rapidly dying out as the sun scorched the tender shoots to the roots. But camels thrive on this parched-up grass, and our brutes nibbled at it whenever one slackened the head-rope.

We traversed the dreary plain, marked every few yards by the bleached bones of camels fallen by the way; the only living thing met with for two days being a snake of the cobra type trailing across our path. The evening of the second day we camped in a long wadi, or shallow valley, full of mimosa trees, where our camels were hobbled and allowed to graze. They delighted in nibbling the young branches of these prickly acacias, which carry thorns at least an inch in length, that serve excellently well for toothpicks. Yet camels seem to rejoice in browsing off these trees, and chew up their thorns without blinking. This I can partly understand, for the camel's usual diet of dry, coarse grass must become rather insipid, and as we sometimes take "sauce piquante" with our cold dishes, so he tickles his palate with one inch thorns.

Climbing ridge after ridge of the dunes, we at last saw stretching before us in the moonlight the valley of Obak, an extensive wadi of mimosa and sunt trees. Our guides halted on a smooth stretch of sand, and I wondered why we were not resting by the wells. Near were three native women squatting round a dark object that looked to me, in the faint light of the moon, like a tray. I walked up to them, thinking they might have some grain upon it for sale, but found to my surprise that it was a hole in the sand, and I realized at once that this must be a well. One of the women was manipulating a leather bucket at the end of a rope, which after a considerable time she began hauling up to the surface. It was about half full of thick, muddy water. Further on along the wadi I now noticed other groups of natives squatting on the sand doing sentinel over the primitive wells. I never came across a more slovenly method of getting water. The mouths of the holes were not banked or protected; a rain storm or sand drift at any moment might have blocked them for a considerable period.

Not being able to get water for the camels was a serious matter, as our animals were not of the strongest, nor had they been recently trained for a long journey without water. This was the evening of the third day from Berber, and many of the poor brutes were showing signs of weakness. We resolved, therefore, to hurry on at once to the next well, that of Ariab; so we left the inhospitable wadi, and started at three in the morning on our next stretch of fifty-three miles.

These night marches were pleasant enough; it was only the hour or two before dawn when the heaviness of sleep troubled us; but just as we began nodding, and felt in danger of falling off our camels, the keen change in the temperature which freshens the desert in the early morning braced us up, and, fully awake, we watched for the coming of Venus. As she sailed across the heavens, she flooded the desert with a warm, soft light, which in its luminosity equaled an English summer moon, and shortly seemingly following her guidance, the great fiery shield of the sun stood up from the horizon, and broad day swept over the plain.

Toward the evening we found ourselves in a bowlder-strewn basin amid rocky, sterile hills, evidently the offshoots and spurs of the Jeb-el-Gharr, which stood out a purple serrated mass on our left, and here we saw for the first time for many a month rain clouds piling up above the rocky heights. Their tops, catching the rosy glow from the declining sun, appeared in their quaint forms like loftier mountains with their snowy summits all aglow. This was, indeed, a grateful sight to us; the camels already pricked up their ears, for the smell of moisture was in the air. We knew that the end of our waterless journey was not far off; for where those clouds were discharging their precious burdens the valley of Ariab lay. But many a weary ridge of black rock and agaba must still be crossed before our goal was reached.

We camped at six that evening till midnight, when we started on our record march.

Unfortunately at this time my filter gave out, owing to the perishable nature of the rubber tubing; the remaining water in our girbas was foul and nauseating from the strong flavor of the skins. I resolved to try and hold out without touching the thick, greasy fluid, and wait till the wells of Ariab were reached. As we advanced, the signs of water became more and more apparent; the camel grass was greener down by the roots, and mimosa and sunt trees flourished at every few hundred yards. When morning came, for the first time we heard the chirruping and piping of birds. The camels increased their pace, and all became eager to reach our destination before the extreme heat of the day. But pass after pass was traversed, and valley after valley crossed, and yet the wadi of Ariab, with its cool, deep wells of precious water, was still afar. It was not till past two o'clock in the afternoon that a long, toilsome defile of rugged rock brought us on the edge of a steep descent, and before us lay the winding Khor of Ariab, with its mass of green fresh foliage throwing gentle shadows on the silver sand of its dry watercourse. It seemed an age as we traversed that extended khor before our guide pointed to a large tree on our right, and said "Moja." We dismounted under the shadow of its branches, and found awaiting us the sheikh of the valley, who pressed our hands and greeted us in a most friendly way; but I was almost mad with thirst, and asked for the well. I was taken to a mound a few yards from our retreat, on the sides of which were two or three clay scoop-outs, all dry but one, and this held a few gallons of tepid water, from which camels had been drinking. The man took a gourd, half filled it, and offered it to me to drink. "But the well, the well!" I cried. "Oh! that's a little higher up," said he, and he led me to a wide revetted well about fifty feet deep, at the bottom of which, reflecting the sky, shone the water like a mirror. "That's the water I want," said I. The man shook his head. "You cannot drink of that till your baggage camels arrive; we have no means of reaching it." I almost groaned aloud, and with the agony of the Ancient Mariner could well cry, "Water, water everywhere, but not a drop to drink." There was no help for it. I made my way back to the shadow of the tree, threw myself on my blanket, and, racked with thirst, tried to wait patiently for the coming of the camel men. Fortunately, the sheikh of the well was inspired with hospitality, and after a while brought us some fresh milk in a metal wash basin, a utensil which he evidently produced in honor of our visit. I took a long draught, and though it was associated with native ablutions, I shall always remember it with the greatest satisfaction. We camped for 24 hours in the sylvan vicinity of Ariab Wells—stretched ourselves in the broad shadows of its mimosa trees, and drank of and bathed in its sweet, cool waters.

This long rest improved our camels wonderfully. By the bye, there was much speculation between two of our party regarding the behavior of these curious animals on arriving at the wells after their long waterless march. A general impression was that for the last few miles the camels would race for the waters, and thwart all endeavors to hold them in. My experience of the strange beast was otherwise, and subsequent events proved that I was right. When the Hamleh, as we christened our caravan, arrived, the camels quietly waited awhile after their burdens were taken from their humps. Then, as if an afterthought had struck them, they slowly approached the scoop-outs and with the most indifferent air would take a mouthful of the liquid, then, stiffening their necks, they would lift their heads and calmly survey the scenery around them, till their drivers would draw their attention to the fact that there was at least another draught of water in the pool. It should be remembered that these animals had just come off a continuous journey of nearly fifteen hours, without a halt, and had been for three whole days without water.

We left our camping ground as the sun began to dip behind the hills shutting in the khor. Our way now lay in a more northeasterly direction, and the sun threw the hills and valleys we were approaching into a marvelous medley of glorious color, and more than one of us regretted that we had not brought our color boxes with us. Sometimes we seemed to catch a glimpse of the heather-clad Highlands of Scotland. Then a twist in the khor we were traversing suggested the rugged passes of Afghanistan. Gazelle and ariel stole among the foot hills or stood gazing at us as near as a stone's throw. One of our party, Mr. Gwynne, commenced stalking a gazelle, but, darkness setting in, the beast got away. For the rest of the journey to Suakim, however, he had good sport, and saved us many a time from going hungry with his shooting for the pot.

About 34 miles from Ariab we came to one of the most interesting spots of the whole journey—the extensive Valley of Khokreb, wherein lay the deserted dervish dem, or stronghold. Here some followers of Osman Digna used to levy toll on all caravans and persons moving toward Suakim, or taking routes south. The dem consisted of a number of well built tokuls, or straw huts, standing in their compounds, with stabling for horses and pounds for cattle. The whole was surrounded with a staked wall, in front of which was a zariba of prickly mimosa bush, to stop a sudden onrush of an enemy. The place was intact, but there was not a living soul within it, or in the vast valley in which it stood, that we could see. In fact, our whole journey up to the present seemed to be through a country that might have been ravished by some plague or bore some fatal curse. As the light of the moon prevailed, we came upon an extensive plain shelving upward toward steep hills. Specks of bright light stood out against the distant background, and we presently found that the moonlight was glinting on spear heads, and soon a line of camels crept toward us, and marching as escort was a small guard of Hadendowahs, with spear and shield.

We found the convoy to be a detachment of a caravan of 160 camel loads of stores sent from Suakim to Berber by that enterprising Greek, Angelo, of the former town. They had been on the road already eight days, having to move cautiously owing to rumors of dervish activity, but had arrived so far safely. We bivouacked for several hours in the Wadi of Salalat, which was quite parklike with its fine growth of sunt trees.

When we had crossed the frontier between Bisheren and Hadendowah country we were in comparative safety regarding any molestation by the natives, for we were escorted by the son of the sheikh of one of the subtribes of the latter country. At all events, I must have been a sore temptation for any evil disposed Fuzzy Wuzzy; for, owing to my camel being badly galled by an ill-fitting saddle, I would find myself for many hours entirely alone picking my way by the light of the moon, the poor brute I was riding not being able to keep pace with the rest. All the following day our route lay over stony plains of a bolder type than any we had yet seen, and when in the heart of the Hadendowah Hills we came suddenly upon a scene in its weirdness the most extraordinary and most appallingly grand I had ever seen. A huge wilderness lay before us like the dry bed of a vast ocean, whose waters by some subterranean convulsion had been sucked into the bowels of the earth, leaving in its whirling eddies the debris of submarine mountains heaped up in rugged confusion or scattered over its sandy bottom. Porphyry and black granite bowlders, in every conceivable form and size, lay strewn over the plain. Sometimes so fantastic did their shapes become that the least imaginative of our party could picture the gigantic ruins of some mighty citadel, with its ramparts, bastions and towering castle. For many hours we were traversing this weird and desolate valley, and when the sun cast long shadows across our track as he sank to rest, his ruddy light falling upon the dark bowlders, polished with the sand storms of thousands of years, stray pieces of red granite would catch his rosy glint, and sparkle like giant rubies in a setting of black pearls.

We found more life in ten miles of the Hadendowah country than during the whole of the first part of our journey. Flocks of sheep, goats and oxen passed us coming to the wells, or going to some pasturage up in the hills, but few natives came near us, and there were no signs of habitation anywhere. The wells we now passed were mere water holes similar to those met with up country in Australia. The flocks of the natives would hurry down at eventide and drink up all the water that had percolated through the sand during the day, befouling the pools in every conceivable way. Natives seem to revel in water contaminated by all kind of horrors. They wash the sore backs of their camels, bathe their sheep and drink from the same pool. At one large hole round which a number of natives were filling their girbas we halted, and procured some of the liquid, which was muddy and tepid, but wholesomer. A native caravan had camped near by and the Hadendowah escort of spearmen crowded round us.

The Fuzzy Wuzzy is a much more pleasant object when seen through a binocular than when he is close to you. His frizzy locks are generally clotted with rancid butter, his slender garment is not over clean. He is a very plucky individual, as we know, thrifty, and lives upon next to nothing, but many live upon him. Several graybeards came up to salute their sheikh, who was traveling with us, and this they did by pressing his hand many times, and bowing low, but they glanced at us with no amiable eyes, and suddenly turned away. There was no absolute discourtesy; they simply did not want to be introduced. Probably they remembered the incident at Tamai, where many of their friends were pierced with British bullets. So they slung their shields, trailed their spears and turned away.

My camel had much improved by gentle treatment and I was able to ride on ahead. Just as I neared the narrow neck of the Tamai Pass, two men and a boy climbed down toward us from a small guard house, on a lofty rock to our left. My camel man and I instinctively came to a halt, for the manner of the comers, who were fully armed, was impressive. They confronted us and immediately began questioning my camel man, after much altercation, during which I quietly leaned over my saddle and unbuttoned my revolver case, for they looked truculent and somewhat offensive. My camel man mysteriously felt about his waist belt, and eventually handed something to the foremost native, whereat he and his companions turned and began to reclimb the hill. As we went on our way, I inquired the reason of the men barring our path. "Oh," my man said, "it is simply a question of snuff." "Snuff," I exclaimed, in astonishment. "Yes; that was all they wanted—a little tobacco powder to chew." Here was a possible adventure that seemed as if it were going to end in smoke, and snuff was its finale.

After all the Suakim-Berber road, that was looked upon as full of dramatic incident—for even our military friends in Berber, when they bid us goodby, said, "It was a very sporting thing to do. Great Scott! They only wished they had the luck to come along"—was a highway without even a highwayman upon it, and apparently for the moment as pleasantly safe, minus the hostelries en route, as the road from London to York. Prom the top of Tamai Pass, 2,870 feet—though of the same name, not to be confounded with the famous battle which took place further south—we began to make a rapid descent, and the last sixty miles of our journey were spent in traversing some of the most lovely mountain scenery I think I have ever visited. Sometimes one might be passing over a Yorkshire moorland, with its purple backing of hills, for the sky was lowering and threatened rain. Then the scene would as quickly change to a Swiss valley, when, on rounding the base of a spur, one would strike a weird, volcanic-torn country whose mountains piled up in utter confusion like the waves of the stormy Atlantic; and further on we would come out upon a plain once more scattered with gigantic bowlders of porphyry and trap, out of which the monoliths of ancient Thebes might have been fashioned.

On the morning of the tenth day out from Berber, we sighted the fort and signal tower of the Egyptian post at Tambuk, on a lofty rugged rock, standing out in the middle of an immense khor. This was practically the beginning of the end of our long journey, and here we rested a few hours, once more drinking our fill of pure sparkling water from its revetted wells.

About half an hour in a northeasterly direction, after a continual descent from the Egyptian fort, we noticed, at intervals between the hills in front of us, a straight band of blue which sparkled in the sunlight. At this sight I could not refrain from giving a cheer—it was the Red Sea that glistened with the sun —for it meant so much to us. Across its shining bosom was our path to civilization and its attendant comforts, which we had been denied for many a month. Night found us steadily descending to ward the seaboard, as we neared Otao, in the vicinity of which we were to bivouac for the night. My camel nearly stumbled over an old rusty rail thrown across my path, and further on I could trace in the moonlight the dark trail of a crazy permanent way, with its rails all askew.

We were passing the old rail head of the Suakim-Berber Railway, that was started in 1885. I wondered, as I followed fifteen miles of this rusty line, a gradual slope of 1,800 feet toward the sea, whether the road I had only just traversed had ever been surveyed for a railway, and whether anybody had the slightest notion of the difficulties to be contended with in carrying out the scheme. Of course, modern engineering, with such men as Sir Benjamin Baker at the fore, can overcome any difficulty if money be no object, but who can possibly see any return for the enormous outlay an undertaking of this kind would entail?

To start with, there is one up grade of 2,870 feet within forty miles from Suakim, and the khors, through which the railway must wind, are sometimes raging torrents. To obviate this, if the line be built of trestles (timber elevations), as with the Canadian Pacific Railway, there is no wood in the country but for domestic purposes. Material, for every detail, must be imported. A smaller matter, but also somewhat important—though water apparently can be found in the khors for the digging, it is a question whether a sufficient quantity can be got at all times for the requirements of a railway. The natives themselves are often very badly off for water, as in the case of the Obak wells.

Wells run dry at odd times in this country, and can never be depended upon. Of course, water can be condensed at Suakim and stored. Further, a rival line is already in progress, which will connect Wady Halfa with Berber early this year. European goods coming by that line from Alexandria would be free of the Suez Canal dues, and certainly the directors of that line would treat freights favorably if Suakim should ever be connected with Berber by rail. As for the interior trade of the country, nearly all the population have either died from recent famine or have been killed off in the Mahdi's cause. There is no commercial center or even market to tap from one end of the road to the other.

The next morning we came in view of Suakim, the city of white coral, with her surf-beaten opalesque reefs stretching as far as the eye could follow. It seemed strange to me to be peacefully moving toward her outlying forts, for when I was last in her vicinity one could not go twenty yards outside the town without being shot at or running the gauntlet of a few spears. But here I was, slowly approaching its walls, accompanied by some of the very men who in those days would have cut my throat without the slightest hesitation. Suakim had changed much for the better; her streets were cleaner, and mostly free from Oriental smells. But these sanitary changes always take place when British officers are to the fore.

Surgeon Capt. Fleming is the medical officer responsible for the health of the town, and he has been instrumental in carrying out great reforms, especially in doing away with the tokuls and hovels, in which the Arabs herded together, and removing them to a special quarter outside the town.

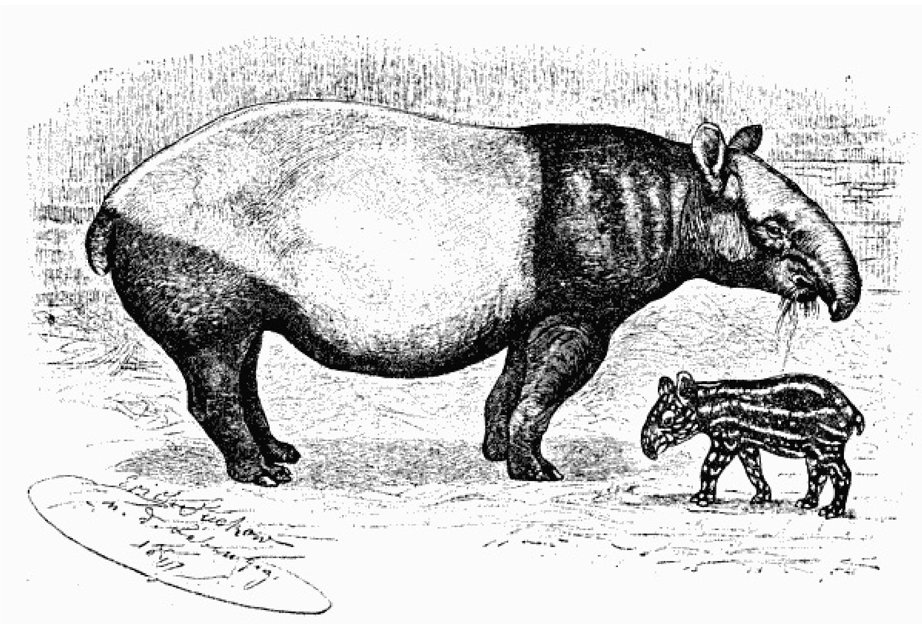
The principal feature about Suakim to-day is its remarkable water supply. In 1884 our troops had to depend on condensed sea water, supplied from an old steamer anchored in the harbor, and the town folk drew an uncertain supply from the few wells outside the town. But now Suakim never wants for water, and that of the best. She even boasts of a fountain in the little square opposite the governor's house. Engineer Mason is responsible for this state of efficiency, to which Suakim owes much of her present immunity from disease. During the last twelve years immense condensing works have been erected on Quarantine Station; but, better still, about two years ago Mr. Mason discovered an apparently inexhaustible supply near Gemaiza, about three miles from the town. There is a theory—which this water finding has made a possible fact—that as coral does not grow in fresh water, the channel which allows steamers to approach close up to the town, through her miles of coral reefs, is caused by a fresh water current running from the shore.

However, on this theory Mason set to work and found a splendid supply at Fort Charter; an excavation in the khor there, about 200 feet long and 40 deep, is now an immense cistern of sweet water, the result of which the machines condensing 150 tons of water a day are now only required to produce one-half the quantity, saving the Egyptian government a considerable outlay.

The natives look upon Mason as a magician, the man who turns the salt ocean into sweet water. But metal refuse, scraps of iron, old boiler plates, under his magic touch, are also turned into the most useful things. For instance, the steam hammer used in the government workshop is rigged on steel columns from the debris of an engine room of a wrecked vessel. The hammer is the crank of a disused shaft of a cotton machine, the anvil is from an old "monkey," that drove the piles for the Suakim landing stage in 1884; the two cylinders are from an effete ice machine, and the steam and exhaust pipes come from a useless locomotive of the old railway. A lathe, a beautiful piece of workmanship, is fashioned out of one of the guns found at Tamai. And the building which covers these useful implements was erected by this clever engineer in the Sirdar's service, who had utilized the rails of the old Suakim-Berber line as girders for its roof, and, in my humble opinion, this is probably the very best purpose for which they can be used.

TAPIRS IN THE ZOOLOGICAL GARDEN AT BRESLAU.

A fine pair of shabrack (Tapirus indicus) and another pair of American tapirs (Tapirus americanus) constitute the chief attraction of the house devoted to pachyderms in the Zoological Garden at Breslau, and interest in this section of the garden has recently been greatly enhanced by the appearance of a healthy young shabrack. This is only the second time that a shabrack tapir has been born in captivity in Europe, and as the other one, which was born in the Zoological Garden at Hamburg, did not live many days, but few knew of its existence; consequently, little or nothing is known of the care and development of the young of this species, although they are so numerous in their native lands. Farther India, Southwestern China and the neighboring large islands, where they also do well in captivity. The tapir was not known until the beginning of this century, and even now it is a great rarity in the European animal market, and as the greatest care is required to keep it alive for any length of time in captivity, it is seldom seen in zoological gardens; therefore, the fact that the shabrack tapirs in the Breslau garden have not only lived, but their number has increased, is so much more remarkable.



SHABRACK TAPIR WITH YOUNG ONE (FIVE DAYS OLD) IN THE BRESLAU ZOOLOGICAL GARDEN.

FROM DRAWING BY ERICH SUCKOW.

Our engraving shows that the five days old tapir resembles its mother in form, although its marking is quite different. Its spots and stripes are very similar to those of the young of the American tapir, several of which have been born in captivity in

Europe. They shade from yellow to brown on black or very dark brown ground, and the spots on the legs take a whitish tone. This little one's fur is longer on the body than on the head and extremities, and is soft and thick, but has not the peculiar glossiness of the full grown animal. Its iris is a beautiful blue violet, while that of the old one is dark violet, and its little hoofs are reddish brown, while those of the mother are horn gray. When standing, the new comer measures about two feet in length and one foot two inches in height, having gained about one inch in height in five days. Its fine condition is doubtless due partly to the great care given it and partly to the healthy constitution of the mother, and it is the pet of its keepers and of the public.—Illustrirte Zeitung.

THE INFLUENCE OF SCENERY UPON THE CHARACTER OF MAN.

The effect of scenery upon the mind of man has often been noticed and much has been written about it. Illustrations of this are generally drawn from the historic lands and from the ancient people of the East. The civilized races, such as the Greeks, Romans and other nations who formerly dwelt on the coast of the Mediterranean, are taken as examples. The Greeks are said to have owed their peculiar character and their taste for art to the varied and beautiful scenery which surrounded them. Their mythology and poetry are full of allusions to the scenes of nature. Mountains and springs, rivers and seas all come in as the background of the picture which represents their character and history. The same is true of the Romans, Egyptians, Phenicians, Syrians, Hebrews, the ancient Trojans and Carthaginians. Each one of these nations seems to have been affected by scenery. They were all, with the exception of the Carthaginians, confined within the limits of a narrow territory, and remained long enough in it to have partaken fully of the effect of their surroundings.

The Romans were warlike at the beginning, and bore the air of conquerors, but their taste for art and literature resembled that of the Greeks. The Egyptians were sensuous and luxurious people. Their character bore the stamp of the river Nile with its periodical overflow, its rich soil and mild climate. The type of their religion was drawn from the gods who inhabited the same river valley. The Phenicians were a maritime people; they were the first navigators who reached the great seas. Their gods resembled those of the Assyrians and Chaldeans, but their character resembled the seas over which they roved; they did not originate, but they transported the products and inventions of the ancient world.

The Hebrews had a national character which seemed to have been narrowed down to a small compass by their isolation and by their history, but their religion was as grand as the mountains of the desert, and their poetry as beautiful as the scenery along the river Jordan, which ran as a great artery through their land. It was a holy land which gave impress to the Holy Book. The effect of scenery upon human character is also illustrated in the case of the ancient inhabitants of America. This land was isolated from the rest of the world for many centuries—perhaps for thousands of years. It is supposed that up to the time of the discovery the tribes were permanent in their seats.

Each tribe had its own habitat, its own customs, its own mythology and its own history. The effect of scenery must be considered, if we are to understand the peculiarities which mark the different tribes. Some imagine that the Indians are all alike, that they are all cruel savages, all given to drunkenness and degradation and only waiting their opportunity to wreak their vengeance upon helpless women and children. Those who know them, however, are impressed with the great variety which is manifest among them, and are especially convinced that much of this comes from the scenery amid which they have lived. The Eastern tribes may have had considerable sameness, yet the Algonquins, who were the prairie Indians, and the Iroquois, who dwelt in the forest and amid the lakes of New York, differed from one another in almost every respect, and the Sioux and Dakotas, who were also prairie

Indians, differed from both of these. They were great warriors and great hunters, but had a system of religion which differed from that of any other tribe.

The Sioux were cradled amid the mountains of the East, and bear the same stamp of their native scenery. They resemble the Iroquois in many respects. The same is true of the Cherokees, who were allied to the Iroquois in race and language. They were always mountain Indians; but the Southern tribes were very different from either. They were a people who were well advanced in civilization so far as the term can be applied to the aborigines. Their skulls are without angles and differ greatly from the keel-shaped skulls. They were dolichocephalic rather than kumbocephalic. They resemble the Polynesians, while the northern tribes resembled the Mongolians. Whatever their original home was, their adopted habitat was in accord with their tastes and character. It did not change them but rather made their traits more permanent and stable.

The tribes of the northwest coast were seafarers; they inhabited the forest and worshiped the animals which were peculiar to the forest and took as their totems the eagle, wolf and raven, but they drew their subsistence in great part from the sea. They worshiped the animals of the seas, such as the shark, the whale and the sculpin. Their skill and courage as navigators have never been equaled. Taking their families and the few articles of commerce gathered from the forest they entered the symmetrical and beautifully carved canoes and breasted the storms and waves of the great sea near which they lived. There was a wildness in the waves which just suited them. The sea brought out the best traits and developed the heroic character. They were the "sea kings" of the Northwest. They were great navigators and great hero worshipers.

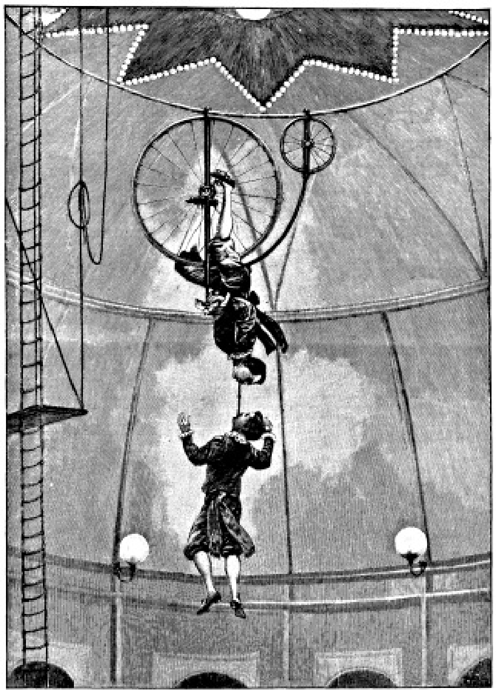
The tribes of the interior, the Pueblos, the Zunis, differed from all other tribes. They were surrounded by wild tribes, such as the Apaches, Comanches and Navajoes. Whatever their origin, they had remained long enough in this territory to be affected by the scenery and surroundings. They were mild, luxurious, given over to religious ceremonies, made much of mythology and had many secret societies. They built their terraced houses, taking the cliffs and mesas as their patterns, and made them so similar to the rock and cliffs that it was difficult to recognize them at a distance. They did not mould the mountains into villages as the Mayas did, but they made their houses to conform to the mountains, and took the mountain gods and their nature divinities as chief objects of worship.

The contrast between the ancient tribes of this region and the wild tribes which intruded upon them was very great. The Navajoes were a mountain people and drew their religion from the mountains. They borrowed many myths and customs from the ancient Pueblos, and like them, settled down to an agricultural life; but their sand paintings and their ceremonies reveal a taste for art and a poetical imagination which are very remarkable. The lone Indian who places his wigwam in the midst of the mountains seems to be always a stranger. The scenery has no effect upon him. It makes his spirit sad and his music plaintive, for he breathes out his spirit in his music. He never has had and never will have the character which some of his ancestors cultivated amid the wild scenes. His race is doomed; his fate is sealed. He can never catch up with the progress of the time.

The railroad is bound to take the place of the Indian trail; the miners' cabin must supplant the Indian wigwam. Great cities will rise near where ancient villages stood, but the savage fails to appreciate the thought or the character of the people who have supplanted him. The wigwam amid the mountains is a symbol of what he is, but the locomotive at its side is an emblem of progress and of promise to those who will use their opportunities. The mountains are in the background—they suggest the possibilities which are before the settler. They interpose barriers, but the barriers themselves are fraught with good influences. Freedom has always dwelt among the mountains. Reverence for the Almighty has also prevailed. The leveling process must cease and man become more elevated in his thoughts as he rises to the altitude of these great heights.—The American Antiquarian.

A NOVEL WAY OF RIDING A BICYCLE.

"Artists" of the variety stage and the circus are always trying to find something new, for the same old trapeze performances, trials of strength, performances of rope dancers, etc., have been presented so many times that anyone who invents an entirely new trick is sure of making a large amount of money out of it; the more wild and dangerous it is, the better. Anything that naturally stands on its feet but can be made to stand on its head will be well received in the latter attitude by the public. Some such thought as this must have been in the mind of the man who conceived the idea of riding a bicycle on the ceiling instead of on the floor. The "trick" originated with the Swiss acrobat Di Batta, who, being too old to undertake such a performance himself, trained two of his pupils to do it, and they appeared with their wheel in Busch Circus in Berlin. The wheel, of course, ran on a track from which it was suspended in such a way that it could not fall, and the man who operated it used the handle bar as he would the cross bar of the trapeze. One would think that the position of the rider was sufficiently dangerous to satisfy any public, but the inventor of the trick sought to make it appear more wonderful by having the rider carry between his teeth a little trapeze from the crosspiece of which another man hung.



BICYCLIST RIDING FROM THE CEILING OF A CIRCUS.

Different colored lights were thrown on the performers as they rode around the ceiling, and at the end of the performance first one and then the other dropped into the safety net which had been placed about sixty feet below them. We are indebted to the Illustrirte Zeitung for the cut and article.

REQUIREMENTS OF PALESTINE EXPLORER.

Lieut.-Col. Conder says that the requirements for exploration demand a knowledge not only of Syrian antiquities, but of those of neighboring nations. It is necessary to understand the scripts and languages in use, and to study the original records as well as the art and architecture of various ages and countries. Much of our information is derived from Egyptian and Assyrian records of conquest, as well as from the monuments of Palestine itself. As regards scripts, the earliest alphabetical texts date only from about 900 B. C., but previous to this period we have to deal with the cuneiform, the Egyptian, the Hittite and the Cypriote characters.

The explorer must know the history of the cuneiform from 2700 B. C. down to the Greek and Roman age, and the changes which occurred in the forms of some 550 characters originally hieroglyphics, but finally reduced to a rude alphabet by the

Persians, and used not only in Babylonia and Assyria, but also as early as 1500 B. C. in Asia Minor, Syria, Armenia, Palestine and even by special scribes in Egypt. He should also be able to read the various Egyptian scripts—the 400 hieroglyphics of the monuments, the hieratic, or running hand of the papyri, and the later demotic.

The Hittite characters are quite distinct, and number at least 130 characters, used in Syria and Asia Minor from 1500 B. C. or earlier down to about 700 B. C. The study of these characters is in its infancy. The syllabary of Cyprus was a character derived from these Hittite hieroglyphics, and used by the Greeks about 300 B. C. It includes some fifty characters, and was probably the original system whence the Phenician alphabet was derived. As regards alphabets, the explorer must study the early Phenician and the Hebrew, Samaritan and Moabite, with the later Aramean branch of this alphabet, whence square Hebrew is derived. He must also know the Ionian alphabet, whence Greek and Roman characters arose, and the early Arab scripts—Palmyrene, Nabathean and Sabean, whence are derived the Syriac, Cufic, Arabic and Himyaritic alphabets.

As regards languages, the scholars of the last century had to deal only with Hebrew, Aramaic, Syriac, Coptic and Greek, but as the result of exploration we now deal with the ancient Egyptian whence Coptic is derived, and with various languages in cuneiform script, including the Akkadian (resembling pure Turkish) and the allied dialects of Susa, Media, Armenia and of the Hittites; the Assyrian, the earliest and most elaborate of Semitic languages; and Aryan tongues, such as the Persian, the Vannic and the Lycian.

The art and architecture of Western Asia also furnish much information as to religious ideas, customs, dress and history, including inscribed seals and amulets, early coins and gems. The explorer must also study the remains of Greek, Roman, Arab and Crusader periods, in order to distinguish these from the earlier remains of the Canaanites, Phenicians, Hebrews, Egyptians and Assyrians, as well as the art of the Jews and Gnostics about the Christian era, and the later pagan structures down to the fourth century A.D.—Nature.

THE NEUTRAL USE OF CABLES.

Eleven submarine cables traverse the Atlantic between 60 and 40 degrees north latitude. Nine of these connect the Canadian provinces and the United States with the territory of Great Britain; two (one American, the other Anglo-American) connect France. Of these, seven are largely owned, operated or controlled by American capital, while all the others are under English control and management. There is but one direct submarine cable connecting the territory of the United States with the continent of Europe, and that is the cable owned and operated by the Compagnie Francais Cables Telegraphiques, whose termini are Brest, France, and Cape Cod, on the coast of Massachusetts.

All these cables between 60 and 40 degrees north latitude, which unite the United States with Europe, except the French cable, are under American or English control, and have their termini in the territory of Great Britain or the United States. In the event of war between these countries, unless restrained by conventional act, all these cables might be cut or subjected to exclusive censorship on the part of each of the belligerent states. Across the South Atlantic there are three cables, one American and two English, whose termini are Pernambuco, Brazil, and St. Louis, Africa, and near Lisbon, Portugal, with connecting English lines to England, one directly traversing the high seas between Lisbon and English territory and one touching at Vigo, Spain, at which point a German cable company has recently made a connection. The multiplication under English control of submarine cables has been the consistent policy of Great Britain, and today her cable communications connect the home government with all her colonies and with every strategic point, thus giving her exceptional advantages for commercial as well as for political purposes.

The schedule blanks of rates of the English companies contain the following provisions: "The dispatches of the imperial government shall have priority when demanded. The cable must not, at any station, employ foreigners, and the lines must not pass through any office or be subject to the control of any foreign government. In the event of war, the government (of Great Britain) may occupy all the stations on English territory or under the protection of Great Britain, and it may use the cable by means of its own employes."

It is not a pleasing reflection that in the actual situation the United States is at a great and embarrassing disadvantage. Meanwhile it would seem to be the policy of the United States to overcome this disadvantage by the multiplication of submarine cables under American or other than English competing foreign ownership and control.

Although somewhat indeterminate, the policy of the United States in respect to the landing of foreign submarine cables, so far, at least, as the executive branch of the government is concerned, appears to be based chiefly upon considerations that shall guard against consolidation or amalgamation with other cable lines, while insisting upon reciprocal accommodations for American corporations and companies in foreign territory. The authority of the executive branch of the government to grant permission is exercised only in the absence of legislation by Congress regulating the subject, and concessions of the privileges heretofore have been subject to such further action by Congress in the matter as it may at any time take. Several bills are now pending in Congress relating to the landing of foreign submarine telegraph cables within the United States, and regulating the establishment of submarine telegraphic cable lines or systems in the United States. As this article is going to press, it is reported that the President has refused permission to a foreign cable company to renew a cable terminus within the territory of the United States, and that the question raised as to the power of the federal government to deny admission to the cable will be referred to the Attorney-General for an opinion. Meanwhile, the executive branch of the government holds to the doctrine that, in the absence of legislation by Congress, control of the landing and operation of foreign cables rests with the President. The question of the landing of foreign cables received some consideration from the late Attorney-General, in connection with an injunction suit brought by the United States against certain corporations engaged in placing on the coast of New York a cable having foreign connection. And he suggested for the consideration of Congress whether it would not be wise to give authority to some executive officer to grant or withhold consent to the entry of such foreign enterprises into this country on such terms and conditions as may be fixed by law.

The principal and most important submarine cables traversing or connecting the great oceans are owned and operated by private corporations or companies. They are in number 310, and their length in nautical miles is 139,754. The length of cables owned or operated by state governments is, in nautical miles, 18,132.

The policies of states, the movements of fleets and armies, and the regulation of the markets of the commercial world, depend upon devices, communications and orders that are habitually transmitted through the agency of submarine cables. In this view, the first aim is to safeguard from wanton destruction the delicate and expensive mechanism of these cables; the second is to restrain within the narrowest limits practicable interruptions in the operation of cables, even in the midst of hostilities; and the third is to encourage the establishment and extension of submarine cables owned and operated by American capital. All these ends may be advanced by the agreement of the powers to neutralize absolutely the submarine cable systems of the world. To do this will be a step in the direction of extending international jurisdiction, which is to be a controlling feature of the new periodical about to be established at Berlin, and to be printed in German, French and English, under the name of "Kosmodike." —Alexander Porter Morse in The Albany Law Journal.

PARK MAKING.

Those who make public parks are apt to attempt too much and to injure not only the beauty, but the practical value of their creations by loading them with unnecessary and costly details. From the time when landscape gardening was first practiced as a fine art to the present day, park makers have been ambitious to change the face of nature—to dig lakes where lakes did not exist and to fill up lakes where they did exist, to cut down natural hills and to raise artificial ones, to plant in one place and to clear in another, and generally to spend money in construction entirely out of proportion to the value of the results obtained.

The best art is simple in its expression, and the highest form of art in gardening is perhaps that which, taking advantage of such natural conditions as it finds, makes the best of them with the smallest expenditure of labor and money. Simplicity of design means not only economy of construction, but, what is of even more importance, economy of maintenance. The importance of making it possible to keep a great park in good condition without excessive annual expenditures for maintenance is a simple business proposition which would not seem to require much demonstration. Yet park makers, with their unnecessary walks and drives; with their expensive buildings which are always getting out of repair; their ponds, in which there is rarely water enough to keep them fresh; their brooks, which are frequently dry; their elaborate planting schemes, often ill suited to the positions where they are wanted, make parks expensive to construct and impossible to maintain in good condition, especially in this country, where the cost of labor is heavy and there is difficulty in obtaining under existing municipal methods skilled and faithful gardeners to keep anything like an elaborate garden in good condition. The most superficial examination of any of our large urban parks will show that wherever elaborate construction and planting have been attempted they have failed from subsequent neglect to produce the effects expected from them, and that broad, quiet, pastoral and sylvan features are the only permanent and really valuable ones we can hope to attain in our great city parks.

It is needless, perhaps, to repeat what has been said so often in the columns of this journal, that in our judgment the greatest value and only justification of great urban parks exist in the fact that they can bring the country into the city and give to people who are obliged to pass their lives in cities the opportunity to enjoy the refreshment of mind and body which can only be found in communion with nature and the contemplation of beautiful natural objects harmoniously arranged. Parks have other and very important uses, but this is their highest claim to recognition. If it is the highest duty of the park maker to bring the country into the city, every road and every walk not absolutely needed to make the points of greatest interest and beauty easily accessible is an injury to his scheme, and every building and unnecessary construction of every kind reduces the value of his creation, as do trees and shrubs and other flowering plants which are out of harmony with their surroundings. Such things injure the artistic value of a park; they unnecessarily increase its cost and make the burden of annual maintenance more difficult to bear. Simplicity of design often means a saving of unnecessary expenditure, but it should not mean cheapness of construction. The most expensive parks to maintain are those which have been the most cheaply constructed, for cheap construction means expensive maintenance. Roads and walks should not be made where they are not needed, and they should not be made unnecessarily wide to accommodate possible crowds of another century, but those that are built should be constructed in the most thorough and durable manner possible, in order to reduce the cost of future care. When lawns are made, the work should be done thoroughly; and no tree or shrub should be planted in any manner but the best and in the most carefully prepared soil. Only as little work as possible should be done, but it should be done in the most permanent manner. The best investment a park maker can make is in good soil, for without an abundance of good soil it is impossible to produce large and permanent trees and good grass, and the chief value of any park is in its trees and grass; and if the money which has been spent in disfiguring American parks with unnecessary buildings and miscellaneous architectural terrors had been used in buying loam, they would not now present the dreary ranks of starved and stunted trees and the great patches of wornout turf which too often disfigure them. Only the hardiest trees and shrubs should be used in park planting; for there is no economy in planting trees or shrubs which are liable to be killed any year, partially, if not entirely, by frost or heat or drought, which annually ruin many exotic garden plants, nor is it wise to use in public parks plants which, unless carefully watched, are disfigured every year by insects. It costs a great deal of money to cut out dead and dying branches from trees and shrubs, to remove dead trees and fight insects, but work of this sort must be done, unless the selection of plants used to decorate our parks is made with the greatest care. Fortunately, the trees and shrubs which need the least attention, and are therefore the most economical ones to plant, are the best from an artistic point of view; and to produce large effects and such scenery as painters like to transfer to canvas, no great variety of material is needed. The most restful park scenery, and, therefore, the best, can be obtained by using judiciously a small number of varieties of the hardiest trees and shrubs, and the wise park maker will confine his choice to those species which Nature helps him to select, and which, therefore, stand the best chance of permanent success. No park can be beautiful unless the trees which adorn it are healthy, and no tree is healthy which suffers from uncongenial climatic conditions and insufficient nourishment. Even if they are not inharmonious in a natural combination, the trees and shrubs which need constant pruning to keep them from looking shabby are too expensive for park use and should, therefore, be rejected when broad, natural effects in construction and economy of maintenance are aimed for by the park maker.

The sum of the matter of park construction is to make rural city parks less pretentious and artificial in design and to so construct them that the cost of maintenance will be reduced to the minimum. This will save money and lessen the danger of exhibitions of bad taste and encourage that simplicity which should be the controlling motive of sincere art.—Garden and Forest.

INFLUENCE OF OCEAN CURRENTS ON CLIMATE.

Few people realize that a very large part of inhabited Europe lies to the north of the latitude which in this country is considered the limit of habitation, says Prof. Ralph S. Tarr, in The Independent. London is situated in the same latitude as southern Labrador, where the inhabitants are scattered in small villages and are mainly summer residents who come there from the more southern lands to engage in fishing. During the winter their ports are closed by ice and navigation is stopped, while toward the British Isles steamers are constantly plying from all directions. The great city of St. Petersburg, which in winter is inaccessible to ships, but in summer enjoys a moderate climate, lies in the same latitude as the northern part of Labrador, where snow falls in every month of the year and where floating ice frequently retards navigation even in midsummer. As a result of the severity of climate the only people who find northern Labrador a place fit for existence are the Eskimo tribes, who win their living under great difficulties almost entirely from the sea. No white men live there, with the exception of some missionaries and the occasional traders.

Everyone knows full well the reason for this difference in the climates of the two lands; the European coasts receive constant supplies of water that has been warmed in southern latitudes and carried northward in the great oceanic circulation and particularly in the Gulf Stream. The west winds, blowing toward the European coast, carry from this warm ocean belt air with higher temperature than that which exists over the land. On the eastern side of the Atlantic in place of a warm ocean current there is the cold Labrador current, which blows from the north and chills the water of the northwestern Atlantic. Therefore, the winds that come from the ocean blow over water that has been cooled, and the prevailing winds, which are from the west, come over the land, which is cool in winter and warm in summer.

One may see these differences in climate and the causes for them even more strikingly exhibited within the Arctic belt than in this case which has been mentioned. The great land area of Greenland, with an area of six or seven hundred thousand square miles, is a highland capped over the greater part of its area with a snow field which completely buries all the land excepting that near the margins. The tongues from this ice field, whose area is some 500,000 square miles, reach into the sea and furnish innumerable icebergs that float away, chilling the waters. Notwithstanding the immense area of ice, the summer climate of the Greenland coast is remarkably moderate, even as far north as Melville Bay. The reason for this is the same as that mentioned for the climatic peculiarities of Europe. A current from the south, probably an eddy from the Gulf Stream, carries water northward along the Greenland coast, thus raising the temperature so that the ice which forms in the sea water and the bergs which float upon its surface are made to disappear during the warm part of the year.

Sailing from the coast of Greenland at about the middle point, near Disco Island, in the early part of September, one leaves a land with a delightfully pleasant climate and warmth almost like that of the early autumn of temperate latitudes, and proceeding south-westward across Davis Straits to Baffin Land, two or three hundred miles southward, there finds himself in the midst of the conditions of early winter. The Greenland coast is not snow covered, plants are still in blossom and the hum of insects is heard; but in this more southern latitude, on the American side, the summer insects have entirely disappeared, only a few belated flowers are seen in protected places and a thin coat of snow covers all the land. Light snow may fall here during any time of the summer; but in spite of these differences Baffin Land is not ice covered, while Greenland is. The ice cap of the interior of Greenland is present less because of the severity of the climate at sea level than from the fact that the air which reaches this land has become humid in crossing the water areas, and further in the fact that the interior is a highland. On the Baffin Land side the interior is less elevated and there is less water to the westward in the direction from which the prevailing winds blow.

CAUSES OF POVERTY.[1]

The most interesting, and at the same time the most difficult, problem connected with an analysis of cases is to determine the real cause of destitution. It requires great experience and intelligence on the part of workers in charity to give even approximately the fundamental reason why a certain family has come to destitution. To classify cases from records without personal knowledge of each case, and then simply to count the cases, is a very inadequate method of arriving at the truth. The primary difficulty, of course, is to reach a classification. The one adopted by Mr. Warner in his book on American charities is: 1. Causes indicating misconduct; 2. Causes indicating misfortune. Under the first head come drink, immorality, laziness, shiftlessness and inefficiency, crime and dishonesty, a roving disposition. Under the second head come lack of normal support, matters of employment, matters of personal capacity, such as sickness or death in family, etc. The trouble with such a classification is that one cause may lie behind another, as drink is often the cause of lack of employment, of sickness or accident. On the other hand, lack of employment may lead to drink, immorality or laziness.

With the limited number of cases that have been analyzed in this investigation, it would be impossible to expect any very conclusive results. We have endeavored, however, to make up for the small amount of the material by a careful and intelligent analysis, and by approaching the subject from three different points. We have first taken the alleged cause of distress—that is, the reason assigned by the person applying for relief. This, of course, will present the most favorable side, and the one most calculated to excite sympathy. We have, secondly, tabulated the real cause of distress, as gathered by the tabulator from the whole record. This, of course, is the judgment of an outside party, and the emphasis will be laid upon misfortune or misconduct according to the disposition of the investigator. We have, thirdly, the character of the man and woman as gathered from the record. This is supplementary evidence as to the real cause of distress. We go on now to present these three points of view. Loss of employment, 313; sickness or accident, 226; intemperance, 25; insufficient earnings, 52; physical defect or old age, 45; death of wage earner, 40; desertion, 40; other causes and uncertain, 103; total, 844. An attempt was made to follow the example of Mr. Booth and introduce supplementary causes as well as principal causes. About the only result, however, is that sickness often accompanies loss of employment, and that loss of employment often accompanies sickness or accident. It is clearly seen in this whole table how disposed applicants for relief are to attribute their distress to circumstances beyond their control.

In the following table we have an attempt to analyze the real cause of distress, according to the judgment of the tabulator as gathered from the full record. In chronic cases the same cause is apt to appear in the successive applications. It was thought that this might lead to undue accumulation of particular causes. A separate tabulation, therefore, was made for the 500 first applications, and then for the total—832 applications. The table is as follows:

THE REAL CAUSE OF DISTRESS.

	First Applications.		**Total Applications.**	
	Number.	**Percent.**	**Number.**	**Per cent.**
Lack of employment.	115	25.0	184	22.1
Sickness or accident.	102	20.4	164	19.7
Physical defects or old age.	27	5.4	42	5.0
Death of wage earner.	18	3.6	30	3.6
Desertion	15	3.0	24	2.9
Intemperance	87	17.4	166	19.9
Shiftlessness	50	10.0	101	12.2
No need	86	17.2	121	14.6
Total	500	100.0	832	100.0

In this table it will be seen that emphasis is laid on misconduct rather than on misfortune. The difference between the two sets of returns is obvious. Where lack of employment and sickness have been alleged as accounting for $62^6/_{10}$ per cent. of the total, they are believed by the tabulator to really account for only $41^8/_{10}$ per cent. On the other hand, intemperance comes in as the real cause in $19^9/_{10}$ per cent.; shiftlessness in $12^2/_{10}$ per cent. of the applications, and in $14^6/_{10}$ per cent. of the applications it was judged that there was no real need. It is very probable that these judgments are severe, but the result shows how frequently, at least, the personal character is a contributory cause of poverty.

An attempt was made when reading the records to determine the general character of the man and woman—that is, the adult members of the family. Such classification is at the best very rough, and does not give us much information. It may be said that the character was put down as good unless something distinctly to the contrary appeared. The results are given in the following table:

PERSONAL CHARACTER OF MAN AND WOMAN.

	Male.	**Female.**	**Total.**	**Percentage.**
Good	122	231	353	45
Criminal	15	1	16	2
Insane	..	1	1	..
Intemperate	81	56	137	17
Shiftless	56	52	108	14
Suspicious	13	30	43	6
Untruthful	5	15	20	3
Uncertain	38	65	103	13
Total	330	451	781	100

"Shiftless" includes	Male.	Female.	Total.
Professional beggers	5	5	10
Loss of independence	1	3	4
Lack of push	2	1	3
Laziness	1	..	1
Extravagance	..	2	2
"Worthless"	7	5	12
Prostitute	..	1	1
Total	16	17	33
Shiftless indefinite	40	35	75
Total	56	52	108

It would seem from this table that the judgment of the investigators was lenient. In nearly one-half of the cases the character of the men and women was said to be good.

Fire tests of cast iron columns, made by order of the city authorities of Hamburg, are described in recent issues of the Deutsche Bauzeitung. The columns were 10 feet 8 inches long, 10.5 inches in diameter and of 1/13 inch or 0.5 inch metal. They were loaded centrally and eccentrically, and some were cased with a fireproof covering. A hydraulic press was placed below the column and its crosshead above it, and then a hinged oven containing twelve large gas burners was clamped about the column. The oven was furnished with apparatus for measuring heat, with peep holes and with a water jet. On an average a load of 3.2 tons per square inch, with a heat of 1,400° F., produced deformation in thirty-five minutes in a centrally loaded column without casing. This showed itself by bulging all round in the middle of the heated part, especially where the metal happened to be thinner; fracture occurred finally in the middle of the thickest point of the bulge. If the load was less, this occurred at a higher temperature. Jets of water had no effect until deformation heat was reached. The casings had the effect of increasing the time before deformation began from half an hour to four or five hours.

[1] Report of Richmond Mayo Smith, Franklin H. Giddings, and Fred. W. Holls, Committee on Statistics of the New York Charity Organization Society.—Condensed for Public Opinion.

ENGINEERING NOTES.

The Massilon (Ohio) Bridge Company has received an order for the construction of a cantilever bridge 562 feet long and 18 feet wide, which is to be built by the New York Dredging Company at Honda, on the Magdalena River, in Colombia, South America.

Navigation on the Amoo-Darya is to be extended considerably, so that Russian steamers will proceed upward on that river to Feisabad-Kalch, which is only about 200 miles from the scene of the recent Indian frontier troubles.—Uhland's Wochenschrift.

A new process of manufacturing artificial stone has been patented in England. The stone is formed in steel moulds, which can be adjusted to any size, shape or design for which the finished stone may be required, and solid blocks weighing several hundred pounds have been easily produced.

M. Berlier, the well known engineer, has laid before the governments of Spain and Morocco a project for the construction of a tunnel under the Straits of Gibraltar. The execution of this plan would have immense economic consequences, so that its fate will be followed with interest. M. Berlier is the inventor of a new method of subterranean boring.

"**The sale** of the steamers 'Pennsylvania,' 'Ohio,' 'Indiana,' 'Illinois,' and 'Conemaugh,' by the International Navigation Company to the States Steamship Company for the Pacific trade leaves but five steamships flying the American flag crossing the Atlantic Ocean," says The Marine Record. "They are the 'St. Paul,' gross tons 11,629.21; 'St. Louis,' gross tons 11,629.21; 'New York,' gross tons 10,802.61; 'Paris,' gross tons 10,794.86; 'Evelyn,' gross tons 1,963.44, the latter three built in English shipyards and denationalized."

John Murphy, general manager of the United Traction Company, of Pittsburg, reports the average life of motor gears on his line as two years, and the average life of pinions, nine months. He is employing the gears and pinions of the Simonds Manufacturing Company. The service is an exceedingly severe one, on account of the many grades on the line. The average life of trolley wheels is 1,000 miles, and the conditions under which they operate are quite severe, as the company has on its main line eighteen railroad crossings. A tempered copper wheel is employed.

According to a recent correspondent of The Buffalo Express, in the Pennsylvania oil region during the last year over 300 gas engines have been placed on oil leases and are doing satisfactory work. The engines vary from 10 to 50 horse power. Every big machine shop in the oil regions is turning out gas engines. The machine shops are also using gas engines to drive their own machinery. During the last year twenty of the Standard Oil Company's pipe line pumping stations have been equipped with gas engines. In all the new stations and in old ones where new machinery is needed, the gas engine will be preferred. Where natural gas cannot be had and coal was formerly burned, gasoline is used. The pumping station engines are all provided with electric ignition.

In a recent issue of The Railway Age is published the following, based upon the last report of the Interstate Commerce Commission: "Last year the railways of the United States carried over 13,000,000,000 passengers one mile. They also carried 95,000,000,000 tons of freight one mile. The total amount paid in dividends on stock was $87,603,371—call it $88,000,000. Of the total earnings of the railways, about 70 per cent. came from freight service and 30 per cent. from passenger service. Let us assume, then, that of the $88,000,000 paid in dividends, 70 per cent., or $61,600,000, was profit on freight service and $26,400,000 was profit on passenger service. Let us drop fractions and call it $62,000,000 from freight and $26,000,000 from passengers. By dividing the passenger profit into the number of passengers carried (13,000,000,000), we find that the railways had to carry a passenger 500 miles in order to earn $1 of profit—or five miles to earn 1 cent. Their average profit, therefore, was less than two-tenths of 1 cent for carrying a passenger (and his baggage) one mile. By dividing the freight profit into the freight mileage (95,000,000,000) we find that the railways had to carry one ton of freight 1,530 miles in order to earn $1, or over fifteen miles to earn 1 cent. The average profit, therefore, was less than one-fifteenth of a cent for carrying a ton of freight (besides loading and unloading it) one mile."

The railroads in the United States have cost about $60,000 per mile, and probably a considerable percentage of this has not entered into the construction of the railroads and the equipment of same, says "Signal Engineer" in The Railroad Gazette. The railroads of Great Britain have cost about $240,000 a mile, and yet we claim for the United States more luxurious travel than can be found in Great Britain; and this is true so long as the travel is safe. The difference in the cost of construction in the United States and England may be found in the item of safety appliances. The railroads of Great Britain carried during the last year 800,000,000 passengers, with safety to all but five, and this was possible because the railroads, instead of expending their capital in luxurious equipment and passenger stations, chose rather to equip their lines with the most improved signaling and interlocking. The railroad companies of the United States in expending large sums for handsome and convenient terminals and luxurious cars are placing monuments before the public eye which naturally lead to the belief that every appointment of such roads is on the same high plane, and it requires much less expenditure to furnish luxurious equipment to be carried over 1,000 miles of road than it does to equip 10 miles of the 1,000 so as to make it safe; and since the expenditure for safety appliances and permanent way is not seen and felt by the passenger so long as he is carried in safety, it is not, therefore, so prominent before the public gaze as is the handsome station and the palatial car. On one road in Great Britain, having but 2,000 miles of track, there are employed more men in the manufacture and installation of signal work than are employed by all the signal companies and in the signal departments of all the railroads of the United States, where we are now operating about 182,000 miles.

MISCELLANEOUS NOTES.

Orders for large quantities of aluminum have been received within the last few weeks by the Pittsburg Reduction Company from the principal foreign nations for the equipment of their armies. The contracts aggregate about fifty tons a month, Russia being the largest consumer.

According to the return published by the Minister of Agriculture, the consumption of horseflesh in Paris has decreased slightly in the last year, being only 4,472 tons, as against 4,664 tons for 1895-96. This was the meat derived from 20,878 horses, 53 mules and 232 donkeys slaughtered during the twelve months; but a very strict supervision is exercised, and 575 of these animals were condemned as unfit for human food. The flesh of the remainder was sold at 190 stalls or shops, and, although the fillet and undercut made as much as 9d. a pound, the inferior parts sold for 2d. or less, and most of the meat was used for making sausages.

According to La Propriété Industrielle, 5,372 Austrian patents were granted in 1896 (5,215 in 1895). Of these, residents of the Austro-Hungarian monarchy received 2,070 (2,031 in 1895), Austrians coming first with 1,813 (1,683 in 1895), Hungarians second with 254 (347 in 1895), while residents of Bosnia and Herzegovina secured 3 patents (1 in 1895). Among foreigners the following show an increase over 1895: United States, 394 (335); Great Britain, 355 (313); France, 244 (243); Switzerland, 94 (79); Belgium, 66 (48); Sweden and Norway, 60 (40); Italy, 50 (45); Russia, 47 (40); Australia, 32 (10); and Netherlands, 26 (18). A decrease is shown by Germany, 1,887 (1,950); Denmark, 10 (17); Canada, 7 (14); and Spain, 6 (10). The total number of Austrian patents granted to foreigners in 1896 was 3,302, as against 3,184 in 1895.

English and French Lighthouses.—An English engineer named Purves has just made a comparison in regard to the intensity of light of the lighthouses on the English coasts and those which illuminate the shores of France. The comparison shows results which are altogether favorable to France. The average illumination intensity of eighty-six English lighthouses of the first class is 20,680 candle power, while thirty-six first class French lighthouses give an average of 34,166 candle power. The difference is more striking if the lighthouses constructed within the last ten years be considered. Since 1886 France has built eleven lighthouses, whose average intensity of light is 8,200,000 candle power; the new lighthouse of Eckmühl gives 40,000,000. According to Mr. Purves, the superior intensity of light of the French lighthouse lies in the use of the flashing rays, which have not yet found favor in England.

In an address by Thomas Morris, before the Staffordshire, England, iron and steel works managers on the remarkable achievements that have been reached in the manufacture of fine wire, the interesting fact was mentioned that the lecturer had been presented by Warrington, the wire manufacturer, with specimens for which some $4.32 per pound were paid, or more than $8,600 per ton—drawn wire, largely used in the construction of piano and other musical and mechanical instruments. Among these specimens also was pinion wire, at a market price of $21.60 per pound, or $43,200 per ton. It took 754 hairsprings to weigh an ounce of 437½ grains; 27,000,000 of these were required to make a ton, and, taking one to be worth 1½ cents, the value of a ton of these cheap little things ran up to over $400,000. The barbed instruments used by dentists for extracting nerves from teeth were even more expensive, representing some $2,150,000 per ton.

At a fête in the Elysée Palace the other day one of the features prepared for the entertainment of the guests was a cinematograph, which contained views taken during President Faure's visit to St. Petersburg. One of the pictures settled for the President a question which had been troubling him considerably. Several months ago a German paper printed an interview with Bismarck, in which the ex-chancellor commented on M. Faure's visit to St. Petersburg, saying that the Frenchman had conducted himself according to etiquette except on one occasion, when, on his arrival in the Russian capital he had been saluted by the Cossack guard of honor, he had returned the salute with the hand, not with the hat. M. Faure being a civilian, this was a serious breach of etiquette, Bismarck said. The interview was reprinted in the French papers and caught the President's eye. He was much concerned about the matter and asked several friends who had been present if he had actually committed the breach. No one could remember. Then came the cinematograph show. As the small audience gazed upon the screen they saw the President's image advance with slow, dignified step before the Cossacks, then all at once raise his hand to his hat, which he lifted with the quick motion so familiar to Parisians. The guests burst into applause and the President smiled. Bismarck was mistaken.

"**We hear** a great deal regarding the decline of our shipping interests, and so far as our shipping in the foreign trade is concerned it is unfortunately true," says The Boston Commercial Bulletin. "But few people realize the immensity of our coastwise commerce. The Custom House figures on the shipping of the port of New York for 1897 show that there were 4,614 arrivals of vessels from foreign ports, 7,095 from Eastern domestic ports, and 3,798 from Southern domestic ports. Of the foreign, 2,313 were British, of which 1,667 were steamships; 952 were American, of which 323 were steamships, and 517 were German of which 444 were steamships. This statement shows that the arrivals from American ports were nearly three times those from foreign countries, though of course this proportion is not borne out in tonnage, vessels on the deep sea trade averaging larger. But it will be doubtless a surprise that of the shipping from foreign ports more than one-fifth were American. At other Atlantic and Gulf ports this proportion undoubtedly does not hold true, but these figures show a less doleful condition of the American marine than some people have been led to expect. When it is remembered that the coastwise fleet numbers many steamers of 2,000 to 3,000 tons and many sailing craft of 1,000 tons and upward, it will be seen that we are yet a sea power of the first class, in fact exceeded only by England."

SELECTED FORMULÆ.

Essence of Pepsin.—

1.	Pepsin (pure)	128	grains.
	Dilute muriatic acid	5	drops.
	Simple elixir	3	fl. ounces.
	Glycerin	1	"
	Water	16	"
	Angelica wine	6	"

Dissolve by agitation and filter through purified talcum.

2.	Glycerole of pepsin	3	parts.
	Sherry wine	5	"
	Glycerin	1	"
	Simple elixir, to make	16	"

3. Pepsin in scales	64	grains.
Glycerin	1	fl. ounce.
Elixir taraxacum compound	1	"
Alcohol	2	"
Oil of cloves	1	drop.
Sirup	2	fl. ounces.
Dilute hydrochloric acid	1	fl. drachm.
Water, to make	16	fl. ounces.

—Pharmaceutical Era.

Applications to Insect Bites.—Brocq and Jacquet (Indépendance médicale, October 20) recommend the following for the bites of bugs, fleas and gnats:

1. Camphorated oil of chamomile	100	parts.
Liquid storax	20	"
Essence of peppermint	5	"
M.		
2. Olive oil	20	parts.
Storax ointment	25	"
Balsam of Peru	5	"
M.		
3. Naphthol	5 to 10	parts.
Ether, enough to dissolve it.		
Menthol	¼ to 1	part.
Vaseline	100	parts.

Bead for Liquors.—In the liquor trade, anything added to liquors to cause them to carry a "bead" and to hang in pearly drops about the side of the glass or bottle when poured out or shaken is called "beading," the popular notion being that liquor is strong in alcohol in proportion as it "beads." The object of adding a so-called "bead oil" is to impart this quality to a low-proof liquor, so that it may appear to the eye to be of the proper strength. The following formulas for "bead oil" are given:

1. Sweet almond oil	1	fl. ounce.
Sulphuric acid, concentrated	1	"
Sugar, lump, crushed	1	ounce.
Alcohol, sufficient.		

Triturate the oil and acid very carefully together in a glass, Wedgwood or porcelain mortar or other suitable vessel; add by degrees the sugar, continue trituration until the mixture becomes pasty, and then gradually add enough alcohol to render the whole perfectly fluid. Transfer to a quart bottle and wash out the mortar twice or oftener with strong alcohol until about 20 fluid ounces in all of the latter has been used, the washings to be added to the mixture in the bottle. Cautiously agitate the bottle, loosely corked, until admixture appears complete, and set aside in a cool place. This quantity of "oil" is supposed to be sufficient for 100 gallons of liquor, but is more commonly used for about 80 or 85 gallons. The liquor treated with this "oil" is usually allowed to become clearer by simple repose.

2. Soapwort, coarsely ground	13	ounces.
Diluted alcohol, enough to make	1	gallon.

Extract the soapwort by maceration or percolation.

This is also intended for 80 gallons of liquor, preferably adding to the latter one-half gallon of simple sirup.

The ingredients of the above formulas, according to the "Manual of Beverages," are not injurious—not at least in the quantities required for "beading." It is said that beyond a certain degree of dilution of the liquor with water, these preparations fail to produce the intended effect. The addition of sugar or sirup increases their efficacy.—Pharmaceutical Era.

Quinine Hair Tonic.—

1. Quinine sulphate	1	part.
Tincture cantharides	10	"
Glycerin	75	"
Alcohol	500	"
Tincture rhatany	20	"
Spirit lavender	50	"

2. Tincture cinchona	50	"
Tincture cantharides	25	"
Peru balsam	20	"
Tincture soap	150	"
Cologne water	250	"
Cognac	2,000	"
Oil bergamot	10	"
Oil sweet orange	10	"
Oil rose geranium	3	"

3. Bisulphate of quinine	½	ounce.
Vinegar of cantharides	2½	"
Spirit of rosemary	18	"
Lavender water	8	"
Glycerite of borax	1	"
Glycerin	14	"
Distilled water	80	"
Caramel, sufficient to color.		

—Pharmaceutical Era.

Soap for Removing Rust.—

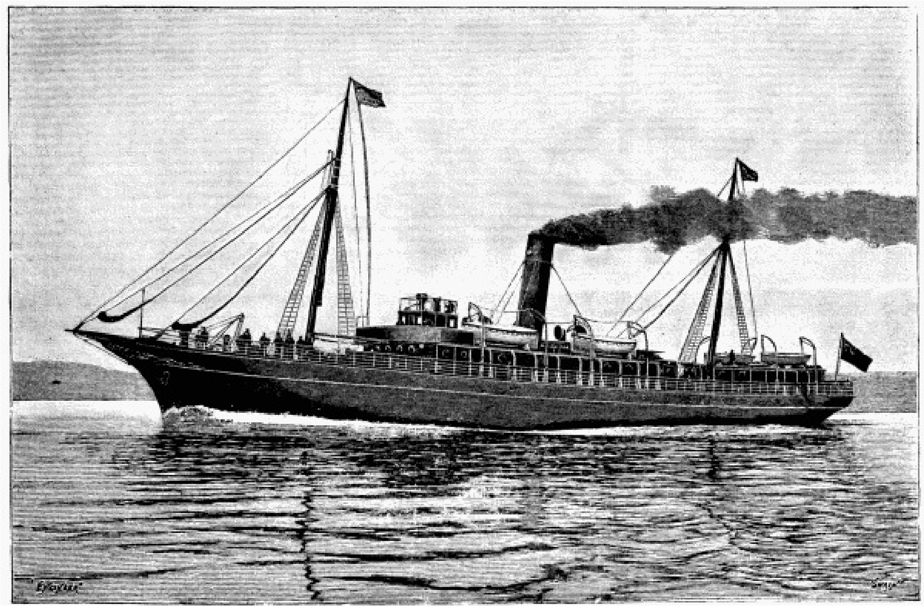
	Parts by Weight.
Whiting	9
Oil soap	6
Cyanide of potassium	5
Water	60

Dissolve the soap in water over the fire and add the cyanide, then little by little the whiting. If the compound is too thick, which may be due either to the whiting or the soap employed, add a little water until a paste is made which can be run into an iron or wooden mould. This will remove rust from steel and give it a good polish.—Oils, Colors and Drysalteries.

THE NEWFOUNDLAND AND NOVA SCOTIA PASSENGER STEAMER "BRUCE."

Messrs A. & J. Inglis, shipbuilders and engineers, of Pointhouse, Glasgow, have recently built a somewhat unique and certainly interesting steamer, for the conveyance of passengers between Port an Basque, in Newfoundland, and Sydney, Cape Breton, in connection with the Newfoundland and Canadian systems of railways. The distance from port to port is about one hundred miles, and the vessel has been designed to make the run in six hours. Messrs. Reid, of Newfoundland, who have founded the line of steamers to perform this service, intrusted to Messrs. Inglis the task of producing a vessel in all respects suitable for the work to be accomplished. The steamer "Bruce," the pioneer steamer, an illustration of which we are enabled to produce, is the result. The navigation of the waters in which this vessel will be employed is attended with some difficulties. Not only are storms of frequent occurrence, but in the months of winter and spring large quantities of drift ice are commonly encountered.

To obtain the necessary speed and carry all that was required on a suitable draught of water, it was essential that the "Bruce" should be built of steel, but in view of the severe structural and local stresses to which she must inevitably be subjected when at sea, it was necessary to afford adequate stiffening and means for preventing penetration or abrasion by ice. Hence the frames are more closely spaced than is usual in vessels of her size, numerous web frames associated with arched supports at the main deck and adjacent to the waterline are fitted throughout her entire length, and a belt of 3-inch greenheart planking, with a steel sheathing over it at the fore part of the vessel, is further provided. Indeed, throughout the vessel, every precaution has been taken with a view to insure her efficiency and safety when running swiftly from port to port, while at the same time the materials employed have been most wisely, judiciously and economically distributed.



THE NEWFOUNDLAND AND NOVA SCOTIA PASSENGER STEAMER "BRUCE."

The dimensions of the "Bruce" are 230 feet long, 32 feet 6 inches broad, and 22 feet deep, her gross tonnage being 1250 tons. She has been built with very fine lines, a considerable rise of floor, and with a graceful outline, which gives her the appearance of a large yacht. Our illustration shows the "Bruce" when running at a speed of upward of 15 knots on the measured mile at Wemyss Bay. Not only has the structure of the vessel been skillfully designed, but her internal fittings are admirably arranged. It is really most interesting to note with what ingenuity passenger accommodation of a somewhat extensive character has been provided in so small a vessel. The "Bruce" has berths for seventy first-class and one hundred second class passengers, and the accommodation is of a very luxurious kind. The berths are between the awning and main decks, where there is also a special apartment set apart for ladies, and at the fore end for the officers' quarters. Besides these a large and handsome dining saloon is situated on the main deck, richly upholstered and fitted with unique little window recesses, which besides adding to the appearance of the apartment, furnishes additional dining accommodation. It is done up in dark mahogany panels, fringed with gold. The chairs are upholstered in blue morocco, and the floor is laid with a Turkey carpet. All the other rooms are in dark polished oak. A large smoking room is also provided on the main deck.

The "Bruce" is further fitted with a complete installation of electric lighting, together with an electric search light; has Lord Kelvin's deep sea sounding apparatus and compasses, also Caldwell's steam steering gear and winches, Weir's evaporators and pumps. Alley and McLellan's feed water filters, and Howden's forced draught. She is steam heated throughout, and in every detail of the sanitary arrangements the health and comfort of the passengers have been attended to. Six lifeboats, having accommodation for 250 people, are hung in davits. When fully laden she carries 350 tons of cargo in her holds and 250 tons of coal in her bunkers.

The contract speed for the "Bruce" was 15 knots—and to obtain this Messrs. Inglis fitted her with triple-expansion engines, which we shall illustrate in another impression, having cylinders 26 inches, 42 inches and 65 inches in diameter, with a 42 inch stroke. Steam is supplied from four boilers loaded to a pressure of 160 pounds per square inch. When on the measured mile a mean speed of about 15¼ knots was obtained with an indicated horse power of 2200, the engines running at 90 revolutions per minute.

The vessel has arrived safely at Newfoundland, having performed the voyage at a mean speed of very little under 15 knots, a most satisfactory performance. She has been running some little time on her route and been giving most satisfactory results. —We are indebted to London Engineer for the cut and description.

HEAT IN GREAT TUNNELS.

One phase of the construction of tunnels through the Alps was recently discussed by M. Brandicourt, secretary of the Linnæan Society of the North of France, in the columns of La Nature. He showed that only a few thousand feet below the eternal snows of that region so high a temperature may be found that workmen can scarcely live in it. Nearly all of the other difficulties encountered in those enterprises had been foreseen. This one was a great surprise. It shows how the interior heat of the earth extends above sea level into all great mountainous uplifts on the earth's surface.

During the tunneling of Mont Cenis, says M. Brandicourt, the temperature of the rock was found to be 27.5 degrees C. (81.5 degrees F.) at about 5,000 meters (16,000 feet) from the entrance. It reached 29.5 degrees (86 degrees F.) in the last 500 meters (1,600 feet) of the central part. The workmen were then about 1,600 meters (5,100 feet) below the Alpine summit, whose mean temperature is 3 degrees below zero (27 degrees F.) Thus there was a difference of 32.5 degrees: that is, one "geothermic" degree corresponded to about 50 meters.

This elevation of temperature was not at first regarded with anxiety. Soon a draught would be produced and would ameliorate the situation. It was time, for the disease known as "miner's anæmia" had begun to claim its victims.

The situation at St. Gothard was much more serious. As at Mont Cenis, a temperature of 29 degrees C. (85 degrees F.) was found about 5,000 meters from the portals of the tunnel. But there remained yet 5,000 meters of rock to pierce. In the center of the tunnel there was observed for several days a temperature of 35 degrees (95 degrees F.) Generally it did not vary much from 32.5 degrees (90.5 degrees F.), a sufficiently high degree, if we remember that the men's perspiration was transformed into water vapor, and that the air was nearly saturated with humidity. In these conditions work was very difficult, and the horses employed to remove the debris almost all succumbed.

Man can bear more than animals. In an absolutely dry air he can endure a temperature of 50 degrees (122 degrees F.) But in an atmosphere saturated with water, underground, where the breath of the workmen fills the narrow space with poisonous vapors, a temperature of even 30 degrees (86 degrees F.) entails serious consequences. In a large number of workmen the bodily heat rose to 40 degrees (104 degrees F.) and the pulse to 140 and even 150 a minute. The most robust were obliged to lay off one day out of three, and even the working day was itself reduced to five hours, instead of seven or eight.

According to Dr. Giaconni, who for ten years attended the workmen at Mont Cenis and St. Gothard, the proportion of invalids was as large as 60 to the 100.

More strange yet, the report of the physicians who dwelt at the works notes the presence among the workmen of the intestinal parasites called "ankylostomes," which have been observed in Egypt and other tropical countries, and which are the cause of what scientists call "Egyptian chlorosis" or "intertropical hyperæmia." This pathologic state is observed only in the hottest regions of the earth. The victim becomes thin, pale and dark. He is bathed in continual sweat, devoured by inextinguishable thirst, and the prey of continual fever. And thus, adds Mr.

Lentherie, "the most robust mountaineer had only to pass a few months in the depths of the Alps to contract the germs of a tropical disease. Under the thick layer of snow and ice that enveloped him he had to work naked like a tropical negro or an Indian stoker on a Red Sea steamer; and in this Alpine world, where everything outside reminds one of the polar climate, he sweltered as in a caldron and often died of heat."

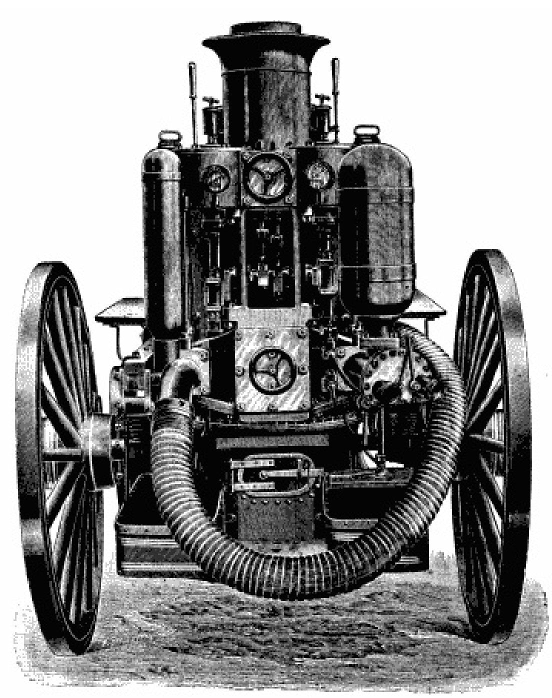
The bad conditions found at St. Gothard will be met also, very probably, in the new Alpine tunnels that have been projected in recent years—those at the Simplon, St. Bernard and Mont Blanc. It can be predicted that for Mont Blanc in particular the temperature of 40 degrees (104 degrees F.) will be far exceeded. M. de Lapparent even considers that the figure of 55 degrees (131 degrees F.) proposed by some geologists is moderate, and errs by defect rather than by excess.

The engineer Stockalpa, who for four years has directed one of the workshops at St. Gothard, and has made a profound study of this temperature question, does not hesitate to say that under Mont Blanc the temperature will be 33 degrees (91 degrees F.) at three kilometers from the entrance, that it will reach 50 degrees (122 degrees F.) under the Saussure Pass, and 53.5 degrees (128 degrees F.) under the Tacul Peak, falling again to 31 degrees (88 degrees F.) under the White Valley.

These are only probabilities, but they are founded on facts, and we may imagine all the preventive measures that they will render imperative.

The experience that has been acquired in these latter years has indicated the best methods of ventilation and cooling. The compressed air used in the workings produces by its escape a very sensible lowering of the temperature, which can be made still lower by using saline solutions whose freezing point is as low as -20 degrees (4 degrees F.), and which will circulate through pipes along the tunnel. The removal of the debris can be effected by electric locomotives; thus the horses, which use up the precious air, can be done away with. The electric light, which can be operated without contamination or consuming the air, will also render great service; these improvements can all be carried out with ease. Together with the preceding, they will form a group of processes that will enable us to gain the victory over the interior heat of the great Alpine tunnels.

AN ENGLISH STEAM FIRE ENGINE.



AN ENGLISH STEAM FIRE ENGINE.

The machine which we illustrate has lately been constructed by Messrs.

Merryweather & Sons, of Greenwich Road, with the view to combining the advantages of both horizontal and vertical steam fire engines. Hitherto the horizontal engine has been considered by some firemen to be less handy of access than the vertical, and the vertical engine has had the undoubted disadvantage of not being stoked from the footplate. By shortening the length of stroke and constructing a special pump, the makers have been able to keep the engine sufficiently high in relation to the boiler to enable the firedoor to be placed directly in the rear of the boiler and underneath the engine, thus enabling the boiler to be stoked en route, and allowing access from the footplate to the starting valve, the suction and delivery connections, the whole of the boiler fittings and feed arrangements. This enables one man to drive and stoke the engine, and to attend to the suction and delivery hoses, and it does not interfere at all with the stability of engine in traveling or at work, as the center of gravity is well below the top of the side frames. Another feature is the absence of a main steam pipe, a bracket being arranged on the cylinders containing the steam passages, to bolt directly onto the top of the boiler. The close proximity of the engine to the boiler renders it peculiarly suitable for cold climates, and times of frost, reducing the chances of the pump or feed arrangements being frozen up. The pump valves are arranged between the barrels, and are all accessible by the removal of one cover, which weighs but 12 lb. The engine, we understand, may be stopped, the cover removed, a damaged valve replaced, the cover put on again, and the engine restarted in two minutes. A slotted link is used with a crankshaft for regulating the length of stroke. All the bearings have large wearing surfaces, and substantial eccentric straps are used, the whole of the motion being simple and accessible. There are three different methods of feeding the boiler, viz., by feed pump driven by the crosshead of the main pump, by forcing water directly into the boiler from the main pump, and by an injector taking its water from a tank either supplied from the main pump or by a bucket when pumping dirty water. All the feed pipes are fitted with strainers where attached to the main pump. Drop feed lubricators are fitted on the cylinders, and an efficient system of lubrication is provided for the rest of the working parts. The carriage frame, hose box, etc., are of the same design as usually employed for engines of this class, with the exception of the fore carriage, which is fitted with a cross spring in the rear, as well as the two longitudinal springs. This arrangement makes the engine run more lightly, and removes much of the strain on the side frames when traveling rapidly on a rough road. The wheels are fairly light for the weight they have to carry, and have gun metal stock hoops with diamond pent rims to prevent the men slipping when mounting in a hurry. The engine and boiler work is brightly polished where-ever possible, and the whole machine has a handsome appearance.—Engineering.

APPARATUS FOR OBTAINING THE CUBATURE OF TREES.

In the exploitation of forests it is an important matter to be able to measure the cubature of trees, and the process most generally employed consists in determining their height and mean circumference, the apparatus used for this latter measurement being compasses having the form of the calipers used by mechanics. The figure indicated is read upon the graduated rule and is called off in a loud voice to another person, who at once writes it down. There are several causes of error: it is possible that the reading may be incorrectly made or improperly called off, or be misunderstood or incorrectly noted. Finally, it is a somewhat fatiguing operation that is often dispensed with and the measurement made by estimate. In order to do away with all such causes of error, M. Jobez, a mining engineer, has had M. Peccaud construct an apparatus that automatically registers all the measurements upon a paper tape analogous to that used in the Morse telegraphic apparatus.

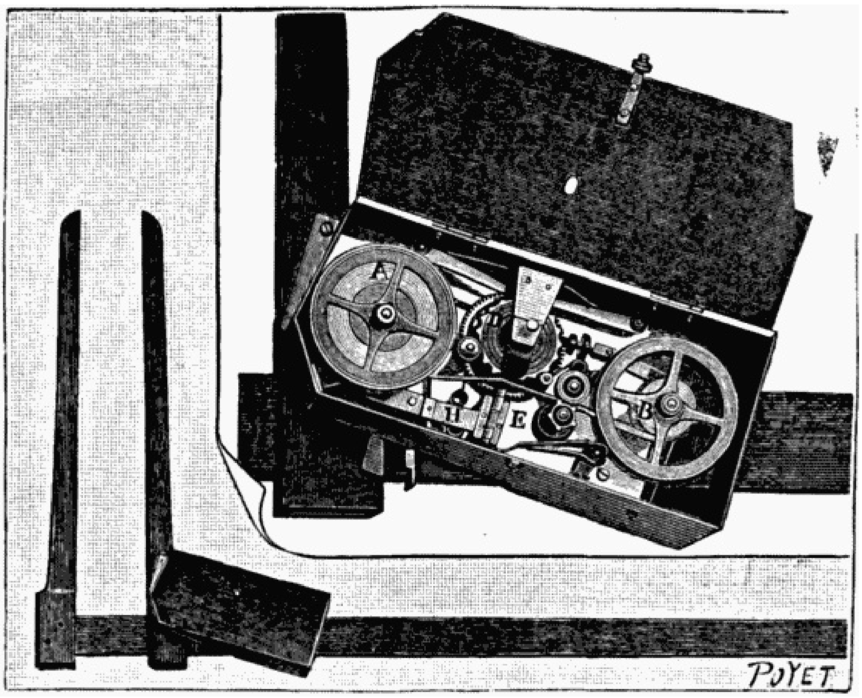


Fig. 1.—APPARATUS FOR OBTAINING THE CUBATURE OF TREES.

The registering mechanism (Fig. 1) is fixed to the movable branch that forms the slide of the instrument. It is so arranged that when this branch is slid along the rule carrying the graduations, a gearing causes the revolution of a wheel, D, which carries figures corresponding to such graduation. At the same time, two feed rollers, E, cause a small portion of the paper tape (which is wound upon a spool, A) to move forward and wind around a receiving spool, B. After the apparatus has been made accurately to embrace the trunk of the tree to be measured, it is removed and a pressure given to the lever, H, which applies the paper to the type wheel, D. A special button permits, in addition, of making a dot alongside of the numbers, if it be desired to attract attention to one of the measurements, either for distinguishing one kind of a tree from another or for any other reason.

With this apparatus one man can make all the measurements and inscribe them without any possible error and without any fatigue. It is possible for him to inscribe a thousand numbers an hour, and the tapes are long enough to permit of 4,000 measurements being made without a change of paper. There is, therefore, a saving of time as well as perfect accuracy in the operation.

In order to make the calculations necessary for the estimate, M. Laurand has devised a sliding rule which facilitates the operation and which is based upon the method that consists in knowing the height and mean circumference of the tree. The circumference taken in the middle is divided by 4, 4.8 or 5 according as one employs the quarter without deduction or the sixth or fifth deduced. This first result, multiplied by itself and by the height, gives the cubature of the tree. As for the value, that is the product of this latter number by the price per cubic meter. It will be seen that there is a series of somewhat lengthy operations to be performed, and it is in order to dispense with these that has been constructed the rule under consideration, which, like all calculating rules, consists of two parts, one of which slides upon the other (Fig. 2). Upon each of these there are two graduated scales, or four in all, the first of which is designed for the circumference and the second for the height of the tree, the third for the price of the cubic meter and the fourth for the total result, that is, the value of the entire tree. The arrangements are such that, after the number corresponding to the circumference of the tree has been brought opposite that corresponding to its height, the result will be found opposite the price per cubic meter.

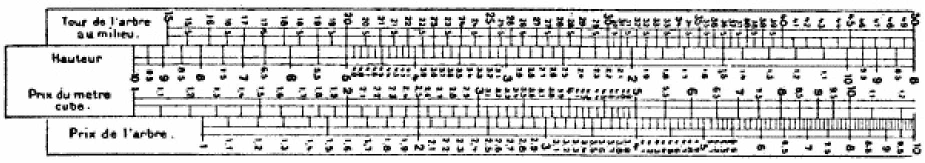


FIG. 2.—LAURAND'S CALCULATING RULE.

Thus, in the position represented in the figure, we may suppose a tree having a circumference of 2.5 m. and a height of 3.2 m.; then, if a cubic meter is worth 25 francs, the tree will be worth 20 francs.

In order to simplify the calculations and the construction of the rule, no account is taken of points; but this is of no importance, since the error that might be made in misplacing one would be so great that it would be immediately detected. A 2 franc tree would not be confounded with a 20 or a 200 franc one. As an approximation, the first two figures of the result are obtained accurately; and that suffices, because, since the whole is based upon an approximate measurement, which is the mean circumference of the tree, we cannot exact absolute precision in the results. The essential thing is to have a practically acceptable figure.—La Nature.

Egypt's population, according to the census taken last June, is 9,750,000, more than double the population in 1846. The foreign residents are 112,000; of these, 38,000 are Greeks, 24,500 Italians, 19,500 Britishers, including the army of occupation, and 14,000 French subjects, including Algerians and Tunisians. Twelve per cent. of the native males can read and write; the other Egyptians are illiterate. Cairo has 570,000 inhabitants, Alexandria 320,000, Port Said 42,000, and Suez 17,000.

MACHINE MOULDING WITHOUT STRIPPING PLATES.[1]

By E. H. MUMFORD, Plainfleld, N.J.

(Member of the Society.)

Moulding machines may be classed under three heads. First, machines which only ram the moulds, and, when the ramming is done by means of a side lever, by hand, are generally called "squeezers." Second, machines which only draw the patterns, the ramming being accomplished by the usual hand methods. Third, machines which both ram the moulds and draw the patterns, ramming either by a hand-pulled lever or by fluid pressure on piston or plunger and drawing the patterns through a plate called a "stripping plate" or "drop plate"—till recently the usual method—or without the use of this plate fitting everywhere to pattern outline at the parting surface, the patterns being effectively machine guided in either case.

It is to the third class that the machine which is used to illustrate the subject of this paper belongs, and which would seem to have enough that is novel in the application of machinery to the foundry to merit the attention of the society.

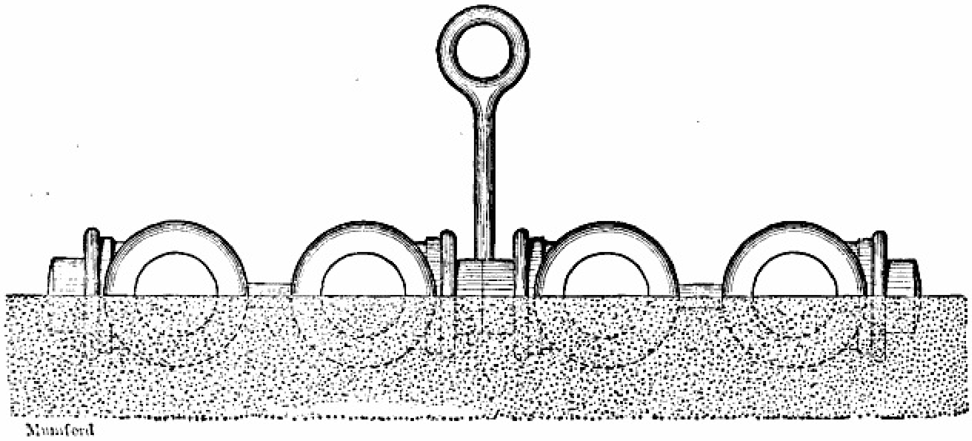


Fig. 1.—ORDINARY METHOD OF DRAWING PATTERN SPIKE AND RAPPER.

At the risk of appearing pedantic, but with a view to developing an appreciation of the true function of the method of pattern drawing used in this machine, attention is called to the following sectional views of moulds and ways of drawing patterns occurring in machine moulding. Fig. 1 shows an ordinary "gate" of fitting patterns being drawn from the drag or nowel part of the mould by means of a spike and rapper wielded by the moulder's hand after cope and drag have been rammed together on a "squeezer" and cope has been removed. Frequently the pernicious "swab" is used to soak and so strengthen joint outlines of the sand before drawing patterns, in such cases as this. In this case, before cope is lifted, these patterns must be vigorously rapped through the cope; an amount depending (and so does the size of the casting) upon the mood and strength of the moulder.

Fig. 2 shows the stripping or drop plate method of drawing patterns.

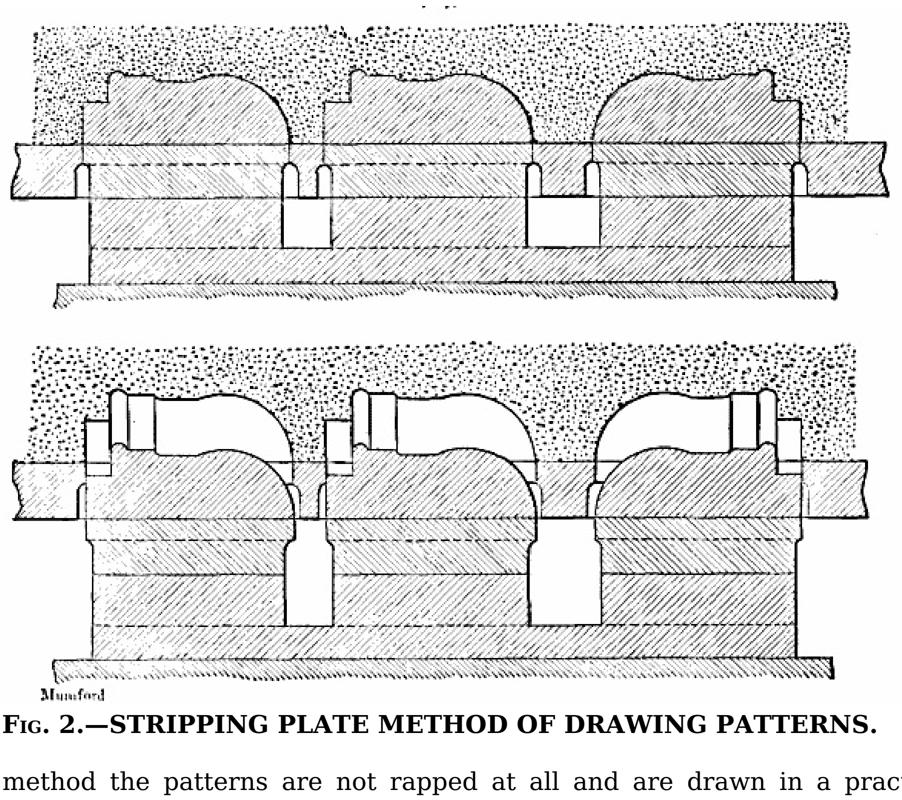


Fig. 2.—STRIPPING PLATE METHOD OF DRAWING PATTERNS.

In this method the patterns are not rapped at all and are drawn in a practically straight line so that the mould is absolutely pattern size.

The stripping plate is fitted accurately to every outline at the joint surface of the patterns, obviously at considerable expense, and, of course, at the instant of drawing the patterns, supports the joint surface of the mould entirely. This is, at first sight, an ideal method of drawing patterns, and it has for years been the only method practiced on machines. It has two disadvantages. The patterns are separated from the stripping plate by the necessary joint fissure between the two. Fine sand continually falls into this and, adhering to the joint surfaces more or less, grinds the fissure wider. This leads to a gradual reduction of size of patterns on vertical surfaces and a widening of the joint fissure often to such an extent that wire edges are formed on the mould, causing, on fine work, "crushing" and consequently dirty joints. A nicely fitted but worn plate of twenty-four pieces which had cost, at shop expense only, $250, was recently replaced by a plate of twenty-eight pieces, fitted ready for the machine under the new system about to be described, for not more than $25.

The stripping plate method has another drawback, not always appreciated, probably because accepted as inevitable. Stripping plate patterns are not rapped, and there frequently occur on surface of patterns, remote from the action of the stripping plate, rectangular corners just as important to mould sharply as those at the parting line. Such corners have either to be filleted or "stooled" in stripping plate work, and neither method often is practicable. When the entire pattern and plate are vibrated so that the corners where the pattern joins the plate draw perfectly, as they do in the machine to be described, it is obvious that similar corners anywhere on pattern surface will draw equally well.

The vibrating of patterns, or rather of moulds, during the operation of drawing the patterns possesses little of novelty. Ever since a bench moulder's neighbor first rapped the bench while he lifted a cope or drew a pattern, the thing has been done in one way or another. In fact, machines are now and then found on the market in which a device like a ratchet or other mechanical means for jarring the machine structure during pattern drawing renders the working of easy patterns without stripping plates possible.

The idea of applying a power driven vibrator directly to the plate carrying the patterns to thus vibrate them independently of other parts of the machine and the flask and sand has been the subject of the issue of patents to Mr. Harris Tabor, and the various figures shown will serve to illustrate the mechanism.

Briefly, the operation of the machine is as follows: The ramming head shown thrown back at the top of the machine is drawn into a vertical position after flask has been placed and filled with sand. The 3-way cock shown at the extreme left is then quickly opened, admitting compressed air of 70 to 80 pounds pressure to the inverted cylinder shown at the center of the cut. The cylinder, with the entire upper portion of the machine, is thus driven forcibly up against the ramming head, flask, sand and all. Often a single blow suffices to rain the mould—often the blow is quickly repeated, according to the demands of the particular mould in hand. Gravity returns the machine to its original position, as the 3-way cock opens to exhaust. After pushing the ramming head back and cutting sprue, if the half mould is cope, the operator seizes the lever shown just inside the 3-way cock at the right, and, drawing it forward and down, raises the outer frame of the top of machine containing the flask pins, with flask and sand thereon, away from the patterns, thus drawing them from the sand. Just as he seizes the pattern drawing lever with his right hand, he presses with his left on the head of a compression valve shown at the left side of top of machine, thus admitting air to the pneumatic vibrator already referred to.

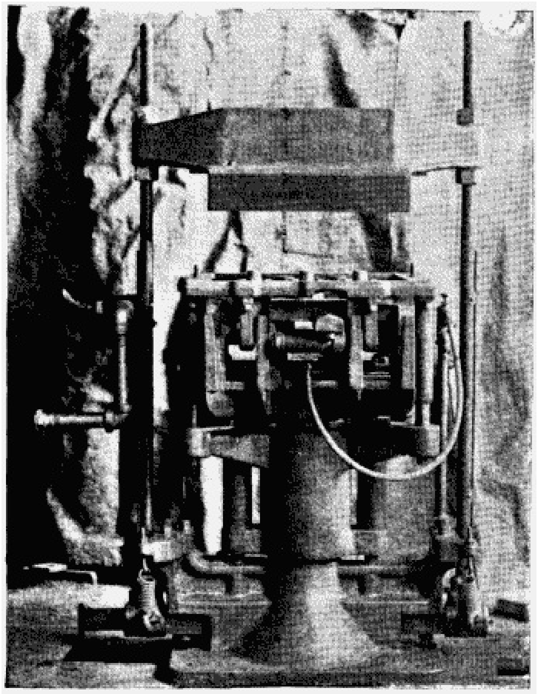


Fig. 3.—POWER DRIVEN VIBRATOR MACHINE.

Fig. 3, a rear view of the machine, shows at the top center, with its inlet hose hanging to it, this vibrator, which is shown in section in Fig. 4. It consists simply of a double acting elongated piston having a stroke of about $^5/_{16}$ inch in a valveless cylinder and impacting upon hardened anvils at either end at the estimated rate of 5,000 blows per minute.

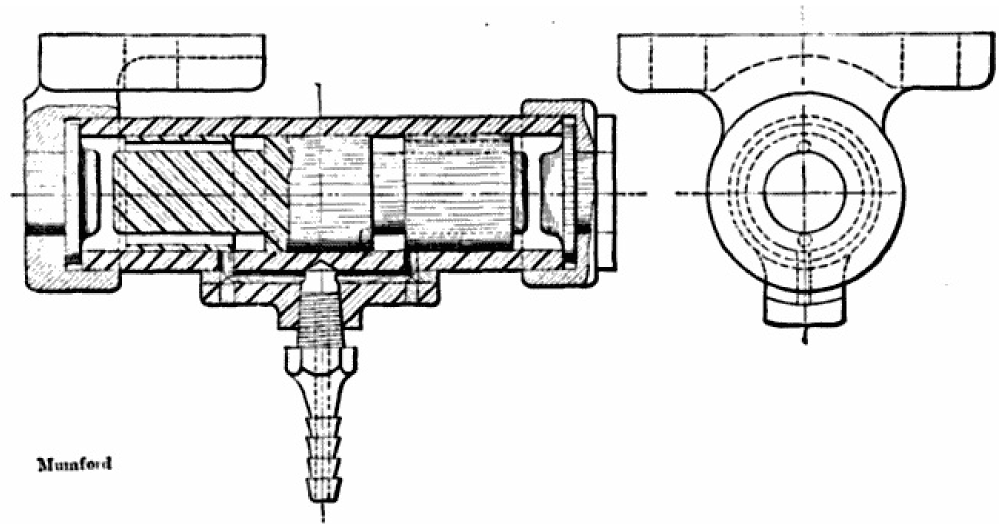


Fig. 4.—SECTION THROUGH VIBRATOR.

The method of communicating the rapid yet small oscillations of the vibrator to the patterns and yet keeping them from being transmitted to the rest of the mechanism is this:

A frame, called a vibrator frame, to which the pneumatic vibrator is bolted and keyed, is shown in Fig. 5. To this frame the plate carrying the patterns, often, in cases of patterns having irregular parting lines, forming one and the same casting with the patterns, is fastened by the four machine screws, the small tapped holes for which are shown in the corners. In fact, in changing patterns, the process consists of simply removing these four machine screws, taking up the pattern plate and screwing to the vibrator frame the new pattern plate. The vibrator frame itself is secured to the machine structure by the four larger bolts, the holes for which are shown in the inner corners. These bolts are, as shown in Fig. 7, surrounded by thick bushings. These bushings are elastic to such a degree as to absorb the sharp vibrations of vibrator frame and patterns, while so firm and well fitted as to hold patterns accurately to their position.

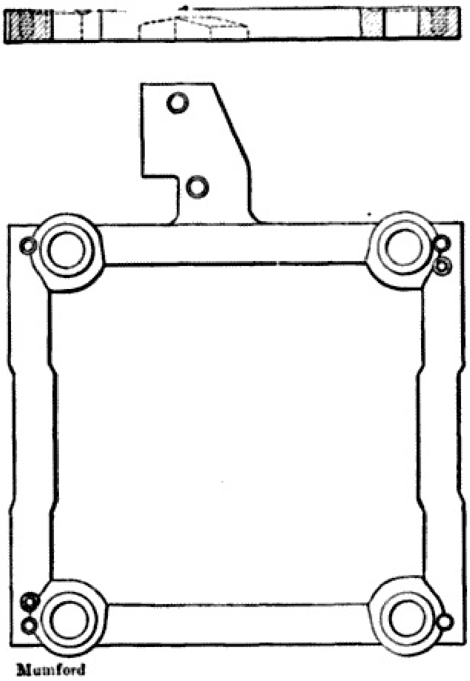


Fig. 5.—VIBRATOR FRAME.

The action of the vibrator is such as to give to the entire pattern surface an exceedingly violent shiver, making it impossible that any sand should adhere to this surface, while the magnitude of the actual movement of the pattern is so slight that it is found to fill the mould so completely that it is impracticable to draw it a second time without rapping. Yet, so truly are the patterns held and so little disturbed from their original position, that it is perfectly practicable to return patterns to a mould having the finest ornamental surface in the ordinary practice of "printing back."

In cases where deep pockets of hanging sand occur, which cannot be held during lifting off and rolling over, machines are arranged to roll the flask over in their operation and draw the patterns up under the influence of the pneumatic vibrator, though, owing to the time consumed in the rolling over process (and each operation counts in seconds on a moulding machine) this style of machine is not usually as rapid in its working as the simpler type, in which the flasks come off in the same way they go on.

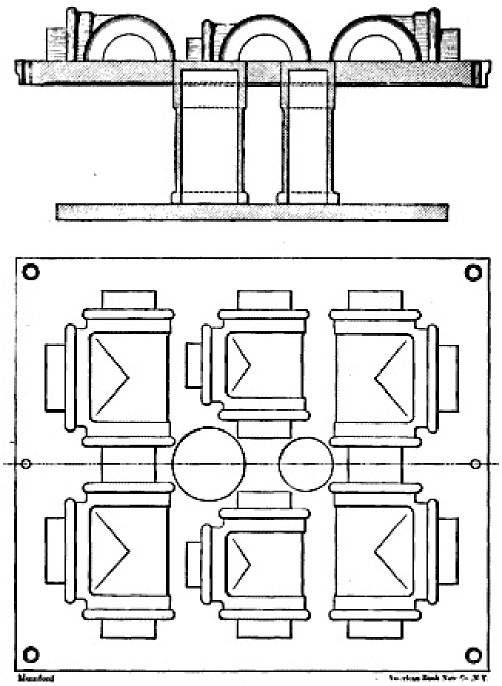


Fig. 6. SET OF PATTERNS FITTED TO PLATES.

Fig. 6 shows a set of patterns as they are ordinarily fitted to plates for this machine. Round holes will be noticed at places in the plate surface. These are openings for the insertion of what are called "stools."

When it is found necessary to support the sand surface at any point, or generally, round holes are drilled through either plate or pattern surface and loose cylindrical pieces are dropped into these holes, their upper end surfaces being flush with the plate or pattern surface and their lower ends resting on the plate called, from this use, a stool plate. This plate appears in Fig. 7 at A and is hung solidly by the brackets shown at B from the frame which carries the flasks, so that it has the same upward motion as the flasks, and the upper ends of the stools remain in contact with the sand of the mould until same is lifted from machine. Fig. 7, showing a vertical section through a machine, will make perfectly clear the position and action of these stools.

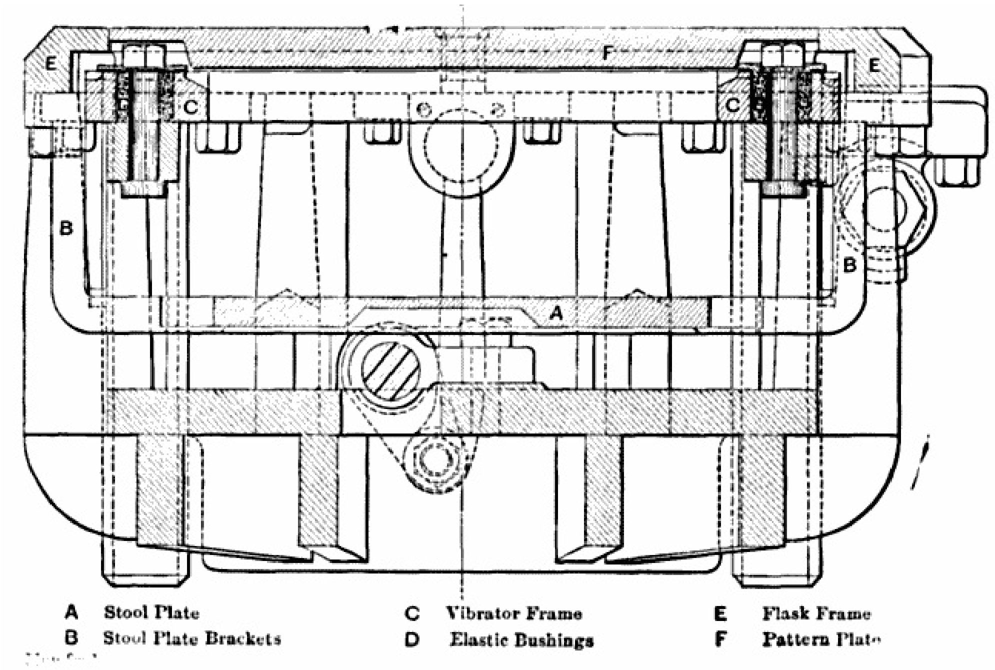


Fig. 7. VERTICAL SECTIONS FITTED TO PLATES.

As illustrating the importance of being able to work without stripping plates on a line of work which is much more extended than that possible with them, we may say that a machinist with a drill press supplied with split patterns and planed pattern plates has matched and fixed five sets of from four to eight pieces in a day: and wooden patterns fitted for temporary use in the same way are of frequent occurrence when it is not thought wise to go to the expense of metal patterns on account of the relatively small number of castings to be made from them.

It is not perhaps too much to say that pattern expense is not the final evil of the costly and not durable stripping plate patterns.

[1] Paper presented at the New York meeting (December, 1897) of the American Society of Mechanical Engineers, and forming part of volume xix. of the Transactions.

ARTIFICIAL INDIA RUBBER.

One of the most recent important events in the history of chemistry was the discovery by an English professor that a substance corresponding in every respect to India rubber may be produced from oil of turpentine.

Dr. W.A. Tilden, professor of chemistry in Mason College, Birmingham, began a series of experiments with a liquid hydrocarbon substance, known to chemists as isoprene, which was primarily discovered and named by Greville Williams, a well known English chemist, some years ago as a product of the destructive distillation of India rubber. In 1884, says The New York Sun, Dr. Tilden discovered that an identical substance was among the more volatile compounds obtained by the action of moderate heat upon oil of turpentine and other vegetable oils, such as rape seed oil, linseed oil and castor oil.

Isoprene is a very volatile liquid, boiling at a temperature of about 30 degrees

Fahrenheit. Chemical analysis shows it to be composed of carbon and hydrogen in the proportions of five to eight.

In the course of his experiments Dr. Tilden found that when isoprene is brought into contact with strong acids, such as aqueous hydrochloric acid, for example, it is converted into a tough elastic solid, which is, to all appearances, true India rubber.

Specimens of isoprene were made from several vegetable oils in the course of Dr. Tilden's work on those compounds. He preserved several of them and stowed the bottles containing them away upon an unused shelf in his laboratory.

After some months had elapsed he was surprised at finding the contents of the bottles containing the substance derived from the turpentine entirely changed in appearance. In place of a limpid, colorless liquid the bottles contained a dense sirup, in which were floating several large masses of a solid of a yellowish color. Upon examination this turned out to be India rubber.

This is the first instance on record of the spontaneous change of isoprene into India rubber. According to the doctor's hypothesis, this spontaneous change can only be accounted for by supposing that a small quantity of acetic or formic acid had been produced by the oxidizing action of the air, and that the presence of this compound had been the means of transforming the rest.

Upon inserting the ordinary chemical test paper, the liquid was found to be slightly acid. It yielded a small portion of unchanged isoprene.

The artificial India rubber found floating in the liquid upon analysis showed all the constituents of natural rubber. Like the latter, it consisted of two substances, one of which was more soluble in benzine or in carbon bisulphide than the other. A solution of the artificial rubber in benzine left on evaporation a residue which agreed in all characteristics with the residuum of the best Para rubber similarly dissolved and evaporated.

The artificial rubber was found to unite with natural rubber in the same way as two pieces of ordinary pure rubber, forming a tough, elastic compound.

Although the discovery is very interesting from a chemical point of view, it has not as yet any commercial importance. It is from such beginnings as these, however, that cheap chemical substitutes for many natural products have been developed. Few persons outside of those directly connected with rubber industries realize the vast quantities imported yearly into this country. Last year there were brought into United States ports, as shown by the reports of the customs officers, no less than 34,348,000 pounds of India rubber. The industry has been steadily progressive since the invention of machinery for manufacturing it into the various articles of everyday use. The wonderful growth of the India rubber interests in this country will be seen from the statistics compiled in the tenth census.

In 1870 there were imported 5,132,000 pounds at an average rate of $1 per pound; in 1880 the imports were 17,835,000 pounds, at an average price of 85 cents per pound; in 1890 31,949,000 pounds were imported, at an average price of 75 cents per pound. The present price of India rubber varies from 75 cents per pound for fine Para rubber to 45 cents per pound for the cheapest grade.

It will be seen that, notwithstanding the increase in importations, the price of the raw material remains at a comparatively high figure. Many experiments have been made to find a substance possessing the same properties as India rubber, but which could be produced at a cheaper rate.

Many of the compositions which have been invented have been well adapted for use for certain purposes and have been used to adulterate the pure rubber, but no substance has been produced which could even approach India rubber in several of its important characteristics. There has never been a substance yet recommended as a substitute for rubber which possessed the extraordinary elasticity which makes it indispensable in the manufacture of so many articles of common use.

Great hopes were at one time placed in a product prepared from linseed oil. It was found that a material could be produced from it which would to a certain extent equal India rubber compositions in elasticity and toughness.

It was argued that linseed oil varnish, when correctly prepared, should be clear, and dry in a few hours into a transparent, glossy mass of great tenacity. By changing the mode of preparing linseed oil varnish in so far as to boil the oil until it became a very thick fluid and spun threads, when it was taken from the boiler, a mass was obtained which in drying assumed a character resembling that of a thick, congealed solution of glue.

Resin was added to the mass while hot, in a quantity depending upon the product designed to be made, and requiring a greater or less degree of elasticity.

Many other recipes have been advocated at different times to make a product resembling caoutchouc out of linseed oil in combination with other substances, but all have failed to give satisfaction, save as adulterants to pure rubber.

Among the best compounds in use in rubber factories at present is one made by boiling linseed oil to the consistency of thick glue. Unbleached shellac and a small quantity of lampblack is then stirred in. The mass is boiled and stirred until thoroughly mixed. It is then placed in flat vessels exposed to the air to congeal.

While still warm the blocks formed in the flat vessels are passed between rollers to mix it as closely as possible. This compound was asserted by its inventor to be a perfect substitute for caoutchouc. It was also stated that it could be vulcanized. This was found to be an error, however. The compound, upon the addition of from 15 to 25 per cent. of pure rubber, may be vulcanized and used as a substitute for vulcanized rubber.

Compounds of coal tar, asphalt, etc., with caoutchouc have been frequently tested, but they can only be used for very inferior goods.

The need for a substitute for gutta percha is even more acute than for artificial India rubber. A compound used in its stead for many purposes is known as French gutta percha. This possesses nearly all the properties of gutta percha. It may be frequently used for the same purposes and has the advantage of not cracking when exposed to the air.

Its inventors claimed that it was a perfect substitute for India rubber and gutta percha, fully as elastic and tough and not susceptible to injury from great pressure or high temperature.

The composition of this ambitious substance is as follows: One part, by weight, of equal parts of wood tar oil and coal tar oil, or of the latter alone, is heated for several hours at a temperature of from 252 to 270 degrees Fahrenheit, with two parts, by weight, of hemp oil, until the mass can be drawn into threads. Then one-half part, by weight, of linseed oil, thickened by boiling, is added. To each 100 parts of the compound one-twentieth to one-tenth part of ozokerite and the same quantity of spermaceti are added.

The entire mixture is then again heated to 252 degrees Fahrenheit and one-fifteenth to one-twelfth part of sulphur is added. The substance thus obtained upon cooling is worked up in a similar manner to natural India rubber. It has not been successfully used, however, without the addition of a quantity of pure rubber to give it the requisite elasticity.

A substitute for gutta percha is obtained by boiling the bark of the birch tree, especially the outer part, in water over an open fire. This produces a black fluid mass, which quickly becomes solid and compact upon exposure to air.

Each gutta percha and India rubber factory has a formula of its own for making up substances as nearly identical with the natural product as possible, which are used to adulterate the rubber and gutta percha used in the factory. No one has as yet, however, succeeded in discovering a perfect substitute for either rubber or gutta percha.

The history of chemistry contains many instances where natural products have been supplanted by artificial compounds possessing the same properties and characteristics. One of the most notable of these is the substance known as alizarine, the coloring matter extracted from the madder root. This, like India rubber, is a hydrocarbon.

Prior to 1869 all calico printing was done with the coloring matter derived from the madder root, and its cultivation was a leading industry in the eastern and southern portions of Europe.

In 1869 alizarine was successfully produced from the refuse coal tar of gas works and the calico printing business was revolutionized.

The essence of vanilla, made from the vanilla bean, and used as a flavoring extract, has been supplanted by the substance christened vanilla by chemists, which possesses the same characteristics and is made from sawdust.

Isoprene, from which Dr. Tilden produced India rubber, is comparatively a new product, as derived from oil of turpentine. It yet remains to be seen whether rubber can be synthetically produced certainly and cheaply. The result of further experiments will be awaited with interest, as the production of artificial rubber at moderate cost would be an event of enormous importance.

DEEP AND FROSTED ETCHING ON GLASS.

The best means of producing these effects is by printing from a steel plate or lithographic stone on thin transfer paper, which, in turn, is made to give up the design to the surface of the glass, the exposed portions of the latter being then etched with acid.

In preparing the steel plate, a coating of varnish is prepared by mixing 200 parts by weight of oil of turpentine, 150 of Syrian asphaltum, 100 of beeswax, 50 of stearin, and 50 of Venice turpentine in the warm. The design is then copied in outline by tracing from the original, the shading being reproduced in a less detailed manner, but with fewer and bolder strokes, in order to adapt the picture to the process. It is then pricked through the tracing paper on to the varnish coating of the plate, and, after clearing out the lines with graving needles, the plate is etched with a mixture of 1 vol. of water and 4 to 7 vols. of nitric acid, either by application or immersion; in the latter event the back of the plate must be varnished over. When the metal is bitten by the acid to about 1-75 of an inch in depth, the operation is finished.

To transfer the design to the glass it is printed from the steel plate on to thin silk paper, the ink used being compounded from 500 parts of oil of turpentine, 1,500 of Syrian asphalt, 500 of beeswax, 400 of paraffin, and 300 of thick litho varnish. The printing is performed in the usual manner, and the transfer laid on the warmed surface of the glass sheet or ware to be decorated, rubbed over uniformly with a cloth to make the ink adhere to the glass, and then the paper is moistened and taken off again, leaving the imprinted design behind. It is well to have the ink fairly thick, and rely on warmth to impart the necessary fluidity; otherwise the design may come away with the paper in patches, and be imperfect.

For etching in the design on the glass, the edges of the latter are coated with the protective varnish, and then hydrofluoric acid is brushed over the exposed portions, which are thereby corroded, leaving the parts covered by the ink standing in relief. According as a clear or frosted etching is desired, the etching liquid is modified, being, for the latter purpose, composed of 500 parts of ammonium fluoride, 100 of common salt, 300 of fuming hydrofluoric acid and 30 of ammonia. This is brushed over the glass two or three times, and then rinsed off with lukewarm water. For deep etching, hydrofluoric acid is diluted with 1½ vols. of water and stored for twenty-four hours before use. The objects are immersed in the baths for thirty to fifty minutes, and kept quite still the while. If the etching is to be left clear, the acid is neutralized by boiling the glass in soda, but if to be frosted afterward it is coated with the first named etching liquid while still damp. Finally, the ink is washed off with turpentine, the glass rubbed over with sawdust, washed in hot lye and rinsed with water.

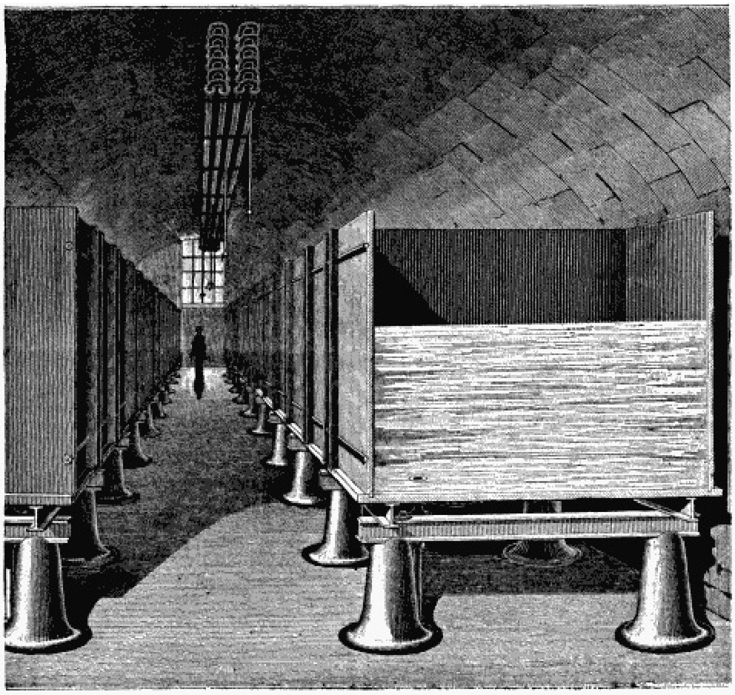
Grained or lined designs can be very suitably printed from a litho stone, on paper faced with a mixture of 1,500 parts of water, 250 of wheaten starch, 1,000 of glycerine and 200 of a thick solution of gum arabic, the ink for printing being prepared by melting and mixing 500 parts of pure tallow, 250 of white beeswax, 250 of liquid mastic, and 150 of pale resin, with 100 parts of lampblack, 5 of minium, and 500 of litho varnish. In transferring the design to the glass, the latter, if flat, may be passed between India rubber rollers or protected by layers of gutta percha when the pressure is applied. The impression produced by this lithographic process has to be strengthened to enable the thin coating of ink to resist the etching liquid, and this is done by dusting powdered resin over the printed surface of the glass, brushing off all that does not adhere, and causing the remainder to attach itself to the ink by means of warmth, and so form an impervious covering. The further treatment is the same as that already described. These methods are particularly suitable for reproducing landscapes, etc., on thinly flashed glass of various colors.—Diamant.

SLATE AND ITS APPLICATIONS.

Slate is, as we know, merely a variety of argillite. Slate quarries are found in England, Switzerland and Italy, but it is in France especially that the industry has been most extensively developed by reason of the large deposits that underlie its surface, particularly in the province of Anjou, where they extend from Trelaze to Avrille, a distance of six miles, and in the department of Ardennes, at Remogne, Fumay, etc.

Normandy, Brittany, Dauphiny and Marne likewise possess quarries, although they are not so productive.

The exploitation is commonly done in open quarry. After the vegetable mould (which in this case is called "cover") has been removed, we meet with a solid slate which it is difficult to split into laminæ, and it is not until a depth of at least fifteen feet is reached that we find a material that is fit to be exploited. All the best beds of slate, in fact, improve in quality in proportion as they lie deeper under the surface, near to which they have little value. Without entering into details as to the exploitation of this product, let us say that the blocks have to be divided in the quarry, since, in the open air, they rapidly lose the property of readily splitting into thin, even laminæ.



SLATE STORE-VATS FOR BREWERIES.

Slate has but slight affinity for water, and, moreover, resists atmospheric influences, humidity and heat pretty well.

This property renders it valuable for a large number of domestic purposes.

There is no certain proof, it is true, that it was employed by the ancients, but it is, nevertheless, extremely probable that it was used in mass at an early period for stair heads, pillars for buildings and as a material for fencing.

The exploitation of the material became especially active at the period when the idea occurred to some one to use slate for the rooting of houses. It was employed for this purpose along with tiles as far back as the eleventh century in the majority of schistose districts. It is well known, for example, that Fumay (Ardennes) at this period had a brotherhood of slate quarrymen.

A method of getting out the material and cutting it regularly was found toward the end of the twelfth century, and it was not till then that it became of general application. Moreover, with the advent of the Gothic period slate became indispensable for castle roofs, which have a conical form.

The best slate for roofing purposes is hard, heavy and of a bluish gray color. A good slate should readily split into even laminæ; it should not be absorbent of water either on its face or endwise, a property evinced by its not increasing perceptibly in weight after immersion in water; and it should be sound, compact and not apt to disintegrate in the air.

For a long time past there have been used in schools slate tablets upon which the pupils write with a pencil made of soft gray schist. This application, which is capable of rendering services in a host of details of domestic economy, has given rise to artificial slates, which, made by a process of moulding a composition analogous to cardboard pulp, present the same advantages as ordinary slate, while being much lighter.

Along about 1834 an Englishman of the name of Magnus utilized the property that slate possesses of taking a fine polish in the invention of what are called enameled slates. These products are used especially in the manufacture of table tops, mantelpieces, altars, etc. They very closely imitate the most expensive marbles, and their properties, along with their low price, have been the cause of their introduction into the houses of all classes of the English population, as well as into those of entire Europe and America.

The ease with which slate is obtained in slabs of large dimensions has greatly contributed in recent times toward still further increasing its applications. One of the first of such applications was the substitution of it in urinals for cast iron plates, which very rapidly oxidize and become impregnated with nauseous odors that necessitate a frequent cleaning and constitute a permanent source of infection.

For a few years past, too, slate has been used, in the manufacture of vats designed for breweries. These vats, of which we show in the accompanying figure a model of the installation employed in the Ivry Brewery, are each 6½ feet square and 5 feet in depth. For leading the beer, which, upon coming from the brewing apparatus, must rest for a few days, they are connected by a system of pipes. A second system of pipes, which in our figure is seen running along the cellar vault, serves as a cooling apparatus and maintains a temperature of 5° C. above zero in the vats arranged in two rows to the right and left.

The details or even a simple enumeration of the new applications of slate would, in order to be anywhere nearly complete, necessitate a lengthy article. Let us say in conclusion that slate is substituted for wood, which is too easily attackable, and for marble, which is much more costly, in our laboratories and amphitheaters and everywhere where the manipulation and stay of easily corrupted liquids and solids require the greatest cleanliness in the material of construction.—La Science en Famille.

BIRTHPLACE OF THE OILCLOTH INDUSTRY.

In Kennebec County, Me., is the quiet borough of East Winthrop, for more than half a century known wherever oilcloth carpeting was used as Baileyville.

Were it not for the inventive brain of one of East Winthrop's early inhabitants, says a contemporary, the village would hardly be known across the lake, but early in the present century one of the numerous family of Maine Baileys evolved a scheme to fill his purse faster than the slow process of nature was likely to do it in growing crops.

Oilcloth carpetings were not known in the long ago, when Ezekiel Bailey pictured in his mind how they might be made, and it was in the little hamlet of East Winthrop that the conceit of their manufacture was hatched and executed. Ezekiel Bailey was, in the days prior to the war of 1812, looked upon as a very likely boy. He was studious and industrious, and while other boys of the village were out in the white oak groves setting box traps for gray squirrels, and spearing pickerel by torch light in the waters of Cobosseecontee, Ezekiel was busy in his little workshop fashioning useful things to be used about the house.

Just how and when and where he was prompted to attempt the making of oilcloth carpet nobody now living at East Winthrop seems to know. Many of the burghers thought he was "a-wastin' uv his time," but they thought different some years later when great factories for the manufacture of oilcloth floor carpeting were erected in East Winthrop, Hallowell, New Jersey, and other places.

And Ezekiel? He amassed a considerable fortune and left the path of life much easier for his kin to pursue. Having met a peddler one day, he bought a table cover made of a combination of burlap and paint. Such things were a luxury in the country at that time, and Ezekiel Bailey was shrewd enough to foresee a big demand for them if the cost could be moderated a bit. While thinking, an idea came to him, and following the idea a small voice which whispered: "Make 'em yourself." He decided to try, and there is a legend to the effect that half the farmers of the village quit work to see the first table cover.

Procuring a square of burlap, or rather enough burlap from which to fashion a square of the desired size, Ezekiel Bailey framed up the fabric as the good old grandmas used to hitch up quilts at a quilting bee, the only difference being that the burlap was framed or stretched over a table made of planed boards large enough for the full spread of the burlap. With paint and brush he began his work. The first coat was a tiller; the next, a thicker one, gave body to the cloth, and when this was rubbed down to a smooth surface the last coat was prepared. This was of a different color and was spread on thick. Then, with a straight edge, a piece of board with a true, thin edge, reaching across the whole surface of painted cloth, the finishing touches were put on. Commencing at one end of the fabric, the straight edge was moved back and forth, and straight along over the fresh paint once or twice, and the whole thing left to dry.

The first table covers were great curiosities, and the homes of the Baileys were visited by all the neighboring housewives, who were anxious to see "how they worked." Of course, it was easy to keep them clean, and they saved the woodwork of the table, which was recommendation enough. To see a cloth was to covet it, and it was not long before Ezekiel Bailey had a considerable business. Employing a boy to help him, he turned out table cloths as fast as his limited facilities would permit, and, as he progressed, new ideas for decorating took shape in his mind. In less than a year he had men out on the road selling them.

The turning out to perfection of an oilcloth carpet in those days was a task that would make a person in these piping times of labor-saving machinery wish for something easier. All the smoothing or rubbing down was done by hand. Heavy, long-bladed knives, as big as the "Sword of Bunker Hill," were used to scrape down the rough body coats of paint, and a smooth surface, on which to stamp the geometrical figures in colors, was fetched after long and laborious polishing with bricks and pumice stone.

Drummers employed by Mr. Bailey traveled to Massachusetts, to New York, and away down into the South, and ere long the demand for oilcloth carpeting became so general that other factories were built and made to chatter and clank with the new industry. There was living not far from East Winthrop at this time a shrewd, wideawake Yankee farmer named Sampson, who had kept his weather eye peeled on the progress of Ezekiel Bailey, and when housewives everywhere began to yearn for the new carpeting, taking a neighbor in as a partner, Mr. Sampson built a factory, and in a very short time was in a position to be considered a formidable rival of Mr. Bailey.

But the originator of the oilcloth carpet was not to be outdone. Discerning good returns from a plant established close to a big center of consumption, Mr. Bailey entered into a deal with New Jersey capitalists, and a big factory was set a-going in that State. A trusted employe of the Bailey concern, Levi Richardson (who still lives and is the proprietor of a modest little store in East Winthrop), was sent to New Jersey to instruct the green hands there in the art of manufacture. While thus engaged, Mr. Richardson's brain was busy with the problem of labor saving, and one day a phantom device for smoothing and rubbing down the first rough coats on the burlaps took form in his mind, and for some weeks he spent his spare time in experimenting. The result was the present patent used in most factories, whereby as much rubbing down can be done in one day as could have been accomplished in four by the old hand method.—Industrial World.

THE KOPPEL ELECTRIC LOCOMOTIVES.

The question of the design of small locomotives for use on pioneer lines has been always a difficult matter.

The needs of the railway contractor have called for such locomotives, for which several systems of power have been tried. In many ways the electric locomotive has distinct advantages over its rivals, steam and compressed air, for these narrow gage lines. Reviewing these advantages briefly, we see that the electrical equipment is more economical to work, as one good stationary engine develops power much more cheaply than several small locomotives. Again, the electric locomotive can be more readily designed for narrow gages than steam or compressed air locomotives.

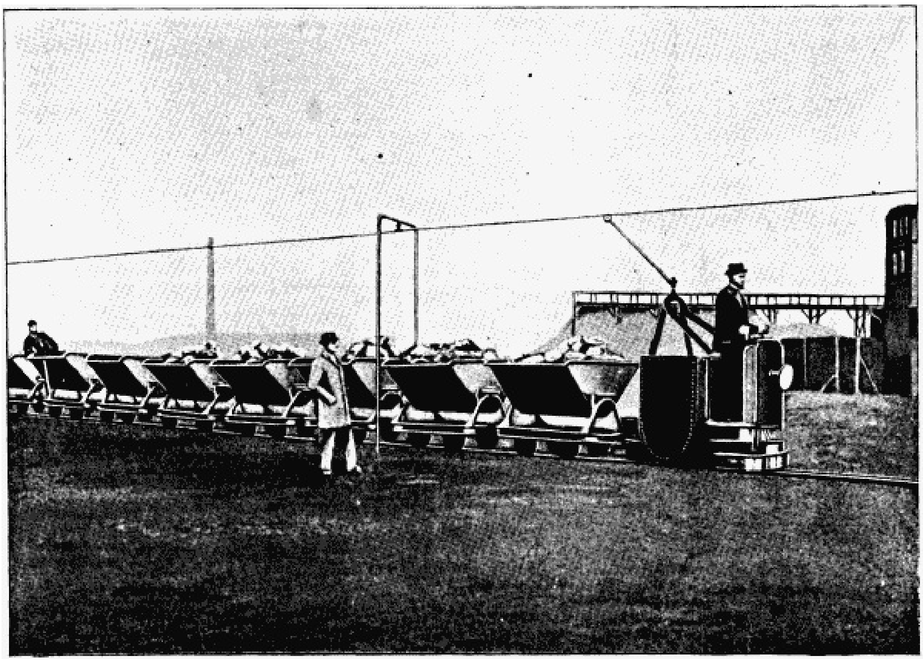


Fig. 1—AN ELECTRIC LINE EQUIPPED ON THE KOPPEL SYSTEM.

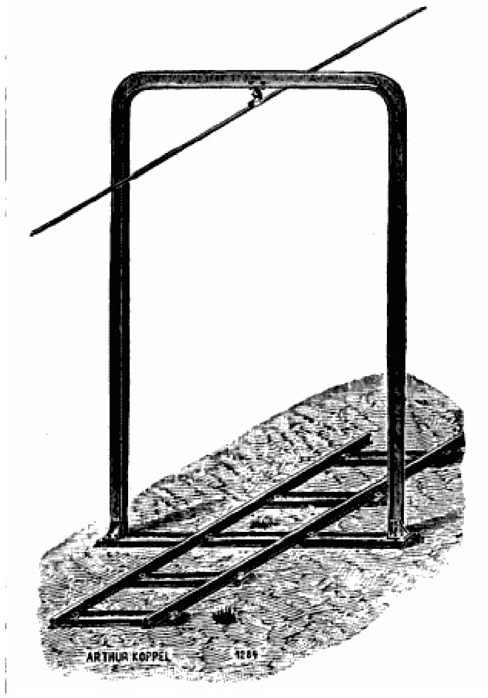


Fig. 2.—THE SECTION WITH THE SUPPORT FOR THE OVERHEAD LINE

A new system of equipment of such lines is now being introduced into this country by Mr. Arthur Koppel, of 96 Leadenhall Street, E. C. The keynote of this system is flexibility, the arrangements being such that extensions or alterations can be readily effected. In fact, the line is portable, and it is claimed also to be cheaper than the ordinary construction. The overhead conductor is employed, as can be seen from Fig. 1, which gives a general view of a locomotive and train of skips on a line actually at work abroad. The supports for the wire are not provided by separate posts and brackets in the usual way, but by arched carriers attached to the sections of railway line, thereby forming a portable section of the electric railway, as illustrated by Fig. 2. The steel carrier or "arch" is fixed to one of the sleepers, which is made of sufficient length for that purpose. On the straight line these line supports are placed about 25 yards apart. In curves of a small radius each section of tramway is provided with an arch, to keep the line of the wire as nearly as possible parallel to the curve of the line. Apart from these special extended sleepers with wire carriers attached, the line is constructed in the ordinary mariner with rails 14 lb. per yard and upward. As the electric locomotives are lighter than steam locomotives, the weight of rail required is somewhat less. The special trolley for erecting the wires along the railway line is shown in Fig. 3. This consists of an ordinary four wheeled platform wagon with ladder, and wire drum with tightening gear and clamps or grips for anchoring the trolley to the line. The wire is led over a sheave on top of the ladder and fixed to the picket post at the beginning of the line. When erecting the wire the trolley is pushed beyond the first carrier arch, clamped on to the rails, and the wire is then tightened by means of the tightening gear. It is then firmly fixed to the insulator on the carrier arch The tension in the copper wire is taken up by a second portable ladder, which is also provided with a tightening gear and can be clamped to the rails in the same manner as the trolley, so that the trolley can then be pushed behind the second carrier arch and the process previously described repeated. By the tension in the wire the carrier arches acquire the necessary stability, while without the procedure previously described it would be impossible to use such light arches attached to the sleepers. On permanent lines, the extreme ends of the wire are attached to properly anchored picket posts. On portable lines, on the other hand, the trolley with the wire drum is fixed to the rails at the end of the line, as shown in Fig. 3, so as to enable the line to be lengthened or shortened, as may be required, with ease.

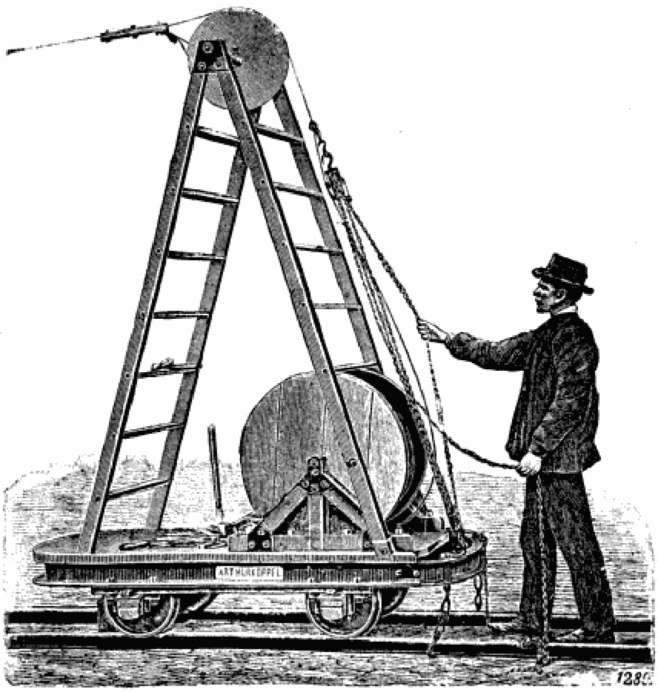


Fig. 3.—THE STRAINING GEAR AND TERMINAL ANCHOR.

Care is taken in insulating the drum and ladders so as to prevent leakage from this erecting trolley to earth. The feeders from the power house to the overhead wire and to the rails respectively are erected on light iron posts, which have also been standardized by Mr. Koppel. A specimen of these posts with an anchored stay is shown in Fig. 4. All these details are arranged for convenience of the contractor required to rapidly equip a line of railway, which can also be removed as soon as the work has been done.

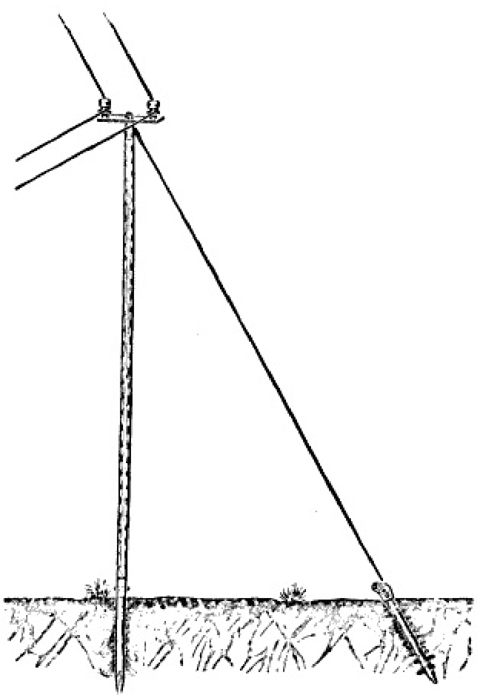


Fig. 4.—LIGHT POLE FOR CARRYING THE FEEDERS.

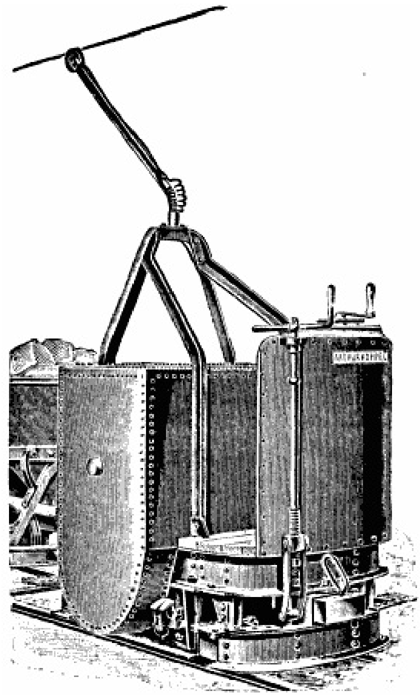


Fig. 5.—THE KOPPEL LOCOMOTIVE.

The locomotive used is varied in form with the gage of the line, but we are particularly concerned with those for gages under 24 inches. One form of such locomotive without a hood to protect the driver is shown in Fig. 5. In this locomotive the gear is the same as that of the next illustration, but it is securely boxed in a watertight iron cover. The controlling gear is then placed vertically in front. Figs. 6 and 7 show the details of the electrical and mechanical parts of this locomotive when fitted with a platform at either end, and with a hood. The motor. M, is of the internal pole type, and is supported on the underframe of the wagon. A double gear is used. The first is a spur gearing, connecting the motor to a countershaft placed under the motor. This gear reduces the speed of rotation to about 200 revolutions. The countershaft is then connected to the two axles of the trolley by chain gearing. This gives the necessary flexibility between the car body and the wheel required, as the springs give to any inequality of the rails. In this gearing there is no change of speed. The underframe is provided with spring axle boxes, and also with spring buffers and drawbars. The speed of the motor can be regulated within very wide limits by the regulator, R. An effective hand brake is also provided.

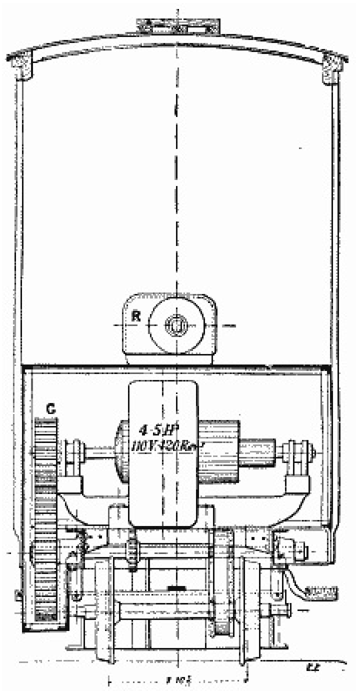


Fig. 6.—END ELEVATION OF LOCOMOTIVE.

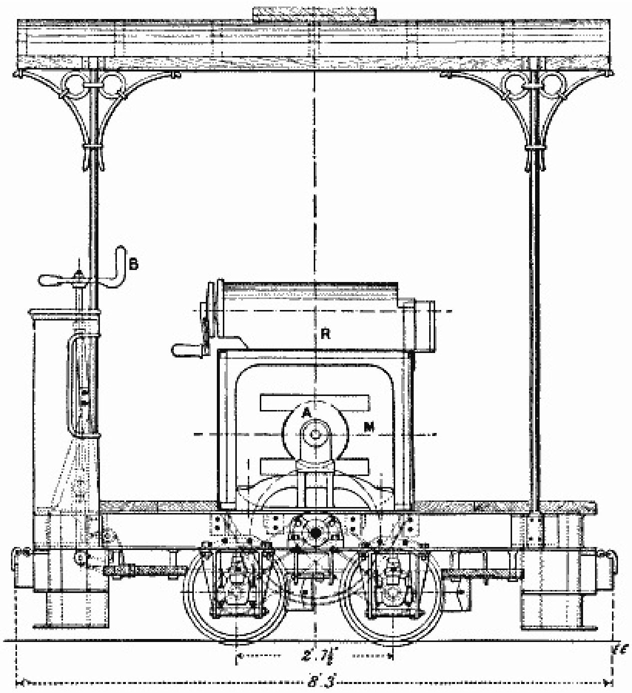


Fig. 7.—DETAILED ELEVATION OF A KOPPEL LOCOMOTIVE WITH A DOUBLE PLATFORM AND HOOD.

For gages of 20 inches and upward the motors can be mounted on springs and attached to the running axles inside of the wagon underframe. This construction is particularly recommended by Mr. Koppel where, in order to mount heavy gradients, the dead load of the motor car must be assisted by the paying load to produce the necessary adhesion. In such cases several motor wagons would be used in the same train. As regards the working voltage, this can be varied to suit special requirements, but the locomotive we illustrate was designed for 110 volts. At this pressure its possible working speed was at least eight miles per hour. The supply of power is also a matter not referred to particularly, as in many cases a lighting plant is used by the contractors, which could also be employed to provide the necessary energy for the electric railway. The good work done by small electric locomotives in the excavation work for the Waterloo and City Railway[1] will convince our large contractors of the valuable service which electricity can render both above and below ground.—The Electrical Engineer.

[1] Electrical Engineer, vol. xvi., p. 499.

A connection between Servian and Roumanian railways is to be established by bridging the Danube. It is reported proposals have already been made to the governments interested, by the Union Bridge Company, also by British and French constructors.—Uhland's Wochenschrift.

LIQUID RHEOSTATS.

By H. S. Webb.[1]

The object in view when the following tests were commenced was to obtain some data from which the dimensions of a liquid rheostat for the dissipation as heat of a given amount of energy could be calculated, or at least estimated, when the maximum current and E.M.F. are known. These tests were rather hastily made and are far from being as complete as I should like to have them, and are published only to answer some inquiries for information on the subject.

In the first test, an ordinary Daniell jar (6¼ inches in diameter by 8 inches deep) with horizontal sheet iron electrodes was filled with tap water. It would not carry 4 amperes for over fifteen or twenty minutes, although the jar was full of water and the plates only ¾ inch apart. After that length of time it became too hot, causing great variation in the current on account of the large amount of gas liberated, much of which adhered to the under surface of the upper electrode. The difference of potential between the plates was 200 volts.

A run was made with 1 ampere and then with 2 amperes for one hour. In the latter case the voltage between the electrodes was about 71 volts and the temperature rose to about 167° F.

From these tests it would be safe to allow a vessel with a cross section of 30.7 square inches to carry from 2 to 2½ amperes when tap water and horizontal electrodes are used.

In test No. 2 the same jar and electrodes were used as in the preceding test, but the tap water was replaced by a saturated solution of salt water. Eleven amperes with a potential difference of 7 volts between the electrodes, which were 7¾ inches apart, were passed through the solution for three hours, and the temperature at the end of the run was 122° F., and was rising very slowly.

Although the current per square inch is much greater, the watts absorbed per cubic inch is much less in this case than when water was used. With the water carrying 2 amperes the watts absorbed would be over 10 per cubic inch, while for the saturated solution of salt when carrying 11 amperes it would be only about 0.4 watt.

In test No. 3 use was made of a long, wooden rectangular trough (42 inches by 6½ inches by 8 inches) with vertical, sheet iron electrodes. The cross section of the liquid, which was a 10 per cent. solution of salt in water, was 44 square inches, and with 10 amperes passing through the solution for 1¾ hours the temperature rose to

95° F., and was rising slowly at the end of the run.

The plates were 41¾ inches apart, and at the end of the run the voltmeter across the terminals read 20. This gives a current density of nearly ¼ ampere per square inch and 0.11 watt per cubic inch. These values are too low to be considered maximum values, for this cross section of a 10 per cent. salt solution would probably carry 13 to 15 amperes safely.

It appears that as the amount of salt in the solution is increased from zero to saturation, the maximum current carrying capacity is increased, but the watts absorbed per cubic inch are less.

A very small addition of salt to tap water makes the solution a much better conductor than the water, and reduces greatly the safe maximum watts absorbed. In using glass vessels, such as Daniell jars, there is danger of cracking the jar if the temperature rises much above 165° to 175° F.

In test No. 4 an ordinary whisky barrel, filled up with tap water, was used. Two horizontal circular iron plates (3/16 inch thick) were used for electrodes. The diameter of the inside of the barrel was approximately 19½ inches. With the two plates 26$^3/_8$ inches apart a difference of potential of 486 volts gave a current of 2.6 amperes. With the plates $^7/_8$ inch apart, 228 volts gave 35.5 amperes at the end of one hour, when all the water in the barrel was very hot (175° F.), and there was quite a good deal of gas given off. The current density in this case was about 0.12 ampere per square inch and the watts absorbed 30.5 per cubic inch. If it were not for the large amount of water above both electrodes, it is doubtful if this current density could have been maintained.

In test No. 5 a rectangular box, in which were placed two vertical sheet iron plates, was filled with tap water. The distance between the plates was $^5/_8$ inch, and with a difference of potential of 414 at start and 397 at end of the run, a current of 35 amperes was kept flowing for 35 minutes. Cold tap water was kept running in between the electrodes at the rate of 6.11 pounds per minute (about $^1/_{10}$ cubic foot) by means of a small rubber tube about ¼ inch inside diameter. This test is very interesting in comparison with the preceding. The current carrying capacity, 0.3 ampere per square inch, was more than double, and the energy absorbed 183 watts per cubic inch, more than six times as great as in case where running water was not used.

The temperature in some places between the plates occasionally rose as high as 205° F., and it was necessary, in order to avoid too violent ebullition, to keep the inflowing stream of water directed along the water surface between the two plates. Less water would not have been sufficient, and, of course, by using more water, the temperature could have been kept lower, or with the same temperature the watts absorbed could have been increased.

When a large current density is used, there is considerable decomposition of the iron electrodes when either salt or pure water is used, and in the case of horizontal electrodes, the under surface of the top plate may become covered with bubbles of gas, making the resistance between the plates quite variable. For large current density a horizontal top plate is not advisable, unless a large number of holes are drilled through it. A better form for the top electrode would be a hollow cylinder long enough to give sufficient surface. Washing soda is often a convenient substance to use instead of salt.

If, from experience, the size of a liquid rheostat for absorbing a given amount of energy cannot be estimated, the dimensions may be calculated approximately as follows:

Suppose, for instance, it is desired to absorb 60 amperes at 40 volts difference of potential between the electrodes. Now, it is inconvenient to obtain a saturated solution of salt, and to use tap water would require too large a cross section—

especially if a barrel or trough is to be used—in order to have the resistance with the plates at a safe distance apart, small enough to give 60 amperes with 40 volts.

Let us try a 10 per cent. solution of salt. Suppose the maximum current this will carry is ¼ ampere per square inch, which will give a cross section of the solution of at least 60 ÷ ¼ = 240 square inches. Now, the specific resistance per inch cube (i.e., the resistance between two opposite surfaces of a cube whose side measures 1 inch) of the 10 per cent. solution of salt used in test No. 3 was 2.12 ohms. The drop, CR, will be 2.12 x ¼ = 0.53 volt per inch length of solution between electrodes. Hence, the electrodes will have to be 40/0.53 = 75 inches apart. This would require about three barrels connected in series. This was taken merely as an illustration, because its specific resistance was known when the current density was ¼ ampere per square inch. This solution, however, will carry safely $^1/_3$ ampere per square inch, but I used the previous figure, since I did not know its specific resistance for this current density, because its specific resistance will be lower for a larger current density on account of the higher temperature which it will have, for the resistance of a solution decreases as its temperature increases.

To reduce this length would require a solution of higher specific resistance, that is, a solution containing less than 10 per cent. of salt, and an increase in the cross section, since the maximum carrying capacity also diminishes as the percentage of salt diminishes. Only approximate calculations are useful because variations in temperature, amount of salt actually in solution and the rate at which heat can be radiated, all combine to give results which may vary widely from those calculated.

As a matter of fact, it is seldom necessary or advisable to use a solution containing over 2 or 3 per cent. of salt. The best way to add salt to a liquid rheostat is to make a strong solution in a separate vessel and add as much of this solution as is needed. This avoids the annoying increase in conductivity of the solution which happens when the salt itself is added and is gradually dissolved.

Liquid rheostats are ever so much more satisfactory for alternating than for direct current testing. The electrodes and solution are practically free from decomposition, and a given cross section seems to be able to carry a larger alternating than direct current—probably due partly to the absence of the scum on the surface which hinders the radiation of heat.

[1] In American Electrician.

THE PROGRESS OF MEDICAL EDUCATION IN THE UNITED STATES.

A retrospective survey of the progress made and of the reforms instituted in medical education in the United States is instructive. In many respects there is cause for much congratulation, while for other reasons the situation gives rise to feelings of alarm. It is pleasing to note and it augurs well for the future that a decided advance has been made in the direction of a more thorough medical training, yet at the same time it is discouraging to observe that, despite these progressive steps, competition does not abate, but rather daily becomes more acute. Dr. William T. Slayton has just issued his small annual volume on "Medical Education and Registration in the United States and Canada." From a study of this book, which fairly bristles with facts, a sufficiently comprehensive opinion may be formed in regard to the present state of medical education in this country. According to this work, there is now a grand total of one hundred and fifty-four medical schools. Of this number, one hundred and seventeen require attendance on four annual courses of lectures, and twenty-seven require attendance on sessions of eight months, and ten on nine months each year. Twenty-nine States and the District of Columbia require an examination for license to practice medicine; eighteen of these require both a diploma from a recognized college and an examination. Fifteen States require a diploma from a college recognized by them or an examination. Five States, viz., Vermont, Michigan, Kansas, Wyoming and Nevada, have practically no laws governing the practice of medicine; Alaska the same. In order to gain a clear comprehension of the existing state of affairs, a comparison of the number of students at two periods, with a lapse of years intervening sufficient to eliminate all minor variations, will be more to the point than merely regarding the multiplication of schools. Many of these mushroom institutions are not worthy of notice, containing perhaps a dozen students, and brought into existence only for the purpose of profit or from other motives of self-interest. The number of students is as reliable an index as can be given. For instance, taking the decade between 1883-84 and 1893-94, it will be found that the students in regular schools in 1883-84 numbered 10,600; in 1893-94 they had increased to 17,601. Students in homoeopathic schools in 1883-84 were 1,267; in 1893-94, 1,666. The number of eclectic students was stationary at the two periods. The increase during the period from 1893-94 to the present time has been at about the same ratio.

These figures reveal more plainly than words the existing condition of affairs, which must, too, in the nature of things, continue until that time when all the States fall into line and resolve to adopt a four years' course of not less than eight months.

To make yet another comparison, the total number of medical schools in Austria and Germany, with a population exceeding that of this country, is twenty-nine. Great Britain, with more than half the population, has seventeen; while Russia, with one hundred million inhabitants, has nine. Of course we do not argue that America, with her immense territory and scattered population, does not need greater facilities for the study of medicine than do thickly inhabited countries, as Germany and Great Britain; but we do contend that when a city of the size of St. Louis has as many schools as Russia, the craze for multiplying these schools is being carried to absurd and harmful lengths. However, that the number of schools and their yearly supply of graduates of medicine are far beyond the demand is perfectly well known to all. The Medical Record and other medical journals have fully discussed and insisted upon that point for a considerable time. The real question at issue is by what means to remedy or at least to lessen the bad effects of the system as quickly as possible. The first and most important steps toward this desirable consummation have been already taken, and when a four years' course comes into practice throughout the country, the difficult problem of checking excessive competition will at any rate be much nearer its solution. Why should France, Germany, Great Britain and other European nations consider that a course of from five to seven years is not too long to acquire a good knowledge of medical work, while in many parts of America two or three years' training is esteemed ample for the manufacture of a full-fledged doctor? Such methods are unfair both to the public and to the medical profession, and the result is that in numerous instances the short-time graduate has either to learn most of the practical part of his duties by hard experience, to starve, or to utilize his abilities in some more lucrative path of life. Taking into consideration the fact that the theory and practice of medicine have become so extended within recent years, it must be readily conceded that four years is barely sufficient time in which to gain a satisfactory insight into their various departments. For a person, however gifted, to hope to receive an adequate medical training in two or three years is vain.

In those States in which the facilities for securing a medical education are abundant, and where the time and money to be expended are within the reach everyone, there is always the danger that an undue proportion will forsake trade in order to join the profession. This is especially the case when times are bad. Many persons seem to be possessed of the idea that the practice of medicine as a means of livelihood should be regarded as a something to fall back upon when other resources fail. Accordingly, when trade is depressed and money is scarce, there is a rush to enter its ranks. That this view of the matter is altogether an erroneous one is too self-evident to need any demonstrative proof. Again, although the question of a universal four years' course is a most important one, it must not be forgotten that examination takes almost as conspicuous a place. It is desirable that every one entering on medical studies should possess a general education. With the exception of a few unimportant schools, the entrance examinations would appear to afford the necessary test. Then comes the much more vital point of how to gage, in the fairest possible manner, the extent of the medical knowledge of those who have undergone their full term of study. For various reasons the conducting of the final examinations by professors in the school in which the student has been taught is open to many and grave objections, more especially when these professors are themselves teachers in that school. As has been pointed out in The Medical Record on more than one occasion, the most obviously fair regulation is that of independent examination by an unbiased State board. If this plan were carried into execution, medical education in America generally would rest on a firmer basis than in Great Britain, in which country the standard, although nowhere so low as in parts of the United States, still varies very considerably in the different schools. The General Medical Council of England has arrived at the conclusion that competition must be checked, and has lately brought into force two drastic measures calculated to attain this object; one is the lengthening of the course to five years, and, more recently, the abolishing of the unqualified assistant. The medical profession of America is quite as conscious of the disastrous results of competition as are its fellow practitioners on the other side, and should use every legitimate means to sweep away the evils of the present system.—Medical Record.

DEATHS UNDER ANÆSTHETICS.

On December 17, 1897, a fatality occurred during the administration of ether. The patient, a woman aged forty-four years, who suffered from "internal cancer," was admitted for operation into the new hospital for women, Euston Road. It was considered that an operation would afford a chance of the prolongation of her life. At the time of admission the patient was in a very exhausted condition. Mrs. Keith, the anæsthetist to the hospital, administered nitrous oxide gas, followed by ether, which combination of anæsthetics the patient took well. After the expiration of thirty minutes and while the operation was in progress the patient became so collapsed that the surgeon was requested by the anæsthetist to desist from further surgical procedure and she at once complied. Resuscitative measures were at once applied, but the patient died after about ten minutes from circulatory failure arising from surgical shock and collapse. We have not received any particulars as to the means adopted to restore the woman or whether hemorrhage was severe. In all such cases posture, warmth and guarding the patient from the effects of hemorrhage are undoubtedly the most important points for attention both before and during the operation. The fact is established that both chloroform and ether cause a fall of body temperature, and so increase shock unless the trunk and limbs are kept wrapped in flannel or cotton-wool. The fall of temperature under severe abdominal and vaginal operations again is considerable. A profound anæsthesia allows of a considerable drop in arterial tension, which has been shown to be least when the limbs and pelvis are placed at a higher level than the head. Again, saline transfusion of Ringer's fluid certainly lessens the collapse in such cases when the bleeding, always severe, has been excessive. We do not doubt that such a severe operation undertaken when the patient was in a dangerous state of exhaustion was as far as possible safeguarded by every precaution, and we regret we have not been favored with the particulars of the methods employed. A death following the administration of ether is reported from the Corbett Hospital, Stourbridge.[1] The patient, aged thirty-nine years, was admitted on September 21, 1897, suffering from fracture of the right femur. A prolonged application of splints led to a stiffness with adhesions about the knee joint which were to be dealt with under an anæsthetic on December 8. Ether was given from a Clover's inhaler; one ounce was used. The induction was slightly longer than usual but was marked by no unusual phenomena. No sickness occurred during or after anæsthesia and no respiratory spasm was seen. There was a short struggling stage followed by true anæsthesia when the operation, a very brief one, was rapidly performed. The patient was then taken back to the ward and the corneal reflex was noticed as being present. Voluntary movements were also said to have been seen. Later he opened his eyes "and seemed to recognize an onlooker." After this no special supervision was exercised. A hospital porter engaged in the ward noticed the man was breathing in gasps; this was twenty minutes after the patient had been taken from the operating theater and half an hour subsequent to the first administration of the ether. The surgeons were fetched from the operating theater and found by that time that the man was dead. "He was lying with his head thrown back, so that no possible difficulty of breathing could have arisen due to his position. The eyes were open and the lips slightly parted; nor was there any sign of any struggle for breath having taken place." The ether was analyzed and found to fulfill the British Pharmacopœia tests for purity. The necropsy revealed that the right heart was distended with venous fluid blood. The lungs also were loaded with blood, as were all the viscera. We cannot but feel that the fact shown at the post mortem examination seemed to indicate that the man died from asphyxia and not from heart failure. No doubt patients appear to resume consciousness after an anæsthetic and even mutter semi-intelligible words and recognize familiar faces. They then sink into deep sleep just like the stupefaction of the drunken, and in this condition the tongue falls back and the slightest cause—a little thick mucus or the dropping of the jaw—will completely prevent ventilation of the lungs taking place. Two very similar cases occurred in the practice of a French surgeon, who promptly opened the trachea and forced air into the lungs, with the result that both patients survived. In his cases chloroform had been given. A death under chloroform occurred at the infirmary, Kidderminster. The patient, a boy, aged eight years and nine months, suffered from a congenital hernia upon which it became necessary to operate for its radical cure. The house surgeon, Mr. Oliphant, M.B., C.M. Edin., administered chloroform from lint. In about eight minutes the breathing ceased, the operation not having then been commenced. Upon artificial respiration being adopted the child appeared to rally, but sank almost immediately and died within two minutes. The necropsy showed no organic disease. At the inquest the coroner asked Dr. Oliphant whether an inhaler was not a better means of giving chloroform, and whether that substance was not the most dangerous of the anæsthetics in common use, and received the answer that inhalers were not satisfactory for giving chloroform and that it was a matter of opinion as to which was the most dangerous anæsthetic. We so often hear that the Scotch schools never meet with casualties under anæsthetics because they always use chloroform, and prefer to dispense with any apparatus, that we can readily accept the replies given to the coroner as representing the views current among the majority of even the thoughtful alumni of those great centers of medical training. A glance over the long list of casualties under chloroform will unfortunately show that whatever charm Syme exercised during his life has not survived to his followers, and overdosage with chloroform proves as fatal in the hands of those who hail from beyond the Tweed as well as "down south." A death from chloroform contained in the A.C.E. mixture occurred at the General Hospital, Birmingham, on December 15. The patient, a girl, aged five years and ten months, suffered from hypertrophied tonsils and post-nasal adenoid growths. She was given the A.C.E. mixture by Mr. McCardie, one of the anæsthetists to the institution, and tonsillotomy was performed. As consciousness was returning some chloroform was given to enable Mr. Haslam, the operator, to remove the growths. She died at once from respiratory failure, in spite of restorative measures. A necropsy showed absence of organic disease, The anæsthetist regarded the death as one from cardiac failure due to reflex inhibition by irritation of the vagus. We are not told the posture of the child or the method employed.—The Lancet.

[1] We are indebted to Mr. Hammond Smith, honorary surgeon to the hospital, and Mr. Edgar Collis for the notes of the case.—Ed. Lancet

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The resistance of nickel steel to the attack of water increases with the nickel contents. The least expanding alloys, containing about 36 per cent. of nickel, are sufficiently unassailable, and can be exposed for months to air saturated with moisture without being tainted by rust. With a view of testing the expansion of nickel steel, experiments have been carried out by allowing measuring rods to remain in warm water for some hours, according to The Iron and Coal Trades Review. They were not wiped off when taken out, but were exposed for a longer period to hot steam, but the lines traced on the polished surfaces were not altered. The rough surfaces, when exposed to steam, were covered after several days with a continuous, but little adhesive, coat of rust.

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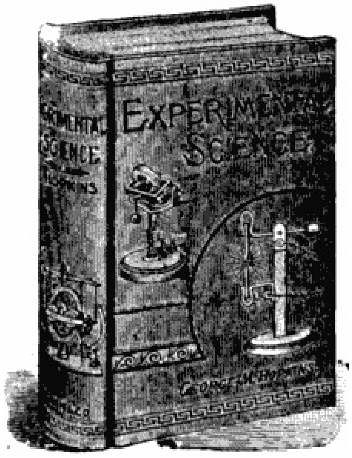

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