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ON THE NECESSITY OF PRACTICAL TEACHING AND PRACTICAL TRAINING IN PUBLIC SCHOOLS.

IN entering upon this subject, which is one of vital importance to the future of Canada, it may be well to inquire what good practical results, so far, have followed from our present system of education in public schools—*i. e.* of the education of the masses who are taught in them and float out into life's arena? It would be a very difficult task, we know, to convince the mere scholar, or the ordinary class of school instructors, who teach according to fixed rules laid down for their guidance, that to cram the mind with a mass of mere superficial knowledge of no practical use to many of them in after-life, is a grave error; for the boy who learns by heart the rules and methods of solving certain questions and problems, without, at the same time, being instructed in their practical application, is merely acquiring by memory to-day what will be forgotten to-morrow. That the present system of education for the masses of the people must naturally be imperfect without conveying, at the same time, some practical application of the subject taught, or giving to our youth an opportunity of completing their education in proper training schools, there cannot be a doubt in the mind of any person who has been connected with machine shops and the manufacturing establishments of the country. Any one who has visited the United States, and is competent to form an opinion on this subject, must have felt convinced how far behind hand the mass of the mechanic are in Canada to those across the border; not only in practical knowledge of the trades they follow, but in any desire to improve their minds by self study, or to raise their social status. That there are many worthy exceptions to this statement we allow, but after having visited nearly two thirds of the manufactories of Canada, and heard the declaration that such was actually the case, what other conclusion can be drawn than that our young mechanics have but little benefitted by their school education, when unaccompanied by practical teaching. In a large manufactory we lately visited, we were assured by the foreman that one half of the employees therein were incapable of setting up a piece of work in the lathe, and were mere living automatons, without a wish to learn, or to do more than earn a day's pay and spend it. But are we to consider that our young men are deficient in intellect to those born in other countries? Certainly not. There is a certain amount of innate talent in every individual, and although only one genius may be found among ten thousand boys, who in the face of every adverse circumstances will rise above the head of his fellows, yet, as a rule, the average talent of every civilized nation is nearly equal, and no matter what ability a boy may be gifted with by nature, it will remain inert until education, accompanied often by accidental circumstances, develope it.

But to come to the bearing of practical teaching and practical training upon the masses. Let us first consider its effect upon the students of the higher professions, who are afforded the means and opportunity of obtaining it in conjunction with their studies.

We will take first the case of a student for the Church. A student, after leaving a high-school for college, generally, before leaving, selects the profession, or it is selected for him, he is to follow, and directs his attention to a course of study and lectures bearing on it. If for the church, his mind is stored with biblical lore and trained in theology for his guidance, and that of others, in the path he is to walk, so that when he enters the ministry, he has had, to a certain extent, practical teaching to be followed by practical training, and be able at once to teach the doctrine he professes to believe in, and combat sophisms in his flock. Should a student be designed for the law, after passing a preliminary examination he must pass a certain number of years in a lawyer's office, and in attendance at the Courts, which is practical training, but unless he is erudite also in all that appertains to the legal profession, he never will attain eminence. Should the medical profession be selected, the student must have a practical knowledge of chemistry, be well versed in pharmacopœia, botany and anatomy; he is taught to dissect and to learn, by practical illustration, the anatomy of the human body, and in walking the hospitals he sees the various diseases of mankind operated upon, and treated for cure—and this to him is practical training. Should a youth prefer to follow the profession of an architect or an engineer, he places himself, after leaving college, under the tutelage of one practising in either of those professions, and there he learns to draw and design, and then to superintend men in the construction of buildings; he has an opportunity to see the precautions used in obtaining a sound foundation, and the method of piling on unsafe ground; he is taught the construction of stone walls and brick work, carpentry and all the other branches of a builder's trade, so that when he comes to start in the profession for himself, he is competent to direct the men under him and not be taught by them. And so, in one of the so-called higher professions, whether in chemistry, painting, music and others of a similar kind, every student thereof has an opportunity, after leaving school or college, to go into practical training, before entering into the practice of his profession. But how is it now with the ordinary classes of mechanics who neither possess the means nor opportunities of obtaining a practical training in all that appertains to their trades? It is quite evident that unless the youth who is to become a mechanic has not received practical training whilst at school, he stands but little chance of obtaining it in after-life. Let us take for example the following trades: Agriculture, Masonry, Carpentry, Painting, and Mechanical Engineering in all its branches. Now upon the intelligence, talent, and practical acquirements of the men who follow these trades the progress of every new country depends. They are in fact the busy hive of workers who build the cells and store the honey for all the rest. They form a very large portion of the community, and from their more humble ranks have arisen many who have founded the wealth and greatness of nations, and yet those who follow these trades, whilst being educated in our public schools, are taught almost nothing in connection with the sphere of life they are destined to fill, and when they enter upon agricultural pursuits or into a machinist's shop, they know nothing of the practical application of what little they have been taught, and have to grope their way to knowledge the best way they can. Is it any wonder, then, that we have so very few talented mechanics or perfect workmen? If the education afforded at our public schools w s more adapted to the sphere these men have to follow in after-life, and mental study and practical instruction went hand in hand together, every subject would be more permanently impressed in the mind. One single lesson in Euclid or trigonometry, practically applied in the field, would do more to fix it clearly on a boy's mind than months of its construction or demonstration on the blackboard. Our children, in fact, are wearied with the study of subjects which are of little utility to them in after-life, and are at best but little understood.

The boy who, with a retentive memory, will rattle off a problem in mathematics, can receive little benefit from this gift of memory, unless the practical application of a problem to things in life is explained to him. His school mate, less gifted perhaps, although unable to commit to memory the exact words of a problem or rule, will, when its practical application is explained to him, bear it on his mind, and perhaps never forget it, and eventually, under practical illustration and practica training, far outstrip in knowledge more gifted boys. It is in the early dawn of life that children imbibe a taste for certain studies, which, if encouraged, and made plain to their comprehension, stimulates them to the desire to learn, and the facility with which they see obstruse studies practically applied, goes a great way to remove their dryness, so that eventually, instead of feeling a disgust for study which they can never thoroughly comprehend the use of, a thirst for information grows upon them. But let a boy he simply told by his master that learning by heart of certain rules and certain studies will be of service to him in after-life, and do not explain to him at the moment for what purpose and how they will be of service, he soon grows weary of school, and leaves it without a desire to improve his mind by after-self-study in those subjects, because he never was taught their practical bearing in the trade he has adopted.

The term *practical training*, apart from practical teaching, has a much wider meaning than generally understood, and it will be well to inquire the meaning given by Webster to the word. First—What means practical? and, second—What is training? Under the first meaning a man may be a practical builder, that is, having a practical knowledge of his trade, and yet not be a *practical* man in another sense; that is, he may not be capable of turning things readily to some use or account, nor will he waste time and money in endeavouring to turn to use or account things which are practically impossible, as, for instance, endeavouring to extract metal from a rock which contains small particles of it, but which, when extracted, would not be worth half the cost of the labour expended. This is an instance in which so much money has been uselessly expended in Canada. When the late Sir William Logan, as a practical geologist, positively asserted that the copper in the Acton mine would terminate in a *pocket*, only one or two persons connected with the mine could be brought to realize the truth of his assertion; but those two were, in the end, the only persons who made money out of the transaction. The practical man would scarcely be guilty of the folly of attempting to do that which his experience had taught him would be futile, but the unpractical man would run the risk, and only know the result when he had sunk his money in it.

Many mechanics having good practical knowledge, in the first sense of the word, have come to us with inventions to patent for them, which have never been of any practical utility, simply because they had had no practical training in the working of their invention. Had they had experience beforehand, the unpractical use of it would have been foreseen. Now, as an instance of a practical invention, we may mention that of Howe in putting the eye of his needle in the *point*; he thus rendered a sewing machine possible and practical; also that of Lyall, in carrying his loom shuttle by friction rollers (instead of batting it through), thereby rendering it possible and practical to weave a fabric of almost unlimited width. There is also another definition of the word *practical* given by Webster: "Evincing practice or skill"—that is as a practical man, one who is always ready to solve new difficulties as presented. Of this class we may mention the sailor who, when the Pope's workmen were raising to its place the obelisk of Rome, and the tackle proved insufficient or ill-calculated, cried out "Wet the ropes!" and by the contraction thus caused to be crowned with success a task which had otherwise failed. Also, in another instance of the sailor who flew a kite over the top of Pompey's Pillar, by which means a party of British officers succeeded in getting a rope over the top, and climbing up, discovered that it had once been surmounted by a statue. It is the practical man who, when a gaping wound in an arm or leg is spurting out the life-blood at a rate which blanches the cheeks of other and less practical bystanders, places his thumb on the artery and directs the applying of a knotted handkerchief as a *tourniquet* above the wound, and thereby saves a life. It is the practical man who gives a prompt emetic in a case of poisoning, never at a loss so long as there is warm water, or any of the dozen other things to be had. It was the practical woman who, when threatened with a watery grave by means of the swamping of a boat in a storm, put her feet in the bottom hoops of her crinoline, and made the skirts a buoy to support her instead of a weight to drag her down. It is the practical person who is ready to roll in a woollen shawl or coat the terror-stricken woman or child whose clothes have caught fire. It is not "mere presence of mind" that leads or permits one to do these things in emergency. Any phlegmatic person may have presence of mind; but unless he is practical, absence of body is much better in case of danger, and just as good in others' need. It is the practical man who can rig up a tool to do a special and unexpected work in a country town, or, in a neighbouring wharf, to repair a disabled steamboat; who can splice, when snapped, the heavy shaft of an ocean steamer; the practical general who always feeds his army when on a march, and allows no rivers to block his progress, if he can make a pontoon or other temporary bridge.

Now, in contradistinction to the practical person, let us recall some of the unpractical people. It is the unpractical person who spends his own time and substance and his neighbours' in seeking after perpetual motion, or, in other words, making a machine to run itself, and supply the power lost through friction. Another unpractical person is the one who places four turbines in a line horizontal to get out of the second, third and fourth each as much power as the first developed, while claiming that the first utilizes or developes 80 per cent. of the theoretical power. It is unpractical to drive a nail in wood with the wedge end lengthwise of the grain, so as to split, instead of crosswise, so as to cut and penetrate. He is unpractical who bleeds to death when cobwebs are plenty to staunch the blood. It was a practical monkey who, when tied by the collar by a rope *just* too short to allow him to lay hands on the mantel ornaments, "backed up" at the coveted treasures and deftly removed them with his *hind* feet; it was not a practical master who did the tying, nor was it a practical woman who painted her cellar steps from top downwards, and found herself a prisoner.

The foregoing are familiar instances of what is practical and what is not, and will show that to be practical implies keen perception, retentive memory, good judgment, the facility of combination and cool and prompt action.

By Webster we further find that practical training implies "To teach and form by practice;" "to exercise." The necessity of *practical* training is obvious. It saves time, money, lives, material. The application of the words is not to be restricted to any particular trade, but to all; it is applicable to man, woman, boy, girl, father, mother, child. There is millions in it to the professional man, farmer, miner, laborer, artisan. It is of equal advantage to the employer and the employed. It has been the saving of nations, and the want of it has been the discomfort of others—as in the case of the late Franco-German war, in which the practical training of the German nation gave them the advantage. Then why should that system of education which makes one nation the vanquisher of another, equally powerful in numbers, be almost ignored in our public schools? "Practice makes perfect," it has been wisely said, but it does *more*. Practice in one occupation not only gives deftness, readiness, neatness and strength in execution in one line, but it gives the power of new conception, of invention and application.

Let it not be supposed for one moment that in advocating the necessity of practical training afterwards, that we ignore theoretical teaching, or we advocate a reduction or change in the usual course of school studies to those whose parents desire their children to follow up, but there is a class, and a numerous class, who leave school with a mere superficial knowledge of the higher studies which is so very superficial as to be of no practical use to them in after-life—in fact time lost never to be recalled; when, had they been permitted to devote the time engaged in endeavoring to learn a smattering of classics, or the higher branches of mathematics, to practical subjects of service to them in any mechanical trade, or in agricultural pursuits, the advantage to them and the community would be tenfold. We feel that the present system of public school education in Canada requires a radical reform, and that it is not adapted to the mass of the children who receive their education at the public schools.

By practical training, in contradistinction to practical teaching, we mean *useful* training, after leaving school, from books, from observation, from self-culture, and the exercise of our reasoning powers; such training, in fact, would, if taught, save many from losing money, time, patienc , and even senses, in seeking to do impossibilities, or losing themselves in a net work of absurdities, without any regard to fixed rules and laws, and which they could have thought out in a common sense way, or read in any common sense book.

Practical training, therefore, means useful training after leaving school or college, from books, from practice, from observation, and, particularly, from self-culture. The mechanic who cannot make working drawings as well as work from them is at a disadvantage. The architect who can draw a chase and beautiful design of building, without being able to carry out his work in all its details, to supply the working drawings, to know when the work is properly executed, and have a practical knowledge of construction, is, in reality, but a mere draughtsman. The inventor who cannot put his thoughts in lines, loses half the value of his invention. The man of general practical information always commands a higher salary than his equal in all other respects, and the man who only knows one thing can never improve or increase his knowledge nor apply it, save in one way. The man with practical training will save money for his employer, receive promotion in his line, and may eventually become an employer himself. Practical teaching in the first place should be made compulsory in all public schools. Every school teacher should be able practically to illustrate, were illustration necessary and useful, every subject he or she teaches. Practical training should be taken into consideration by the Government, by forming training schools in the principal cities of the Dominion. It should receive also every encouragement from the public. Is not the lesson taught to us by the exhibition of arts and manufactures which have been exposed in Europe and America for the last thirty years an encouragement? Have they not shown the wonderful results of the system of technical schools in Europe? And are they not well worth learning? Why should not we endeavour to afford to our artisans the advantages offered by foreign governments to their people, and by the Guilds of London, in particular, to the English people? These Guilds having nobly contributed large sums of money to the formation of technical schools, and the promotion of practical training, they waited not for the initiative to be taken by the government on a matter in which the industries of the country were in peril if she fell behindhand in the march of improvements. Let each parent encourage home study, and insist upon their children being taught thoroughness and not a smattering of a variety of subjects of little practical utility to the mass. The Royal families of England and Germany have their children taught trades for twofold reasons, and many English noblemen excell in art working, designing, engraving, mechanics, &c., and yet there are many in Canada, from a faulty education, who are foolish enough to consider that such work is lowering to their social status. Is it not time that we grew wiser, and that such false pride and ignorance were dissipated?

THE KANSAS WHIRLWINDS.

On the evening of May 30, a severe storm swept over portions of Kansas, Nebraska and Missouri, developing locally two or more whirlwinds of limited scope,—but of terrific violence. The severest of these appears to have formed on the Salina river, Kansas, crossing the country to Solomon river, then northeastward into Nebraska. Much of the country traversed has been but recently settled, and in the absence of complete telegraphic communication, it is impossible to form a connected idea of the course of either of the whirls, or to gain any definite idea of the destruction wrought by them. Forty or fifty persons are reported killed and wounded; and many houses were wrecked at points so situated as to make it certain that no single whirlwind could have done all the mischief. Even where a definite line of disaster can be traced on the map, it takes a curiously zig-zag direction; and local reports describe the main course as having been diversified by many remarkable loops and curves.

In their general features, the whirls substantially repeat those of the whirlwind that wrecked the town of Richmond, Mo., just a year before. There was the same sort of funnel-shaped cloud, with its terrific rotary motion and irresistible suction, sweeping across the country with a writhing motion, leaving in its track a looped and sinuous line of ruin and death. Whatever came within its range was lifted bodily, torn to pieces, and scattered broadcast over the country. Nothing was blown down; everything was twisted and whirled into promiscuous ruin. Horses, cattle and hogs were caught up and carried to considerable distances, then thrown aside, crushed often into shapeless masses. In some places the track would be straight and narrow; at others the terrible meteor would sway from side to side, leaving a belt of partial destruction half a mile wide, with here and there a section entirely unharmed, perhaps an island-like space in a loop of complete devastation. In one of these loops, it is said, a house remains undisturbed, though the terrible whirl passed closely all around it.

Mr. Davidson, an American Artist, has had the good fortune to witness one or more of these unwelcome visitants, without experiencing their immediate effect. It is impossible for the most lively imagination, uninstructed by actual observation or experience, to form any adequate idea of whirling storms. The forward motion of the whirl may be not more rapid than that of a stiff breeze; yet the actual speed of the wind in the whirl would seem to be immeasurably great. It is impossible to estimate the resistless violence of the air movement at such times. Houses are swept up like straws, heavy wagons and machinery are crushed and carried for long distances, and the toughest trees are twisted off like reeds. The electrical action in connection with these murderous whirls is naturally excessive, but the immediate rainfall is apt to be slight.—*Scientific American.*

HYPOSULPHITE OF SODA IN ERYSIPELAS.

Anthony's Bulletin contains the following concerning the hyposulphite of soda as a remedy for erysipelas: "When erysipelas proceeds from a wound, it is more delicate to manage, and requires the best surgical skill; but when it is of the milder form, on the outside skin in the face or any other part of the body, proceed as follows: Take of hyposulphite of soda any quantity, and make a saturated solution in a bottle of any convenient size—six, eight, or ten ounces. If the individual is a strong, hearty man, and the disease has a good start, give your patient one tablespoonful every hour for twelve hours; then decrease the dose, as the benefits become manifest, say once in three hours. It may cause diarrhea; but never mind, it will destroy any febrile symptoms. Twenty-four hours is generally sufficient to produce a decided change for the better, unless it has six or seven days' start, in which case it will take longer. The results are generally so wonderful that I have never known the remedy to fail. With an old person you may substitute a teaspoonful for tablespoonful, and once every two hours. You may put this down: that the sooner you can get a good quality of the soda solution into the body, the sooner the trouble will be over. Now, for an outward application: use equal parts of the soda solution and glycerine; saturate cotton flannel with the above, and lay on the part affected. Eat simple food—avoid all exciting food and drink; farinaceous diet is absolutely necessary. If you can bathe the part affected with the above solution, do so; then lay on the saturated cotton.

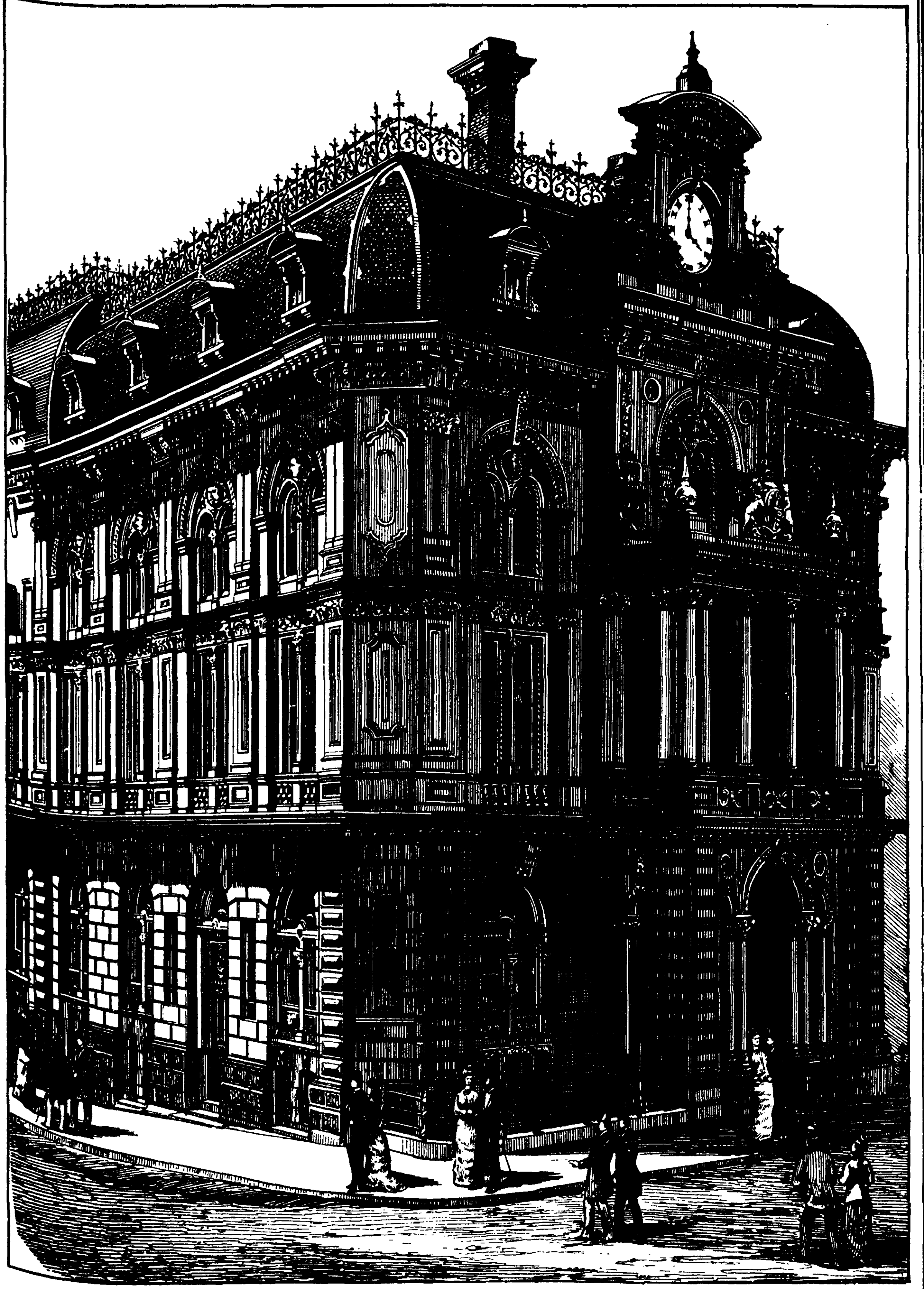
"Hypo is equally as efficacious in any poisons from insects or vegetables; old wounds in sores are healed by washing the parts in a solution of soda. It is also good in typhoid fever, carefully administered.

"Now, if a person has a form of erysipelas that is not so decided, but (say) chronic, let him take a teaspoonful every night of the solution, and the disease will be entirely removed, if kept up for a month. The disease seldom or never attacks a person the second time when eradicated by the soda treatment."

FOOD AND DIGESTION.

In a lecture before the Workingmen's Lyceum, Dr. Seguin spoke as follows of food: "An ordinary meal is generally composed of five ingredients—animal or nitrogenous food, starchy or sweet food, watery vegetables, beverages and condiments. This food when digested is taken into the system by blood vessels. For persons, and especially for workingmen, in this climate, meats are the most easily digested, and at the same time are the most nourishing food. Tripe is the easiest and pork the hardest to digest. Among vegetables, rice and boiled cabbage are the extremes. Anything that is boiled in fat is extremely indigestible. Milk contains the five ingredients referred to above, and so is really 'all-sufficient.' Mothers make a great mistake in trying to induce infants under two years of age to eat starchy food, for there is no alkaline fluid in the stomach of an infant by which the starch can be changed to sugar, and so infused into the system. It has been estimated that a man working in the open air daily needs 15 ounces of meat, 18 ounces of bread, 3½ of butter or fat, and 51 of water. I agree with many eminent chemists who have proved that alcoholic drinks are an aid to the system in retarding the waste of tissues. So, too, for the same reason, I regard tea and coffee as nourishing. An excess of starchy food is to be carefully avoided. Men who handle lead ought to abstain from alcohol, for if too much is taken the kidneys, which throw off the poison of the lead, are likely to become diseased."

Nature has supplied an infinite variety of food to suit every taste and the gratifications of every stomach. "What is one man's meat is another man's poison," is an old and true saying. The whole of good health may be concentrated in the simple observation to "eat only what agrees with you." Volumes of information can give no better or other advice. No physician can prescribe a more efficacious remedy.



TORONTO.—CUSTOM HOUSE.

THE EDDYSTONE LIGHTHOUSE.

In the English Channel, fourteen miles south-southwest of the port of Plymouth, and twelve and a half from Rame Head, stand the Eddystone Rocks, a cluster of twenty-three gneiss rocks about 650 feet long from north to south, spurs and detached reefs covering about the same distance from east to west. They are almost in the line which joins the Start and Lizard points, and in the fair-way of all vessels coasting the southern shore of England. So exposed are they to the ocean swell from all the south and west, that even in comparatively calm weather the waves go raging and thundering over their ledges, and their name indicates the incessant swirl of the deep about them. Excursion steamers run there often during the summer, but rarely land their passengers. On these rocks three light-houses have been built in the last hundred and eighty years, since Europe became civilized enough to make such works practicable. Henry Winstanley, a retired London mercer, was the architect of the first, which was begun in 1696 and completed in 1699. He had such a taste for mechanics—for the bizarre in mechanics, that is—as Robert Houdin displayed so ingeniously in his villa near Paris, to the consternation of all his acquaintances, and amused his leisure at Littlebury, where he lived, by constructing chairs which folded their arms round those who sat down on them and held them prisoners, though less cruelly than the maiden statue filled with knives at Baden, and by arranging an innocent slipper in the middle of a room, which, when the unwary visitor paid it the passing tribute of a kick, caused a frightful ghost to start up from the floor. The idea of his light house was suggested to him by a picture of a Chinese pagoda, and he built it of wood, in a polygonal shape, about a hundred feet high, and set it upon a polygonal stone base twelve feet high and twenty-four feet in diameter. Its form of course rendered it peculiarly liable to be swept away by the waves, while its huge gables, vanes, cranes, and wooden candlesticks exposed it to the action of the wind. It was gaudily ornamented with painted and gilded suns and compasses and mottoes, such as "Post Tenebras Lux," "Pax in Bello," and "Glory be to God," and to protect its occupants against the attacks of foreign enemies, Frenchmen, Dutchmen, Spaniards or Turks, there was a platform from which, by means of a movable shoot, masses of rock could be hurled upon assailants. There was a kitchen, accommodation for the keepers, a state parlor carved and painted, with a chimney, two closets, and two windows giving upon a spacious balcony, and a splendid bed-chamber richly gilded and painted. Winstanley is represented in an engraving of this light-house (which was virtually a huge cockney summer-house set on stilts) as fishing out of the parlor window. Engineers and scientific men even then knew that he was mad, and warned him that the structure was a card-house, but to no effect. He insisted on spending a portion of his time in it as a point of honor, and declared his anxiety to "be in it during the greatest storm that ever blew under the face of heaven." His wish was gratified. He had visited it in November, 1703, to superintend some repairs when what is remembered still as the "Great Storm" burst over the English coasts, the ever-memorable tempest which destroyed many of Sir Cloudesley Shovel's vessels then in the Downs, unroofed half of London, and inspired Mr. Addison, then "distressed by indigence," to compare the Duke of Marlborough, at Blenheim, with the angel riding in the whirlwind and directing the storm, a simile which earned for its author the Commissionership of Appeals. When the sun rose on the 27th November there was no vestige of the pagoda to be seen, and with it Winstanley and his five men had been swept away.

In 1706 the erection of the second light-house was begun at the expense of another London silk mercer, Mr. John Rudyerd. It was completed in 1709, and was a very creditable piece of engineering. In form it was the frustum of a circular cone. For twenty-seven feet it was nearly solid, the filling consisting of courses of cut-stone alternating with courses of squared timber, the outside casing being of seventy-two oak posts fastened into the rock by heavy irons let into lewis holes, this being the first recorded application of the lewis for this use. The tower stood till the night of December 3, 1755, when it caught fire in the lantern and was destroyed. The keepers had to retreat from room to room as the fire gained till they reached the rock. For a wonder the weather was calm enough to admit of a boat landing in the morning and taking them off. Mr. John Smeaton was selected to build the third light-house, the type of all structures of the kind that have since been erected. His studies of wave action convinced him that no building can stand the continuous shock of wave after wave if the blocks are merely laid one upon the other as in ordinary masonry, so he set himself to make a tower which should be practically a monolithic prolongation of, and so be equally stable with, the rock beneath. He took stone for his material, and for the lines of his model measurements of the proportions of the trunks of the old oaks in Windsor Forest. The general form of the "deep-sea lamp-post" is "the frustum of a solid of revolution formed by revolving a vertical plane bounded on one side by a concave curve around a vertical axis." It was built of large blocks weighing from a ton to a couple of tons of the strongest Portland oölite, cased in granite, the expense of using nothing but granite being thought too great. The stones of each course were joined by dovetailing, and the courses were connected by stone dowels, and the upper surface of the rock was cut in horizontal bed. The combinations devised for obtaining the greatest strength by dovetailing, dowelling, cramping, and the use of hydraulic mortar have never been surpassed; indeed Smeaton's discovery has been called "a revolution in architecture as great as that effected by the use of the keystone in the arch, or the introduction of the iron girder in buildings of the Italian style." The diameter of the lower partial course of masonry is 32 feet, that of the lowest entire course 26 feet. To a height of 35 feet it is solid; the whole height of the masonry is 77 feet. Under the coping the course is 15 feet in diameter; the tower is surmounted by a parapet wall 6¾ feet high and 8¾ feet in internal diameter. There are four rooms, one above the other, and at the top a gallery and the lantern. The stone floors are flat above and concave below, and are kept from pressing against the sides of the building by a chain let into the walls. The light-house was begun on the 2nd of April, 1757, and when it was finished, August 24, 1759, Smeaton said that nothing but an earthquake could destroy it.

And yet this splendid tower had one fatal fault—it was too strong! The waves have smitten it in vain—the keepers say that each blow sounds like a cannot-shot, and the lighthouse vibrates like the trunk of a wind-shaken tree as the waves actually overleap the lantern, and the only accident in its history was the burning of the wooden part of the structure in 1770. It stands on an irregular shaped crag, the House Rock, the upper surface of which more or less overhangs its actual foundations, and the waves have gradually undermined this precipitous submarine wall; at the same time so solid is the light-house that it has played the part of a rigid crowbar thrust into the rock and violently worked to and fro, creating fissures in the foundation crag; it has been an immense lever, and sooner or later will break or pry off the rock and tumble with it into the waves. In 1839, and again in 1865, iron bands were introduced into the interior of the superior portion; part of the projecting crag was cut away to lessen the leverage of the water, and the cornice which Smeaton placed near the top, partly for ornament, partly to protect the lantern, was bevelled off, but all in vain, and the fine old monument of engineering skill was condemned. Twice already, indeed, on the 3rd of February, 1869, and on the 9th of October, 1878, it has been reported as destroyed. The Elder Brethren of the Trinity Board have now prepared a light-ship, which can be moored close by, should the present structure tumble ere the new one is completed.—*Exchange.*

CENTRIFUGAL FORCE AND FLY-WHEELS.

It is not always that practical men are willing to admit the value and importance of scientific knowledge as regulating the operations and accidents of a workshop. We had a valuable incident of the kind that forced itself upon our notice, says a foreign contemporary, a few days back. A large pulley or rigger, three feet in diameter, and very wide, was split across its rim by carelessness in unloading; at the same time it was noticed that two of the arms out of six were cracked by contraction in cooling. In order, however, to save expense it was proposed to patch the broken rim of the pulley with wrought-iron plates, which was done. *Per se*, the iron plates were stronger than the original casting, but the whole weight of the patch amounted to about 15 pounds. As the pulley revolved at the rate of 600 revolutions a minute, this unbalanced weight on the rim became by calculation as much as 7½ cwt. radial force outwards. This scientific result was brought to the knowledge of the practical men, but they could not see why the pulley would not do very well if the patch was as strong as the rest of the rim. The pulley was accordingly run under protest, and hardly had the maximum speed been attained before the pulley flew in pieces, and might have been dangerous to life and limb. The pulley, undoubtedly, broke, as above indicated, by centrifugal force, which, by the unbalanced patch of 15 pounds, caused a breaking radial pressure outward upon the broken rim at the position of the patch of 7½ cwt. This was quite sufficient to break the rim outward with enormous force, so that the pieces flew about the shop like fragments of a bursting shell. It will be well for machinists to remember this incident when they have occasion to repair fly-wheels.—*Scientific American.*

ENORMOUS POWER REQUIRED FOR ELECTRIC LIGHT.

Notwithstanding all the claims about the economy of electric illumination, it appears that it is by no means cheap after all, but, on the contrary, highly expensive. It has often struck us that the power driving the magneto-electric machines used for evolving this light was much greater than represented ; one had only to make an estimate by the combined consideration of the dimensions of the belt used and its velocity, also of the furnace used to furnish the steam. Last winter, in order to furnish two electric lights outside the Roman Catholic Cathedral in New York, quite a large fire was required under a good sized boiler, consuming an amount of coal, which, if converted into gas, would have been sufficient to feed gas jets by the hundred. The same has been observed in Paris ; the furnishing of light for 1,000 feet length of streets required an engine of 20 horse-power, so that in order to furnish electric light for the 550,000 feet of streets in Paris it would require a motive force of more than 100,000 horses, which is more than double the power employed in all the industries in Paris and the departments for 100 miles around, taken together.

Statistics show that for every 1,000 cubic feet of gas consumed in the streets of Paris, 9,000 cubic feet are burned in private houses, churches, hotels, operas, gardens and places of amusement ; so that in order to furnish light for all would require a force of 1,000,000 horses ; taking the average consumption of coal to be 3 lbs. per hour for every horse-power, it would require 3,000,000 pounds, or 1,500 tons of coal per hour to furnish the power required to develop illumination by electricity. After such exposés holders of gas stock may feel easier.

PRESERVING CLEOPATRA'S NEEDLE.

The London Metropolitan Board of Works recently took in hand the subject of preserving their Cleopatra's Needle, which had caused so much trouble to float to its destination. After consultation with experts it was decided to grant to one Henry Browning the job of cleaning and coating the monolith with a solution of his own invention.

The effect, says the *Times*, has exceeded the most sanguine expectations of the Board of Works. In operating upon the granite Mr. Browning first gave it a thorough cleansing, removing all the sooty and greasy matter from the surface, and indurated it with his invisible preservative solution. The effect has been to give a freshness to the granite as if only just chiseled from the rock, retaining the original color, disclosing the several veins, the white spar shining in the sun's rays like crystals, and exhibiting the polished portions as they formerly existed. More than this, the "intaglio," or the hieroglyphic engravings, come out far more pointedly than before, and the injuries the stone has received are now plainly distinguishable from the hieroglyphics. The solution soaks well into the pores of the granite, and the best authorities consider that it will have the effect of thoroughly preserving the monolith for centuries yet to come.

Gas and Electricity.—After a full survey of the field, the New York *Times* concludes that gas companies have been driven from every stronghold except that of purely domestic illuminating by the electric light, and that they may be driven from that before the year 1879 closes. There are four electric lamps claiming to meet the conditions of subdivision, namely, Edison's, Holcombe's, Werdermann's and Fuller's, with one comprehensive method of subdivision, D'Ivernois', and one double-circuit generator, that of Mr. Keith. Neither of these has yet been submitted to test on a comprehensive scale, but all have done satisfactory work in the laboratory, and one of them, Werdermann's, has been tested in out-door experiments equivalent to street lighting. We have already referred to the fact that electricity and gas are not exclusives. A more perfect system of illumination will be introduced, and gas find other and more appropriate uses than as a means of illumination, as cooking, heating, etc.

THE WORLD'S COMMERCE.

Dr. Neuman, of Stuttgart, Germany, has completed a book on the subject of the world's commerce, upon which he has bestowed a great deal of labor, and which covers the subject very fully. He puts down the total wealth of Great Britain at $4,500,000,000, with an average yearly increase of over $125,000,000. The grain trade, or rather that part of it exported, which, of course, is but small compared with the whole, proves a tenth part of the international commerce of the world. The coal production he estimates at nearly 300,000,000 tons ; it has doubled since 1860. Nearly 14,000,000 tons of iron are manufactured yearly, though the industry is comparatively in its infancy. The consumption of iron is yet less than one pound per annum for the majority of the inhabitants of the world. Such countries as Russia use up 10 pounds of iron per head per annum.

The imports and exports of each country may be stated in round numbers as follows :—

	Millions.	Millions.
Great Britain	3,260	
Germany	1,600	
France	1,520	
Balance of Europe	3,600	
United States	1,090	
Brazil	210	
Canada	180	
Balance of America	620—	2,100
British India	470	
China	230	
Japan	70	
Balance of Asia	340—	1,140
Australia		460
Africa		300

The internal, however, is the great trade of the United States, which, of course, does not at all appear in the above figures.

Scientific.

THE TELEPHONE AN INSTRUMENT OF THE PRESENT.

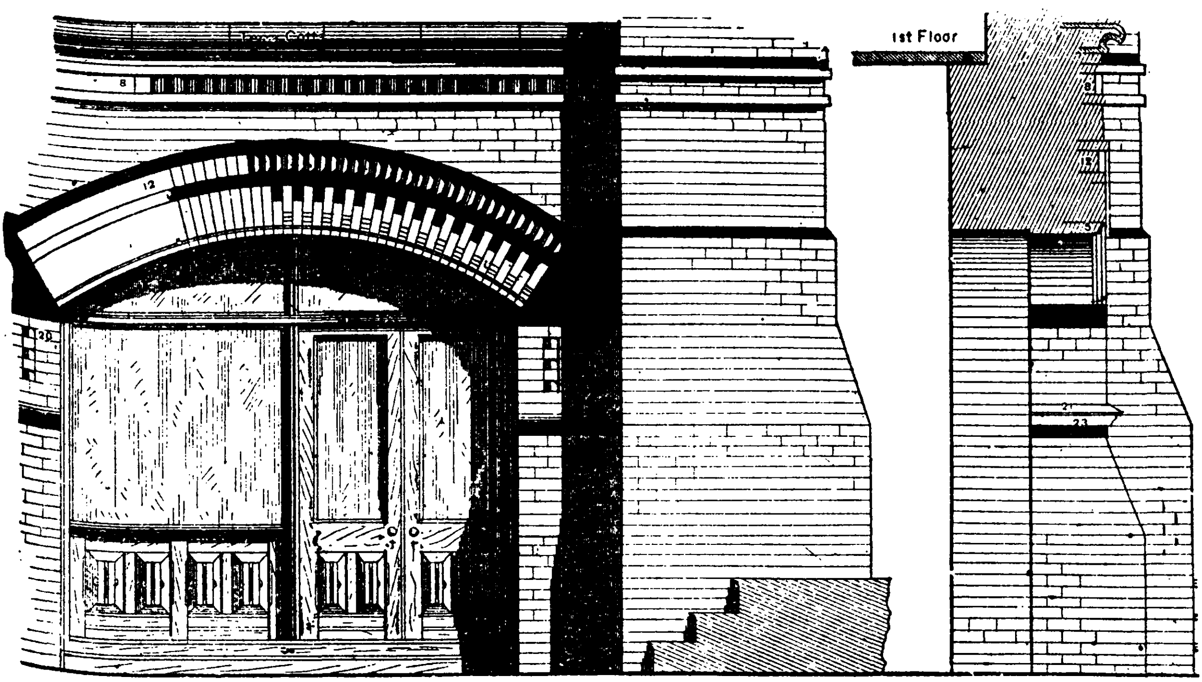
There are said to be about 30,000 telephones now in service in this country, and only 500 in England—a fair sample of the greater quickness of the younger country to adopt new inventions. Prof. Wm. Henry Preece, an eminent English electrician, recently said he did not think that the telephone would be an instrument of the future, and be largely adopted by the public ; "for although it had been largely adopted in America, we had not the same necessity for it, for we had a superabundance of messengers for all purposes, which the Americans had not."—*Ex.*

Perhaps not. We must, however, give Prof. P. credit for his foresight. The telephone, truly, will not be an instrument of the *future*, because in this country, at least, it is an instrument of the *present*, and as to England, refer to the following :

Twelve sets of telephones have been sent out to Sir Garnet Wolseley, for use at the seat of war in South Africa. The great advantage of the telephone over the telegraph, is that the General can carry on confidential talk with the officer at the district station, or a soldier can creep out toward the enemy's lines and whisper back the information as to position. A fine wire—the thinner the better—is all that is needed. This the soldier carries on a reel upon his back—a mile weighing only a few pounds. This will be the first time the telephone has been used as an instrument of warfare.

Lightning Rods.—Mr. E. S. Brough has been discussing, in the *Philosophical Magazine*, the proper sectional areas of iron and copper lightning rods. So far as mere conductivity is concerned, a comparatively thin wire of either metal would suffice for any conductor ; but such a thin conductor would be dangerous, because it would be fused by a heavy discharge of lightning. Iron being more liable to be fused than copper, Mr. Brough sought to determine the relative sectional areas of rods of two metals, so that neither would be more liable to fuse than the other. Ordinarily, it is stated that the iron rod should have four times the sectional area of the copper rod. Mr. Brough shows that these areas should be as eight to three ; or since the rods are invariably made circular, and circular areas are to each other as the square of their diameters, the diameters of iron and copper rods of equal effectiveness should be in the proportion of 1.63 to 1. Iron is, therefore, much the cheaper metal for lightning rods.

Artistic Brickwork.—Fig. 9.—Entrance to the Morse Building.—Concluded from page 241.



Artistic Brickwork.—Fig. 10.—Detail of the Basement Story of the New Morse Building.—Scale ½ Inch to the Foot.

ARTISTIC BRICKWORK.

(Concluded.)

In Fig. 9 is shown in perspective the front entrance, which occurs on Nassau street, and which may be declared to be one of the most important features, artistically considered, in the whole building. In general appearance it is very imposing, and is altogether in keeping with the structure of which it is so conspicuous a part. Terra-cotta forms have been used sparingly in its details, as may be seen by inspection of the engraving; the finial above the pediment, the capitals to the pilasters, and the rosettes being of this material.

In Fig. 10 is shown a detail of the arches in the basement, of which mention has already been made. Figs. 12, 17 and 18 show enlarged views of the molded brick of which the basement arches are constructed.

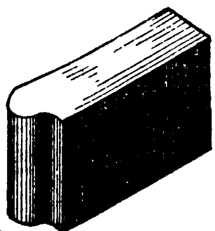


Fig. 11.—Enlarged View of Brick No. 22, in Fig. 15.

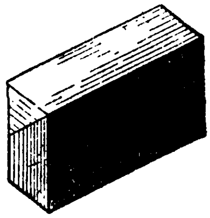
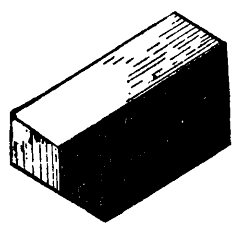


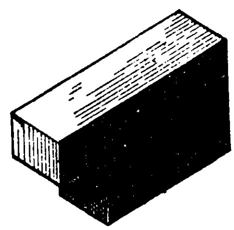
Fig. 12.—Enlarged View of Brick No. 12, in Fig. 10.

Fig. 15 shows the first-story arches, also before mentioned. The sill in this story is formed by means of a terra-cotta tiling, the lower member of which is molded to form a drip. The details of the molded brick used in the first-story arches are shown in Figs. 11, 14, 16 and 19.

We have mentioned that the building is fire-proof. The general construction being of brick, goes far toward rendering this a fact, rather than a mere name. In the construction of the floors, iron beams, spanned by corrugated iron arches, have been employed. There is little in the building to be burned in case a fire should originate in any part of it, while its solid brick walls, separating it from adjacent buildings, will resist any fire which is likely to be kindled against it. Iron beams are used in the roof. The corrugated iron arches are covered by a heavy layer of cement, upon which are bedded flat, vitrified tile. A bonfire might be lighted upon this roof without endangering the building in the least.



Artistic Brickwork.—Fig. 13. Enlarged View of Brick No. 7.



Artistic Brickwork.—Fig. 14. Enlarged View of Brick No. 50, in Fig. 15.

Concerning the use of molded bricks in connection with this building, one of our daily contemporaries says: "There are few cases, for instance, in New York, in which molded bricks have been used at all, in which they have not been so intemperately used as to mar the effect of the building they were meant to beautify. The use of them in this building as the modeling of the openings of the basement and the first story, in which they are chiefly employed, is positively delightful. It is clear that they have been used, not because the designer was anxious to introduce molded bricks, as commonly appears to be the case, but because he found them necessary to carry out his design." The same writer continues: "The same is true of the use of black bricks, generally employed merely for variety, and so either ineffective or distracting, but here intelligibly to express or define an arch, to emphasize a needful line, or to add vigor to a springer, and consequently effective."

We have already mentioned that the molded brick used in the construction of this building were furnished by the Peerless Brick Co., of Philadelphia. This company has given especial attention to the problem of obtaining rich and durable colors in brick, as well as good quality in ornamental brick. We clip the following from a recent Philadelphia paper:—

"The Peerless Company has revolutionized the manufacture of bricks, and has gone far toward effecting a welcome revolution in brick architecture, not alone by the infinite variety of shapes and excellence of finish which the company imparts to the bricks it turns out, but also by reason of the beauty of their color. It is, doubtless, owing to the impossibility which architects have heretofore found of getting rich and lasting shades in vari-colored bricks, that a brick building up to this time has meant invariably a dull red pile, unrelieved by any other tint except in occasional instances, and then by the introduction of a white that would turn green, or a black that was not black when viewed from certain angles. George E. Street, one of the ablest writers of the age on art and architecture, says: 'At the present day there is, I think, absolutely no one point in which we fail so much, and about which the world in general has so little feeling, as that of color. Our buildings are, in nine cases out of ten, cold, colorless, insipid academical studies, and our people have no conception of the necessity of obtaining rich color.' And again: 'Our buildings should, both outside and inside, have had some of that warmth which color only can give; they should have enabled the educated eye to revel in bright tints of nature's own formation, while to the uneducated eye they would have afforded the best of all possible lessons, and by familiarizing it with the proper combination of color and form, would have enabled it to appreciate it.'"

The Morse Building as it stands, independent of the ground, has cost about $175,000, rendering it one of the cheapest buildings, all things considered, which have been erected in this city since 1861. It will, no doubt, prove a profitable investment to its owners, while being a characteristic example of new ideas in the construction of office buildings.

UTILIZING IRON AND STEEL SHEARINGS.

Thin shearings, or pieces of iron or steel—such, for example, as the scrap from cutting iron sheets for tin-plate making, and from various other operations in which thin sheet iron or steel is employed—are very frequently re-worked with other metal, either in the puddling furnace or in the refining furnace. In some cases the scrap is placed loose in the puddling or refining furnace, but more commonly it is made into bundles. In any case the binding only serves to keep the material together while heating up, for the bundle then falls apart, allowing the metal to mix with the remainder of the charge upon the bed or hearth of the furnace. There is much loss in this process of re-working, 30 cwt. of this scrap not producing more than a ton of manufactured metal. According to the invention of Mr. J. H. Rogers, of Llanelly, England, the shearings or waste pieces of thin iron or steel are compacted together into masses or blocks, and these are placed in a re-heating furnace, and, when heated to a proper temperature, are consolidated under a steam hammer, or in any other convenient way. In this manner he can obtain a ton of manufactured metal from 23 cwt. of shearings. In order to form the shearings or pieces of iron or steel into masses or blocks ready for heating, he places them in a box or mold, and with a steam press or other suitable machine he presses the contents of the box or mold until a compact block is obtained. The mass thus compacted is withdrawn from the box by an opening provided for the purpose, and which is closed by a door while the material is being molded. The compacting of the scraps is performed in a cylinder or mold, wherein they can be compressed by a kind of steam hammer. To discharge the molded mass, the box is opened, and by means of a bar inserted at a suitable hole it is forced out in a condition to go into the re-heating furnace. In the furnace, and in the subsequent hammering, the blocks or masses are treated in the same way as piles or blooms.

Telephones without Diaphragms.—M. Ader reports some experiments confirmatory of the views of Du Moncel, upon telephones without diaphragms. He has often observed that the reproduction of words and sounds, which are occasioned by the interruption of currents, can be made in these telephones with a different quality, and upon a higher or lower pitch, according to the degree of tension which is given to the iron wire; but if the fundamental sound of the wire is muffled by holding it between the fingers, the sounds which are reproduced become dull, a little more feeble, and always in the same tone. He concludes from his experiments, that the sounds which are produced by a magnetic nucleus are probably the result of shortenings and lengthenings of the wire, determined by rapid magnetizing and demagnetizing, the molecular vibrations of the magnet producing the effects of the telephone, and the iron diaphragm only strengthening the vibrations, and rendering them more sensible to the ear by its own vibrations. We know it is possible to replace the iron plate of the receiver by non-magnetic substances, as a plate of copper, glass, wood, and even card-board. The magnet does not exercise any particular action upon the diaphragm. The mistake was not in the fact but in the cause, the substance of the diaphragms receiving the molecular vibrations and communicating them to the ear.

ROOM DECORATION.

By William Hodgson.

I am not astonished at the fact that many persons have grey and white drawing-rooms, when I think of the hideous effects sometimes shown me as decorations, where, perhaps a pale emerald green, a grey and a ghastly pink—the very pink that will not harmonize with the crude green in question—are the colors employed. The hideousness of some decorations, so called, is beyond expression, and white walls are infinitely preferable to such.

A *dining-room* we generally make rather dark; citrine, or blue of medium depth, and with greyish hue, looks well for the walls of a dining room, and a maroon dado is very suitable. The emblems of the feast—fish, birds, and beasts—may sometimes be incorporated with the decorations of a dining-room with advantage. The effect of lightness is usually given to drawing-rooms. I think we generally make these rooms too light; we give to them a coldness which is freezing, rather than that depth of tint which gives a snugness, and that cheerfulness which promotes conversation. Furniture cannot look well against a very light wall, and against this as a background every object seems cut out with offensive sharpness and hardness.

Bedrooms are wrongly made very light. The decorations of a bedroom should be soothing. In the hour of sickness we all feel this—it is not whiteness to dazzle that we want, it is that which is soothing and which conduces to rest. There must be an absence of spots or specially attractive features from all good decoration, but in a bedroom this is especially necessary.

A *smoking-room*, or "sanctum," is the one room where we may indulge in the grotesque and humorous, but the grotesque must always be clever and vigorous.

In these days of competition, when the brain is very active, and the nerve force is kept for many hours together in constant play, it is peculiarly desirable that our rooms be soothing in effect and snug in appearance. If special richness is to be indulged in, bestow it upon the library.

ON THE WOOD-WORK OF ROOMS.

If the wood-work of a room is simply varnished, or stained and varnished, then the decoration of the walls and ceiling must harmonise with it, for it is a tint we cannot alter; if, however, it is painted, then it can be colored as may be required. Whatever acts as a frame to something else is better darker than that which it frames, or in some way stronger in effect. A cornice, as the frame of a ceiling, should be stronger in effect than the ceiling; in like manner a skirting which frames the floor should always be dark. I have never yet seen a room which was altogether satisfying to the eye where the skirting was light. I often make the skirting black, but in this case I generally varnish the greater portion of it, yet leave parts "dead," thus getting a contrast between a bright and dead surface. I sometimes run a few lines of color upon its mouldings, but I never in any way ornament it. It should be retiring yet bold in effect; hence its treatment must be simple. If not black it may be brown, rich maroon, dark blue, or bronze green. A dark color gives the idea of strength; that portion of a wall on which weight appears especially to rest should be dark.

I like to see the wood-work of a room generally of darker tint than the walls. A door should always be conspicuous. I find that a room almost invariably looks better when the doors are darker than the walls, and the advantage of dark architraves must be obvious to all who have tried them. A door should rarely, if ever, be of the color of the wall, even if of darker tint; this is a resort of those who cannot form a harmony with the wall color. If a wall is citrine the door may be dark, low-toned Antwerp blue, or it may be of a dark bronze green, but in this case a line of red should be run around the inside of the architrave. If the wall is blue a dark orange-green will do well for the door, but a line of red round the door will improve it, or the door may be an orange-maroon. If the wall is bright turquoise in color the door may be indian-red (vermillion brought to a beautiful tertiary shade with ultramarine). These are mere *illustrations of numerous harmonious combinations which* may be made, but they serve to show my meaning.

The architraves of doors may often be varnished black, or consist in part of bright and in part of "dead" black; if the architraves of the doors are black, one or two lines of color may be run upon them. If the lines are very narrow, say 1.16 in. in width, they may be of the lightest colors; if broad, say $\frac{3}{4}$ in., they should be much subdued in tone, and hardly brighter in tint than the color of the wall. I rarely find it necessary to decorate the panels of doors and shutters, and I never place ornaments on the "styles." If an ornament is placed on a panel it is better quaint or slightly heraldic in appearance. A monogram may in some cases be applied to a door, but it must not be frequently repeated.

ON THE DECORATION OF WALLS.

Perhaps the best treatment of walls is that of arranging a dado upon them. Let a room be 12 ft. high; the cornice will take 6 ins. from the top of the wall, and the skirting will be 12 ins. from the bottom. Let us now draw a line 3 ft. above the skirting or a little over 4 ft. from the floor. The wall we make cream color, but the dado, a portion below the line, we paint maroon or chocolate; on this lower portion we place a pattern called a dado rail. A cream color wall comes well with a dark blue dado. In this case the blue should consist of ultramarine, with a little white added to give a certain amount of neutrality; a ceiling must look pure, a wall somewhat neutral. A citrine wall looks well with a dark blue dado; a grey blue wall of middle tint looks well with a rich and slightly orange maroon dado. Dados *may advantageously vary in height*; in some cases they may be two-thirds the height of a room. This gives quaintness of effect. Dados may vary from 18 ins. to 7 ft. in height, according to circumstances. A wall should never be divided into equal parts; the more difficult to detect proportions the better. A dado in relation to a wall may be as four to eleven, as se en to twelve, and so on, but not as three to six.

CORNICES.

Nothing in the way of decoration is so difficult as rightly to color a cornice. Each member occupies a particular place, and has a particular sectional form; we have to color a cornice that every member shall appear to be in its proper position, and look to be exactly what it really is. A cornice is the frame to the ceiling, and the uppermost boundary of a wall; it should therefore be stronger in effect than the wall. It is also much smaller as a quantity than either walls or ceilings; it may therefore be more "colory" in effect. Strong colors may generally be used with advantage on a cornice, even pure vermillion, carmine and ultramarine. But with these colors it is often necessary to have a much paler, and somewhat grey, shade of blue, and it is generally necessary to have also a soft shade of yellow (formed of middle chrome and white). Yellow is an advancing color, and should therefore be used in advancing or convex members. Red, as a color, is about stationary; that is, a red object looks neither nearer nor farther from us than it actually is; it should therefore be used *chiefly on flat surfaces. It looks best in shades; in light* it is too attractive. Blue is a receding color. It is adapted for hollows, as covings or concave mouldings. Now the difficulty in coloring a cornice rests in our having to render every member distinct, and in so modifying our yellows, blues and reds, or whatever colors we employ, as to cause each separate member to appear to advance or recede to the exact extent that it actually does.

If a cornice is uncolored, it is often impossible to judge of its sectional shape. If there are flat members in a cornice of an inch and a half or more in breadth, these may be enriched with simply patterns in blue and white or red and white, or in any colors demanded by the situation of the member; a coving, if sufficiently large, may be enriched. Care must always be taken not to cause a cornice to look liney; there must be a certain amount of breadth of treatment. If the cornice only consists of narrow lines, it cannot look well. There must be broad members, as well as those which are narrow. It is often necessary that the colors employed in the decoration of a cornice, especially if they be "primaries," be separated from each other by a white line, or by a white member. Red and blue, if of the same depth, produce a "swimmy" effect if juxtaposed, and the production of this dazzling is not desirable; it is prevented, however, by a white line interposing between them. The principles that apply to the coloring of cornices also apply to the treatment of all relief ornament. Red is best in shadow, blue on receding surfaces, yellow on *advancing members. I will say a few words, in conclusion*, on the necessity for harmony in all parts of a room.

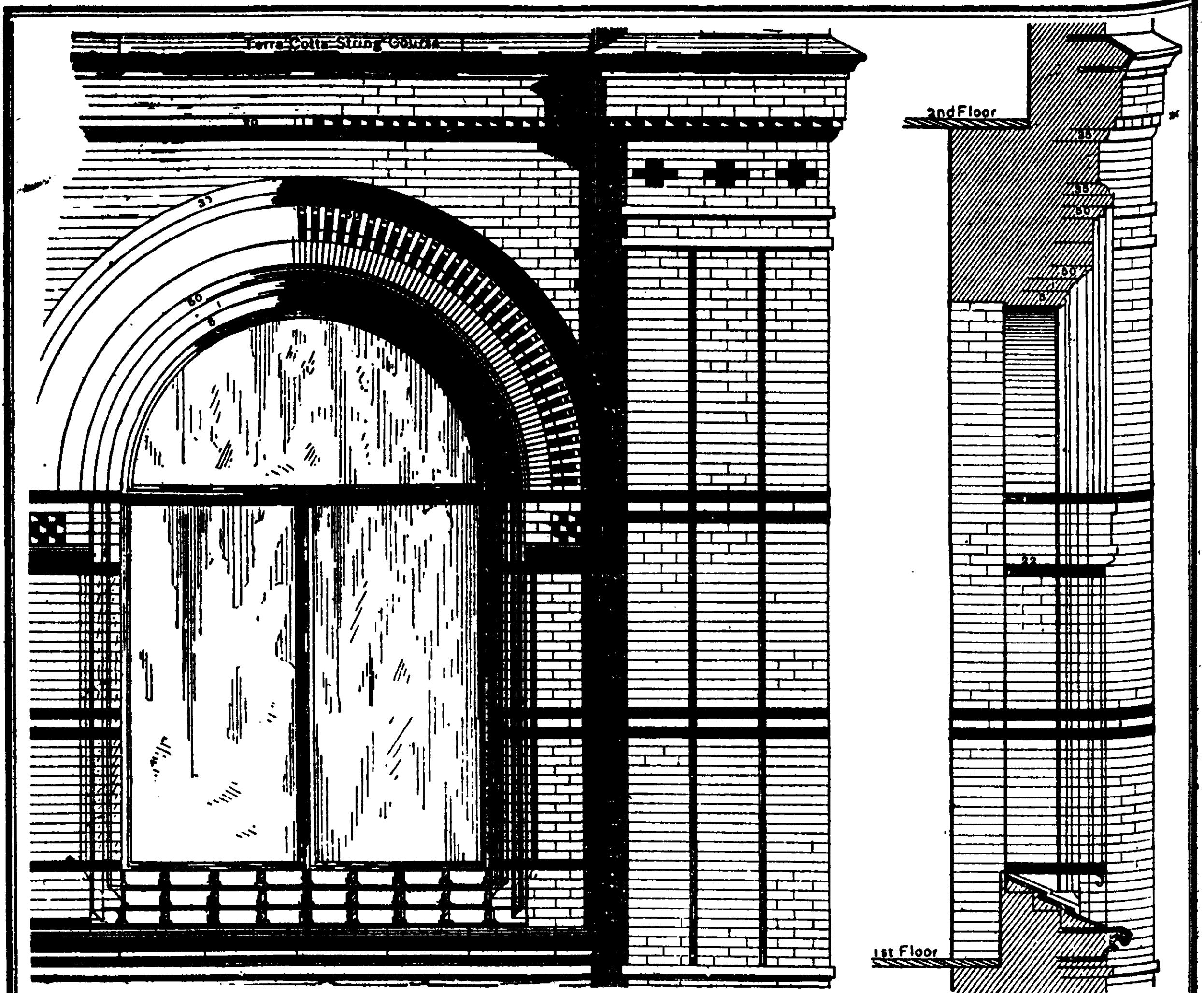
Harmony between the various decorations can be achieved in many ways. A ceiling in which blue prevails, or even a plain blue ceiling, a suitable colored cornice, citrine walls and a rich maroon dado, will produce a harmony. A ceiling of blue green, general effect, walls of low-toned yellow-orange, and a dado of deep red purple, will produce a harmony. In both these cases the doors might be of bronze green, and the architraves black. A plain blue ceiling, I have said, will harmonize with a citrine wall and a maroon dado; but if the ceiling decoration presents various pure colors, so arranged that its general hue is olive, and the wall ornaments are formed of bright colors so disposed that they yield a citrine tint, and the dado is made of such an admixture of colors that the general tone is russet, the three will produce a harmony; for olive, citrine and russet are the three tertiary colors, and they together form a harmony, and the harmony produced will be refined, intricate, and peculiarly pleasant to dwell upon. When rooms open one into the other, it is often desirable to give one a general citrine hue, to another a russet hue, and to another an olive hue; for in such a case the three, when seen through the openings which lead from one to the other, produce a harmony. If there are but two rooms adjoining, one may have a red hue and the other a green hue, or one may have a blue tone and the other an orange tone; in either case a harmony will be produced. It must be especially noticed that I speak of hues and tones of colors only, and not of positive tints, which are always too strong for walls.

If your readers will follow out these simple yet truthful instructions, which I have gleaned from proficient masters in the decorative art, also from thirty-five years' practical experience, I will venture to say they will feel satisfied with the result of their labors.

A POWERFUL SPECTROSCOPE.

In the young science of spectroscopy, as in others, an important element of progress is the improvement of instruments for dealing with the phenomena presented, and many minds are engaged on this. A new spectroscope of remarkable power has just been brought to the notice of the French Academy by M. Thollon. Its chief feature is the use of sulphide of carbon prisms, which are closed laterally, not by plates with parallel faces, but by prisms of the form of Amici's—*i. e.*, having curved sides meeting at an angle, which, however, is much smaller than Amici's prism. The refringent angles of these prisms are in an opposite direction to that of the sulphide prism. Two of these compound prisms are substituted by M. Thollon for the simple prisms in a spectroscope, which he formerly described to the academy. Without going into further details, we may simply state that an enormous dispersion is obtained; with a magnifying power of 15 to 20 times, the spectrum has a length of 15 meters. The angular distance of the D lines of sodium is about 12′, whereas that produced by M. Gassiot was only 3′ 6″. This instrument should throw considerable light on the structure of the spectrum, and M. Thollon has already noticed some interesting facts. The lines of sodium and magnesium present a dark nucleus passing into a nebulosity, which becomes gradually merged in the continuous spectrum. Many lines have been split up, and all that have been thus resolved have been found to belong to two different substances. One of the hydrogen lines presents a nebulosity without a nucleus. M. Thollon remarks on the magnificence of the spectrum of carbon from the electric arc, observed with the new instrument. The spectra of iron, copper, and magnesium in the same arc were also seen with admirable clearness and brilliancy. These new spectroscopes have been constructed for M. Thollon by the able optician, M. Laurent.

THE HELIOGRAPH.—Devices for signaling, very similar to the heliograph or "sun writer," have been in use for ages. As far back as the Persian invasion of Greece, polished metal surfaces were used to flash the rays of the sun and give warnings of one kind or another. The signaling in this and other cases was, however, imperfect, and could not be carried on over a space of more than 18 miles. But the instrument now in use, the Mance heliograph, is a great improvement, for it not only concentrates the sun's rays, but it flashes them with the utmost precision to any required spot, irrespective of the relative location of the sun. It is also provided with a finger key, so that flashes may be made of long or short duration, thus permitting the employment of the Morse telegraphic alphabet. Under favorable conditions inter*course has been carried on through the medium of two of these* instruments over a distance of nearly 100 miles, and at several points occupied by the English army in Afghanistan, regular communication is maintained at distances of not less than 50 miles by heliographic signals. The instrument weighs only seven pounds, and can be carried and worked by one man. It is, of course, useless in cloudy weather. It has already been proposed to establish a systematic telegraphic communication between various islands in the West Indies by this process, and before long it will be adopted as a means of signaling between vessels when at sea.



Artistic Brickwork.—Fig. 15.—Detail of First Story Windows of the New Morse Building.—Scale ½ Inch to the Foot.

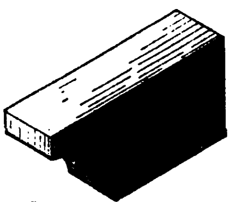


Fig. 16. Enlarged View of Brick No. 1, in Fig. 15.

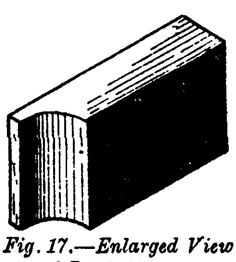


Fig. 17.—Enlarged View of Brick No. 23, in Fig. 10.

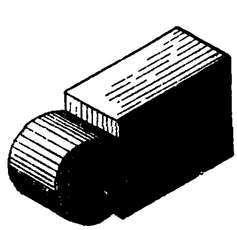


Fig. 18.—Enlarged View of Brick No. 8, in Fig. 10.

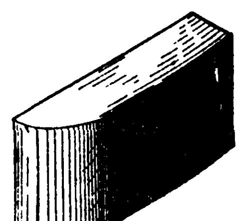


Fig. 19.—Enlarged View of Brick No. 36, in Fig. 15.

ON DIPHTHERIA.

Dr. E. M. Snow says, in his last report as Register of the city of Providence :

In connection with this subject I think it my duty to ask the attention of the people of Providence, and especially of parents, to the following statements :

1. No case of diphtheria occurs without an adequate cause. This is self-evident.

2. The cause of nearly all cases of the disease exists in the houses or premises, or within a few feet of the houses where the cases occur.

3. The cause of nearly all cases that occur in the city is breathing impure air from privy vaults or sink drains, or cesspools ; or drinking impure water.

Much observation and long-continued and careful investigation have perfectly satisfied me of the truth of these propositions, and they are applicable to all cases, whether in the tenements of the poor or in the mansions of the rich.—*Med. and Surg. Reporter.*

The Fluids of the Body.—Prof. Jager, of Leipsic, has recently published a work in which he maintains that an increased proportion of water in the tissues and humors of the body is one of the most essential conditions of liability to disease. To guard against disease, therefore, it is necessary to make the body yield as much water as possible through skin and lungs, and to avoid all that favors the accumulation of water. To this end he recommends the wearing of close-fitting woolen clothing throughout the year ; all bodily movements which promote perspiration ; on outbreak of disease the use of vapor or sweating baths, of drinks that excite perspiration, and of foods that do the same ; constant ventilation of sitting and bedrooms, so that the moisture of the air may not become great. Dr. Jager asserts that the specific gravity of a living body is an accurate criterion of the strength of constitution of a man or a domestic animal—that is to say, for its capability of resistance to causes of diseases, such as chills, infection, etc., and its power of work, bodily and mental.

THE PRINCE IMPERIAL.

Born at the Tuilleries, Paris, March 16th, 1856. Killed during a reconnaissance near Stelezi, Zululand, June 1st, 1879.

Scientific.

A NEW THEORY OF THE EARTH'S MAGNETIC POLES.

From a study of the movement of the compass-needle producing declination at London, Mr. B. G. Jenkins, of the Royal Astronomical Society, has become convinced that the various vicissitudes of the needle during the last 300 years can best be explained by the supposition of a strong magnetic pole above the earth's surface, and revolving around the geographic north pole in about 500 years. He finds four magnetic poles, as maintained by Halley and Handsteen, to be necessary to explain satisfactorily all the phenomena of terrestrial magnetism, but he places these not in the earth, but in the atmosphere. These poles he regards as the free ends of as many broad magnetic belts, two extending from the vicinity of the north pole to the equator, the other two coming up from the south pole to meet them, the boreal magnetism of the northern belts uniting with the austral magnetism of the southern belts along the magnetic equator. These bands he believes to revolve at slow and unequal rates round the poles of the earth, producing secular variations.

It will be observed that Mr. Jenkins describes the magnetism of the northern hemisphere as "boreal." Contrary to the current theory, he holds that the north end of the compass-needle is a true north pole, and that the facts observed are, when properly understood, in full accord with the great magnetic truth that like poles repel and unlike poles attract.

After submitting the evidence in favor of this view, Mr. Jenkins argues in this wise: If the north end of the dipping needle is a south pole, its pointing to the ground in Boothia (where Sir James Ross located the earth's north magnetic pole) must be attributed to attraction. If it is attracted it is attracted by something either in the crust of the earth or at the centre of the globe. If there is something in the earth's crust which attracts the needle in Boothia, it ought to attract the needle in London. But the needle in London is attracted neither to the crust at Boothia nor to the earth's centre. The truth is, Mr. Jenkins believes, that the north pole of the needle pointed to the ground almost perpendicularly in Boothia because it was repelled by the true north magnetic pole in the atmosphere above that region when Sir James Ross was there 50 years ago.

Further evidence as to the existence of the alleged magnetic belts above the earth's surface is promised. Meantime, it is of the first importance, Mr. Jenkins thinks, that it should be clearly settled whether the magnetic pole remains in or above Boothia. According to his calculation it should now be in latitude 72°, longitude 115°, in Prince Albert land.—*Scientific American.*

THE SPHYGMOPHONE.—The sphygmophone is a recent application of the telephone, and is an instrument invented by Dr. Richardson, by which the movements of the arterial pulse are transmitted into loud telephonic sounds. In this apparatus the needle of a Pound's sphygmograph is made to traverse a metal or carbon plate which is connected with the zinc pole of a Leclanche cell. To the metal stem of the sphygmograph is then attached one terminal of the telephone, the other terminal of the telephone being connected with the opposite pole of the battery. When the whole is ready, the sphygmograph is brought into use as if a tracing were about to be taken, and when the pulsation of the needle from the pulse-strokes is secured, the needle, which previously was held back, is thrown over so as to make its point just touch the metal or carbon plate, and to traverse the plate to and fro with each pulsation. In so moving, three sounds—one long and two short—are given from the telephone, which sounds correspond with the first, second and third events of sphygmographic reading. In fact, the pulse talks telephonically, and so loudly that when two cells are used the sounds can be heard by an audience of several hundred people. By extending the telephone wires, the sounds can also be conveyed long distances, so that a physician in his consulting-room might listen to the heart or pulse of a patient lying in bed (speaking modestly as to distance) a mile or two away.

BRAIN WORK AND SKULL GROWTH.—The London *Medical Record* sums up as follows the results of some very interesting measurements of heads by two French physicians, Messrs. Lacassagne and Cliquet. Having the patients, doctors, attendants, and officers of the Val de Grace at their disposal, they measured the heads of 180 doctors of medicine, 133 soldiers who had received an elementary instruction, 90 soldiers who could neither read nor write, and 91 soldiers who were prisoners. The instrument used was the same which hatters employ in measuring the heads of their customers; it is called the conformator, and gives a very correct idea of the proportions and dimensions of the heads in question. The results were in favor of the doctors: the frontal diameter was also much more considerable than that of the soldiers, etc. Nor are both halves of the head symmetrically developed; in students, the left frontal region is more developed than the right; in illiterate individuals, the right occipital region is larger than the left. The authors have derived the following conclusions from their experiments: 1. The heads of students who have worked much with their brains are much more developed than those of illiterate individuals, or such as have allowed their brains to remain inactive. 2. In students the frontal region is more developed than the occipital region, or, if there should be any difference in favor of the latter, it is very small, while in illiterate people the latter region is the largest.

THE NEEDED MOTOR.—The demand to which we have so often referred—a motor fitted for street railways—is felt in Europe, and the British Lords have been investigating the subject, and recommend the passage of a law permitting the use of such. They approve a locomotive worked by compressed air as more promising and desirable than any other, and advocate the use of steam engines in streets until a better discovery is made. The demand is for a simple power that can be attached to any car and that will draw it without fire. It is out of belief that science is stalled by so simple a demand. Study has not been given the problem. An insured reward would eventually discover it, and release countless horses, reduce fares, increase speed and avert injuries. We claim an unequaled ingenuity, and apply it to telephones and improve stoves and shoe-brushes. Here is a call for it, and every day that call grows more urgent. The wonder is that it has not been heeded, and that some slight machine or agent has not been found that will propel a car, a carriage, a sewing-machine, a churn, turn a lathe, and be many men and horses in one. Let us have this instead of new designs for perpetual motion and new combinations for an elixir, and fortune will repay the inventor.—*North American.*

INSTRUMENT OF RESUSCITATION.—A Frenchman has the credit of inventing an apparatus for aiding in the resuscitation of persons apparently drowned, or who from any other cause have been temporarily deprived of animation. It consists of a cylinder of sheet iron large enough to contain the body of an adult person. It is closed at one end, and the inanimate individual is inserted, feet foremost, in the receptacle as far as the neck, round which there is placed a padded diaphragm, fastened to the cylinder so as to be air-tight. An air-pump, attached to an opening in the tube, creates a partial vacuum, and the outer atmosphere, by its own pressure, forces its way into the lungs by the mouth and nostrils, which are left exposed. By a reversed action of the pump the air is allowed to re-enter the cylinder, and respiration is thereby re-established. A glass plate inserted in the iron casing enables the operator to watch the movements of the chest, which rises and falls as in life with the working of the pump. The action may be repeated, it is stated, 18 times in a minute, an exact imitation of natural breathing being thus produced.

THE SOUTH AFRICAN CABLE.—The telegraphic cable to connect the European and Asiatic telegraphic systems with the Cape of Good Hope will be 4,000 miles long, extending from the Red Sea cable, of Aden around Cape Guardafui and along the east coast of Africa to Port Natal, where it made a junction with the present land line to Cape Town. The cable will be laid along the coast, the depth being moderate along that side of the continent and the facility for repairing possible breakages has been carefully ascertained. The cable will touch at Zanzibar, Mozambique, Sofala, Delagoa Bay, and thence to Durban as the submarine terminus, from which point the land telegraph becomes available to complete the circuit to Cape Town. The cost of constructing and laying the cable is estimated at $7,500,000. The line from Durban to Zanzibar is to be finished in July, and the whole cable by the middle of November.

PETROLEUM AS FUEL.—Producers are gradually beginning to use petroleum as fuel under boilers, and they find it cheaper by far than coal. One large producer in the lower oil country, who is trying it, says that one barrel of oil a day with the gas from the wells, gives him sufficient fuel under a boiler that is pumping three wells. Before using petroleum, he was burning $2 worth of coal a day. In the Bradford region, the petroleum burner is being introduced successfully, as well as in manufacturing establishments. But many hundred barrels per day more could be consumed if producers would but interest themselves in thus aiding the consumption of their product. Thousands of barrels daily could be used in this way, with a corresponding benefit to producers in better prices.—*Ex.*

Mechanical Items.

STEERING MADE EASY.

To avoid the slacking of rudder chains and the constant jerking of the rudder in a rough sea, Capt. Sam Martin, of New York, has hit upon a valuable invention. His plan is to cut out a certain section of each rudder chain about midships of the vessel, and in the place of the detached pieces put cylinders. In each cylinder he placed a piston, and connected the rudder chains with each piston. This done he had to all purpose the same old steering apparatus, for the pistons were simply links in the rudder chains and could be moved by turning the wheel in the pilot-house. The next thing to do was to apply steam to the cylinders. They were consequently joined by a steam pipe, the boiler was tapped, and the steam supplied through a valve in the pipe connecting the two cylinders. This valve he operated from in the pilot-house. When the lever in the pilot-house was straight, it showed that there was an equal pressure on both pistons, and that there was as much steam in one cylinder as the other. As the lever was moved, and the rudder turned, it transferred a percentage of steam from one cylinder to the other, and as the piston of the right cylinder went in, the piston of the left proportionately ran out, taking up the slack chain at the stern and holding the rudding taut in any position. By turning the lever to a certain point both cylinders were exhausted and the steam shut off.

The wheel in the pilot-house not only served as an indicator, night and day, to show that the cylinders were answering the turn of the lever, but it could be used in another way. If there was a break in the machinery, or the steam ran low, the vessel could be steered in the old-fashioned way with a man at the wheel, the pistons in the cylinders acting as a link in the chain that leads from the wheel to the rudder. A practical experiment on the steamer *Maryland* from Jersey City to Harlem, satisfied every one that a boy of ten years could manage the helm.

The main point of Capt. Martin's invention is its cheapness. He says it can be put in any steam vessel for an eighth of the cost of any steam steering apparatus now in use, and the cost of the steam is a mere bagatelle. Those now in use are run by donkey engines, requiring the services of extra men at the engines. Capt. Martin gets his steam from the boilers in actual use, and dispenses with the services of men already employed.

Submarine Engineering.—Some very interesting experiments have lately been made in raising sunken vessels or other submerged objects by a plan invented by a Viennese engineer. The Berlin *Tribune* says that the agent employed to lift the sunken objects is carbonic acid gas, generated below the surface of the water. In an otherwise empty balloon a bottle of sulphuric acid is placed, embedded in a quantity of Buller's salts, and an arrangement is provided by which the bottle can be broken at pleasure. The balloon, empty, with the exception of the bottle and the salts, is taken down by a diver, and securely attached to the object to be raised. The bottle is then broken, and the sulphuric acid thus set free percolates the salts and generates carbonic acid gas, which inflates the balloon, and after a time, causes it to rise to the surface, bringing with it the object attached to it. The trials which have been made with this new apparatus have, as yet, been only on a comparatively small scale, but they are stated to have been, so far, eminently successful. A small vessel, weighing several hundred pounds weight, was sunk in 60 feet of water, a diver was sent down and attached the balloon to it, and in a very short time the machine appeared on the surface of the water, bringing the vessel with it. On another occasion five sacks filled with sand were thrown overboard in 60 feet of water, and in five minutes were similarly recovered.

The Blessing of Labor.—I believe that for most men more than eight hours' work per day is required for the maintenance of physical, mental, and moral health. I think that for most men including operatives, mechanics, farmers, and clergymen, more than eight hours' labor per day is necessary, in order to keep down and utilize the forces of the animal nature and passions. I believe that if improvements in machinery should discharge men from the necessity of laboring more than six hours a day, society would rot in measureless and fatal animalism. I have worked more than ten hours per day during most of my life, and believe it is best for us all to be compelled to work. It would be well, I think, if we could make it impossible for an idler to live on the face of the earth. Religious teachers are not without responsibility for having taught that the necessity of labor is a curse. The world owes most of its growth hitherto to men who tried to do as much work as they could. Its debt is small to the men who wished to do as little as possible.—*June Atlantic.*

Welding Cast-Iron.—The Chinese process of welding cracked iron wares by cementing them with molten iron is thus described: In the case, for example, of a cast-iron pan requiring such treatment, the operator commences by breaking the edges of the fracture slightly with a hammer, so as to enlarge the fissures, after which the fractured parts are placed and held in their natural positions by means of wooden braces; the pan being ready, crucibles made of clay are laid in charcoal and ignited in a small portable sheet-iron furnace, with bellows working horizontally. As soon as the pieces of cast-iron with which the crucibles were charged are fused, it is poured on a layer of partly charred husk of rough rice, previously spread on a thickly doubled cloth, the object of this being to prevent the sudden cooling and hardening of the liquid metal. While in the liquid state, it is quickly conveyed to the fractured part under the vessel and forced with a jerk into the enlarged fissures, while a paper rubber is passed over the obtruding liquid inside of the vessel, making a neat, strong, substantial, and in every respect thorough operation.

Marking Patented Articles.—The Patent law says: All patented articles must be marked with the word "patented," together with the day and year the patent was granted. If the article itself cannot be so marked, a label containing the notice must be affixed to the package containing one or more of the articles. The marking is intended as a notice to the public that the thing is patented, and in any infringement suit by the party failing so to mark, no damages shall be reported by the plaintiff, unless it is proved that the defendant had due notice of the infringement. Any person who falsely marks an article patented that is not patented, or marks anything for which he has not obtained a patent with the name of another who has obtained a patent, or who marks an unpatented article with the word "patent," or any word importing that the thing is patented, for the purpose of deceiving the public, is liable to a penalty of $100 for every such violation of the law, one half to go to the informer.

To Temper Drills, Gravers, Etc.—Select none but the finest and best steel for your drills. In making them, never heat higher than a cherry red, and always hammer till nearly cold. Do all your hammering in one way, for if, after you have flattened your piece out, you attempt to hammer it back to a square or a round, you spoil it. When your drill is in proper shape, heat it to a cherry red, and thrust it into a piece of resin or into quicksilver. Some use a solution of cyanuret potassa and rain-water for tempering their drills, but for my part, I have always found the resin or quicksilver to work best. Gravers and other instruments larger than drills may be tempered in quicksilver as above; or you may use lead instead of quicksilver. Cut down into the lead, say half an inch; then, having heated your instrument to a light cherry red, press it firmly into the cut. The lead will melt around it, and an excellent temper will be imparted.

Babbitt Anti-Friction Metal.—The metal is made of one part copper, three parts tin, two parts antimony, and three parts more tin are added after the composition is in the molten state. This composition is called hardening, and when the metal is used for filling boxes, two parts tin are used to one of hardening. The above alloy constitutes the best anti-attrition metal in use, but on account of its expense it is very little used. The anti-attrition metals commonly used are principally composed of lead, antimony, and a little tin, but they are not nearly so good as the above.

Low Water in Boiler.—Whenever the water in a boiler becomes dangerously low, the attendant should immediately draw the fire and allow the boiler to cool. He should not admit any cold water to the boiler, or attempt to raise the safety valve, as this is a dangerous proceeding. It lessens the pressure by allowing the steam to escape from the boiler and thus permits the water to rise and come in contact with the overheated iron. Probably many explosions have been caused in this way.

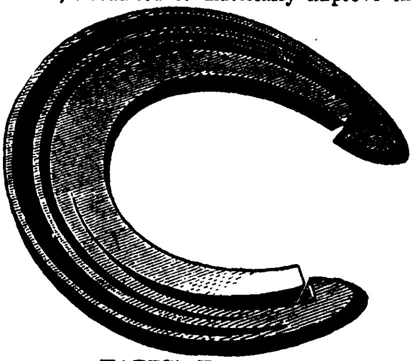
Steel wire strings of pianofortes are annealed by making the wire red hot and then plunging it into boiling water. The water should be quite at the boiling point, and the steel at a bright red heat. The wire should be fairly surrounded by the water. These conditions being fulfilled the steel remains red hot under water for some time. It seems to be surrounded by a film of vapor, and is not in actual contact with the water. The toughening is, it is thought, due to the uniformity of cooling thus effected.

Smith's Work.

A SPRING HORSE SHOE.

This progressive age suggests another valuable invention in the form of a steel spring horse shoe, that has been thoroughly tested on a number of valuable horses, having various shaped hoofs, in good as well as sore condition, and found to have had a very beneficial effect in every instance. Horse shoeing in general must be regarded as a necessary evil to enable the horse to perform his duty on the artificial, hard, stony roads and streets, and the art of successful horse shoeing consists in surmounting the obstacles nature has thrown in the way. Very little attention has, as a general thing, been paid to the peculiar growth of the hoof. The gradual transformation from the normal to the abnormal form caused through domestication and violation of the laws of nature, such as confinement in stables, lack of moisture in hoofs, owing to the dryness of climate and inattention, as well as wrongly calculated proportions of metal improperly distributed over the foot in the form of shoes, is the main cause of so many hoof evils, which ruin many horses.

Such is the peculiar construction of this shoe that with every step it gives a yielding resistance, and arrests the vibration caused by jarring or pounding on hard roads, this vibration usually having a very destructive effect on the nervous system and muscular action of the animal. The severe concussion following the blow of every step upon the old style of horse shoe is entirely obviated. The new shoe gives an equal bearing around the wall of the hoof. After the yielding resistance of the downward blow, there follows a lifting power, estimated by Mr. Yates at over 200 pounds, at every step of each front foot. The increased weight in the toe of the shoe gives a firm knee action to reach out further, calculated to materially improve the gait of the horse.



YATES' HORSE SHOE.

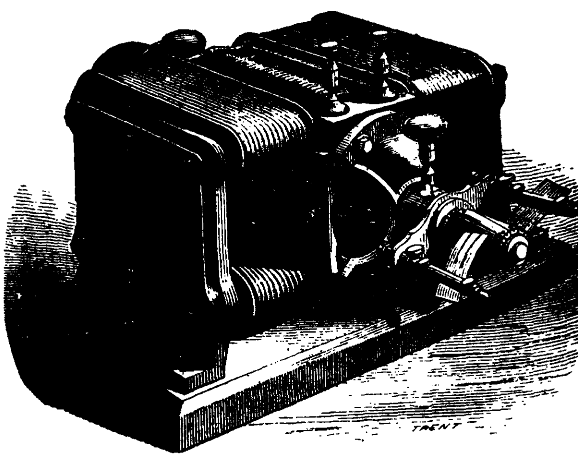
This shoe is made by hand of a good tough quality of steel, and by skilled mechanics. It must be put on cold, as it is tempered in oil, and a man without experience could not re-temper it with any certainty of success. In ordering these shoes, therefore, parties at a distance should send a paper pattern made from an old shoe.

A shoe of this kind is a cheap remedy to apply to horses' feet. The inventor states that by its use he expects to see horses trot a mile in two minutes on a hard track. He informs us that Mr. Soloman, of the Grand Central market, declares that his horse has been benefited $75 in a month by using these shoes. And also that a three-minute horse has gained 28 seconds on spring shoes, with a decidedly improved action, increasing his value some $200. Mr. H. G. Yates, of San Francisco, is the inventor.

HORSE-SHOE PADS.—Hartman's Patent Horse-Shoe Pads are constructed of vulcanized india-rubber, and made in sizes to fit every shoe. It is a simple contrivance, the pad being merely slipped into the horse-shoe with a pair of tongs, and can be removed in the same manner instantaneously. Among other advantages which these pads possess, we are informed that horses whose shoes are provided with these appliances require no "roughing," and in snowy weather there is no possibility of the shoe "balling." They prevent slipping on asphalte, snowy, or frozen roads; avoid concussion, and relieve the legs and feet on hard stony roads; and dispense with leather and all artificial means of shoeing. The pad is said to be most comforting to the foot, especially in chronic weakness or disease, while the grip of the hoof is rendered so secure that a considerable reduction in the labour of drawing is thereby afforded the animal.

COWDERY'S PATENT KNIFE CLEANER.

Messrs. R. Hodd & Son, of Hatton Garden, London, E.C., are introducing to the trade a remarkable effective little implement, called "The 'Lady-Help' Knife Cleaner" (Cowdery's Patent) of which they are the sole makers and licensees. As will be seen from our illustration, the "Lady-Help" machine is more compact than any other knife cleaner in the market, the dimensions of the apparatus complete being only 7 in. by 6 in., and 9 in. high. There is no casing required, all the mechanism, which is of the simplest kind, being exposed to view, so that the operator can see the progress of the work which this machine accomplishes so readily and well. It consists of a japanned iron frame within which are enclosed a pair of cylindrical rollers of india-rubber

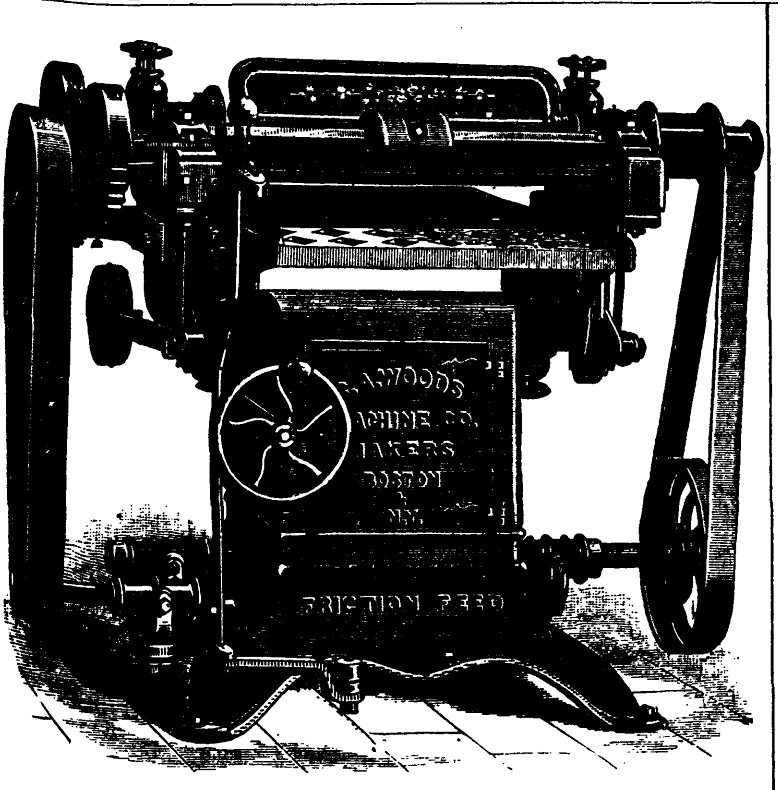


in suitable bearings, the rollers being made to revolve by cog wheels turned by a small handle. The motion is smooth, rapid, cleanly, and easy, and can scarcely be put out of running gear even by the most inexperienced domestic "help." The operation of this machine thoroughly cleans any size knife, including carvers, with a smooth polish like silver, imparting to table cutlery in daily use an appearance hitherto unattainable by any known process of ordinary knife cleaning. It is claimed that Cowdery's patent knife cleaner cannot damage knives or their handles, whether ivory or silver, nor wear them away, as they only come in contact with the india-rubber. Carving forks can also be thoroughly cleaned in every part. From its compactness the new knife cleaner is well suited for shipment to colonial and other foreign markets.

ORIGIN OF KEROSENE.—A Russian paper says that the farmers in the District of Kabilianki (Poltava) have given up the use of kerosene lamps because this sort of oil (petroleum) comes from the decomposed part of Satan, who has been confined to rot beneath the mounts of Caucasus since he rebelled against the heavenly powers. The Boston *Journal of Chemistry* cites this to show the Russian superstitious sentiments, but no longer than one month ago an individual in Pennsylvania circulated a petition to the Legislature of that State to prohibit the sinking of any more oil wells, because the oil was needed to lubricate the axle of the earth, which was already beginning to grind through loss of oil. He obtained many signatures, so it is said. An imagination sharpened by a constant diet of baked beans cannot be expected to find any superstition except in some foreign country.

THE *Herald of Health* says that sleeping after dinner is a bad practice, and that ten minutes before dinner is worth more than an hour after. It rests and refreshes and prepares the system for vigorous digestion. If sleep be taken after dinner it should be in the sitting posture, as the horizontal position is unfavourable to healthful digestion. Let those who need rest and sleep during the day take it before dinner instead of after, and they will soon find that they will feel better, and digestion will be improved thereby.

LABORIOUS mental exercise is healthy, unless it be made anxious by necessary or unnecessary difficulties. Regular mental labor is best carried on by introducing into it some variety. Business and professional men wear out their hearts by acquiring habits of express-train haste, which a little attention to method would render unnecessary.—*Chambers' Journal.*



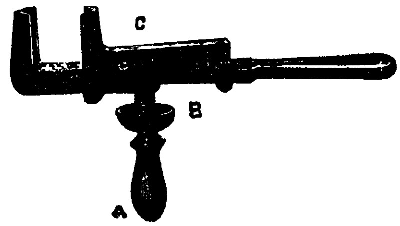


Fig. 1.

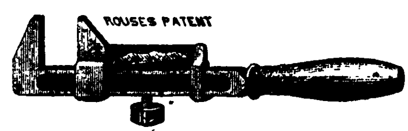


Fig. 2.

NEW SURFACE PLANER, WITH FRICTION FEED.

The new surface planer represented on this page, recommends itself by its compactness of design and strength, resulting from having a heavy frame cast in one piece, with a broad base, affording a firm support, although occupying but little room. At each side of the cylinder pressure bars are applied, the leading-in bar being hinged and weighted, allowing it to yield to inequalities in the surface of the lumber, while the two bars, being placed very near to the cut, enable pieces 6 inches or less in length to be planed with perfect facility.

An improved friction feed is applied, having two changes controlled by a single lever, dispensing with cone pulleys. The lever being moved in one direction produces the fast feed, and in the opposite direction the slow; when midway between the above the feed is stopped. These feed works are very strong and reliable, and cannot get out of order; their position in the hollow frame of the machine keeps them fully protected from dust and shavings, and renders the whole more compact and firm than when otherwise located.

The feed rolls, four in number, are made of cast-steel and strongly geared, two friction rolls being also placed in the table, directly under the first and last upper rolls. The broad bearing thus afforded holds the stuff firmly and prevents the clipping or chopping of the ends of the boards. A great cause of complaint with the small planers of other makers, has been the fault mentioned above, and the lack of feed power, both of which are entirely overcome in this machine. The leading-in rolls are fluted, and the carrying-out rolls are plain, the latter being protected by a shaving cap, and provided with steel scrapers to prevent them from marking the board.

The manufacturers, the S. A. Woods Machine Company, have made planing and molding machines a specialty for the last quarter of a century, and guarantee that this machine will give satisfaction, as it does in all the leading establishments where it is in use.

COMPARATIVE STRENGTH OF WOOD AND IRON.—Heim finds that, in most cases, a uniform strength of structure can be more economically secured by the use of wood than by the use of iron. The strength of wood is proportioned to its density, and can be increased by its immersion for two or three days, or until complete saturation, in linseed oil, kept at a temperature of from 150° to 212° F.—*Fortschr. der Zeit.*

ROUSE'S IMPROVED WRENCHES.

R. R. Rouse, of Indianapolis, Ind., is manufacturing some new and improved wrenches, of which we give illustrations on this page. Fig. 1 represents an axle nut wrench. When the sliding jaw C is in its proper position, the set-screw B is screwed up against it. This not only makes the jaw fast, but also tips it, so that when loose the nut is held and prevented from falling. When the wrench is adjusted the loose handle A is held in one hand, while the other handle shown can be turned rapidly. This wrench fits any vehicle, from a coach to a track sulky.

In Fig. 2 is shown a machinist's wrench, for which strength and simplicity are claimed. This wrench, with the exception of the handle, is made entirely of steel. When the set-screw is brought in contact with the sliding jaw, which is wedge-shaped, the latter is prevented from opening further, though not from closing. The handle is of hollow iron. It is slipped over the main steel beam and riveted solid.

SPIDERS KILLING TROUT.—Seth Green, the noted piciculturist, has been for a long time puzzled by the terrible destruction of very small trout, and his investigations have at length resulted as follows: "There is a small worm which is a favorite food of trout and many other kinds of fish. This worm is one of the greatest enemies which the young fry have. It spins a web in the water to catch young fish, just as a spider does on land to catch flies. I have seen them make the web and take the fish. The web is as perfect as that of the spider, and as much mechanical ingenuity is displayed in its construction. It is made as quickly and in the same way as a spider's, by fastening the threads at differents points, and going back and forth until the web is finished. The threads are not strong enough to hold the young trout after the umbilical sac is absorbed, but the web will stick to the fins and get around the head and gills, and soon kills the fish. I have often seen it on the young trout, and it has been a great mystery and caused me many hours, days and weeks of wonder to find out what was wound around the heads and fins of my young trout and killed them. I did not find out until lately, while watching recently-hatched white-fish. These are much smaller than the trout when they begin to swim, and they were caught and held by the web. I found ten small whitefish caught in one web in one night. The web was spun in a little whitefish preserve into which I had put 100 young fish."

Engineering.

THE RAILWAY OF THE FUTURE.

Comparatively novel methods for improving railway operations in various ways, appear to be under serious consideration. One of these directions was probably indicated in a speech delivered by Mr. Edmund Smith, one of the vice-presidents of the Pennsylvania railroad, at a banquet given by the Wholesale Grocers' Association of Philadelphia in Long Branch a few weeks ago. After referring to the marked improvements which have resulted from the introduction of steel rails and the increase of the load of freight cars from one ton per wheel to five tons, he said : "Shall we go on to improve and develop the system in the future as in the past ? There is no reason why we should not. I venture the opinion that the day is not far distant when our main lines of railway will be illuminated at night by the electric light, and other and greater improvements will keep pace with the spirit of the age."

The same subject was discussed more at length in a paper recently contributed by Sir Edward Watkin to the London *Times*. He suggests that there "is no reason why the railway machine should not be so improved as to far more than double the industrial forces." To promote this result he advocates a great increase of the rate of speed of all passenger and freight trains, accompanied with facilities which would enable any passenger "who chooses, to utilize undisturbed the flying hours of the accellerated railway train." He estimates the time now consumed by the English travelling public in railway journeys at 200,000,000 hours, which, at the low rate of sixpence per hour, is worth £5,000,000, or the capitalized sum of £125,000,000, and he contends that appliances might be devised which would enable many travelers to use advantageously time that is now lost. He also suggests "the use of stations for purposes of business, of deposit, of merchandise, and of banking." He also strongly advocates a great increase in the average rates of speed, contending that "if one train can go 60 miles an hour with given loads others can do the same."

Sir Edward declares that what is wanted is, equality of speed and the means of passing stations of second importance instead of stopping at them. As regards any railway with traffic enough in costly regions of property, we could establish, if need be, a second story. The former is a question of the equalization of the power of the engine and of the provision of a kind of carriage for goods, minerals, and cattle which could safely run at maximum velocity. The essentials of this latter are the best material, proper springs, oil-boxes, spring-buffers, four-feet or four-feet-six-inch wheels. The railway loader would have to learn his business of storage for speed. The increase and equalization of speed would double the time-saving at present effected by railways, and then let me ask the reader to realize the new power of production, the new power of competition, the new lengthening of life resulting."

CEMENTS, MASTICS AND CONCRETES.

Many of our readers have occasion to use cements or mastics, especially in putting down cellar floors or making old walls tight. They will find the following hints upon the subject valuable :—

A cement of one part sand, two parts ashes and three parts clay, mixed with oil, makes a very hard and durable substance like stone, and is said to resist the weather almost like marble.

Damp brick walls are common, especially in houses in the country where they are exposed upon the north and east sides. So common is this that, in many places in the country, a strong prejudice exists against brick houses on account of their constant dampness. Last year a gentleman having a brick house exposed on all sides, and suffering from dampness in the kitchen, which was in a wing upon the most exposed side, tried an experiment which has proved very satisfactory. A barrel of the best English Portland cement was purchased, and a common tin wash basin used for mixing it. The cement was mixed with water till about the consistency of cream, and then applied thickly with a large paint brush. Of course the mixture had to be constantly stirred to prevent the cement from settling to the bottom. And on account of its very rapid settling it could only be mixed in very small quantities ; half a gallon is about as large a quantity as can be readily handled at a time. When first dried it seemed somewhat of a failure, because it could be so easily brushed off, but after it had had 24 hours to harden it formed a strong, durable coating. The color is a neutral tint, somewhat like Ohio stone. This coating kept the wall perfectly dry, and as it is not expensive and does not need skilled labor in its application, ought to be extensively used. We do not know just what Portland cement (English) is worth at the present time, but the last quotation was about $3 per barrel in New York. The gentleman who put on the cement suggests that a damp or foggy or misty day is best for its application. The coating should be brushed into all the crevices and openings of the work, and it may be found desirable to apply two coats in order that all the openings, &c., may be completely closed.

Cement is much stronger than mortar, and can be used to great advantage in many places instead of lime, even in the face of the fact that it is much more costly than lime, except in a few favored localities where it is made. The usual proportions are 1 part of the hydraulic lime to 5 of sand. In pointing, the proportion is sometimes as low as 3 parts sand to 1 of the hydraulic lime or cement. Coarse clean sand—almost pebbles—can be used to the extent of 3 parts to 1 of the cement. Some advise mortar, to be allowed to set and then wet and worked again. This course will not answer with cement, which is greatly injured by such a method of working. The greatest enemy of both mortar and cement is the frost. The power with which water expands at the freezing point is practically unlimited, and where it penetrates into the crevices and pores of mortar and freezes, or when wet mortar is allowed to freeze, its strength is destroyed.

For making floors, the following method is said to produce very desirable results : Four parts coarse gravel, or broken stone and sand, and 1 part each of lime and cement, are mixed in a shallow box, and well shovelled over from end to end. The sand, gravel and cement are mixed together dry. The lime is slaked separately and mixed with just mortar enough to cement it well together. Six or eight inches of the mixture is then put on the bottom, and when well set another coating is put on, consisting of 1 part cement and 2 of sand. This will answer for making the bottom of a cistern that is to be cemented up directly upon the ground without a lining of bricks This will also form a very good cellar floor.

THE WORLD IN WAX.—Mr. Grube, a maker of wax images in New York city, has constructed what is claimed to be the largest globe of the world, showing the ranges of mountains and other peculiarities of the surface of the earth, in relief, now in existence. Its diameter is four feet and about one inch, the scale being one in 10,000,000. The range of even the Himalayas would not be visible upon this globe if the scale were adopted for the elevations as for the map, and accordingly the relief is made upon a scale which exaggerates heights twenty times. The oceans, seas and rivers are colored blue ; the continents are yellow ; the glaciers, icebergs and floating cakes of ice white. Plains and mountain ranges are clearly shown, and every part of the world is exhibited in its true character. Red, black and white lines cross the globe to indicate the isothermal belts, the variations of the magnetic needle, the date line where ships correct their logs by skipping from Saturday to Monday, and *vice versa*, and other facts of like character. The map has been corrected in the light of the latest discoveries down to two months ago. The northern coast of Siberia has been much altered in the atlases by the Nordenskjold expedition, the ships sailing in deep water over places marked as 500 miles inland, and being compelled to go hundreds of miles around promontories, etc., which are occupied on the maps by bodies of water. The globe is made of wood. The relief is formed by wax. Mr. Grube has been two years in perfecting his globe, and Chief Justice Daly and other geographers have lately been giving attention to it.

PREHISTORIC REMAINS IN OREGON.—The coast of the Pacific ocean some distance below the mouth of the Columbia and above, even to the colder latitudes, shows in its shell mounds or beds, evidences of a dense population that must have long ago lived and thrived on the bounteous sea-food that the ocean provides. Up the little streams and inlets may these beds also be found. Excavations made at Clatsop beach, Oregon, show a depth of six feet of shells, human bones and skulls *without* having reached the original dirt stratum. The length of this bed is unknown, and its age can only be imagined. It is in-shore half a mile, and in ancient times must have been the beach proper. Ages have passed since these wild people encamped by the booming waves, for immense old firs, five and six feet in diameter, are growing over the giant trees that preceded them. No implements of any kind have as yet been found in these beds. It is said that similar beds are found on the Alaska coast, also remains of ancient junks.—*American Antiquarian*

Cabinet Maker's Work.

PRACTICAL HINTS.

Cleaning and Polishing Oak Furniture.—Half pint of linseed oil mixed with half that quantity of vinegar and spirits of turpentine. Method: wet a woollen rag with the liquid, and rub the wood the way of the grain, then polish with a clean soft cloth. A brighter polish may be obtained by the following mixture: Raw linseed oil, 6 ozs.; vinegar, 3 ozs.; methylated spirit, 3 ozs.; butter of antimony, ½ oz. Mix the linseed oil with the vinegar by degrees, and shake well to prevent separation, then add the spirit and antimony, and mix thoroughly. If a gold line be preferred inside, when the frame has had one coat remove carefully with sand-paper any japan that has run on the part to be gilt, then varnish carefully all other parts, but avoid letting any particle of the japan run on the part to be gilt. When dry, procure a small quantity, say half a gill, of best japanners' gold size, warm the size by standing the bottle in warm water, pour a little of the gold size in a saucer, and with a camel hair brush go very carefully over the part to be gilt; place the frame aside for two or three hours, lay a sheet of leaf gold on a cushion, cut the gold in strips with a blunt knife, take up a strip of gold on the tip, lay it evenly on the gold sized line until the whole is covered, then press gently the gold leaf with a pad of the best cotton wool; when quite dry, say after forty-eight hours, procure a sheet of fine tissue paper, wrap it round a paper-knife, and gently burnish the gold by rubbing carefully backward and forward; should the gold in any place be rubbed off, touch with gold size, add a piece of gold leaf, and when wet, burnish carefully. Those who care not to take the trouble may use the gold bronze powder, put on with a brush, using best copal varnish one part, and turps one part.

Figures.—Plaster figures may be treated in two ways, both of which have been much admired. In the first, to make them look like pink glazed china, brush them over with a mixture of pink sealing-wax dissolved in spirits of wine. Break the sealing-wax up (it must be the best), and pour a little spirits of wine on it, and as it dissolves keep adding more until it is of the consistency of treacle; then brush it over evenly; one coat ought to be enough. Sometimes two are required, but no varnish. The second mode gives plaster figures the appearance of marble, and this is the receipt: Dissolve 1 oz. of pure curd soap grated in water, and add 1 oz. of white wax cut in thin slices; when the whole is incorporated it is fit for use. Having dried the figure before the fire, suspend it by a string and dip it in the mixture. When it has absorbed the varnish dip it in a second time, and that generally suffices. Cover it carefully from the dust for a week, then rub it gently with soft cotton wool, which gives a brilliant gloss like polished marble. By immersing the cast when perfectly dry in pale linseed oil, it produces an appearance like wax. If the cast be large, the oil must be laid on with a brush, which is a tedious process, as the plaster absorbs a great quantity. Dip the cast in melted stearac, and this will harden the plaster and give it a waxy appearance. Stearic acid is semi-transparent, and closely resembles spermaceti. Figures thus prepared may be washed with soap and water.

Artificial Sandstone.—*Glaser's Annalen* contains a description of an improved method and apparatus for the manufacture of artificial sandstone. A thorough mixture of four to six parts of fine sand, and one part of slaked lime is exposed for about three days to a high temperature and a pressure of more than three atmospheres, causing the formation of a silicate of lime which acts as a cement, so that the mass, when cooled down to the ordinary temperature, hardens. This hardening process continues for some weeks by exposure to the air, so that finally a product is obtained which is as hard and solid as good sandstone. The apparatus consists of a tank, into which the mixture is filled, and in which it is heated and stirred by a steam pipe, provided with a number of arms and rotated by belting or gearing. After the mixture has reached the proper temperature the steam is cut off, and a second vessel, inclosing the tank on all sides, is put into communication with the boiler. By this means the mass is heated for the period necessary. It is then run into a brick machine and shaped into the forms required. The process, it is claimed, effects great economy, especially for the manufacture of window sills, etc. The apparatus used is made large enough to produce 250 cubic feet of material in every charge—requiring, generally, three to four days.

How to Prepare Wood for Polishing.—It is quite an art to prepare wood for polishing purposes, and many recipes have been given for this purpose; but the following is an excellent method, which can be used for any kind of wood and in all seasons of the year. The wood is first stained the desired color and then sized with varnish or polish. For walnut or similar woods it is best to finish with fine glass paper, No. O. Color linseed oil with alkanet root and rub into the wood well, and afterwards let it stand for a time until the oil has thoroughly soaked in; then proceed to fill the pores with a composition of plaster of Paris 3 parts, tallow 1 part, and a little red polish. This is to be thoroughly worked until it is mixed and becomes a crumbly mass. It can be rubbed into the wood with a piece of rag, after which all the superfluous pieces are removed, and the surface is ready for the final polish.

Carver's Squeezing Wax.—This preparation is used for obtaining the exact patterns of carvings, and to give the workman a clearer idea of projections or depths than a drawing would do, unless a considerable time were expended upon it. In cases where it is required to match furniture which is at a distance, and cannot be removed, the wax can be applied without injury to the carving, and can be made from either of the following:—Suet, 1 part; beeswax, 2 parts. Wax, 5 parts, olive oil, 1 part. Wax, 4 parts; common turpentine, 1 part. The parts only need be melted together, and allowed to cool; the wax is then fit for use. It should be well pressed into the carving. Sometimes it is only possible to take the front or side of an object at a time, as it must be drawn off in the form of a mold. The sections, when ready, should be filled with plaster of Paris and water, made into a thick paste, and allowed to set. The mold is then removed, and the plaster cast is ready to work from.

Worms in Furniture.—Syringe carbolic acid over the wood, allow it to dry, and after rubbing the furniture down, apply the following preparation: Melt 12 ozs. resin in an iron pot, add 3 gals. of train oil and three or four rolls of brimstone, and when the brimstone and resin are become thin, add as much Spanish brown or red and yellow ochre, or any other color best matching the tint of the furniture, grinding the same in oil to the desired shade. Lay on this preparation with a brush in a hot state, and as thin as possible, and some time after the first coat has dried, put on a second. The above is also effective in cases of dry rot.

Painting on Wood.—Wood for painting on is generally prepared with a light coating of gesso or some other mineral preparation to prevent the color sinking in. The gilding must be done by a decorator before the wood is painted. The design marked on it with a fine crochet needle or stile by means of a tracing paper. The paint used is oil color, which will be more brilliant from being put on over the gold. Some of the old masters adopted this plan in order to give greater effect to their colors.

Fretwork Polishing.—The piece of wood should be French polished before cutting, on the shown side at least. You cannot polish it after; but you may varnish it, giving two or three coats of spirit varnish, rubbing down with flour paper, and repeating the coats. The edges can be done with a quill brush, the faces with a camel hair brush about an inch broad. When polished before cutting, the edges need only be touched up with raw linseed oil, using quill brush.

Polishing Horn.—The surface must first be prepared by scraping with a steel scraper; the polishing can then be effected by means of a buff wheel, in the lathe, dressed with powdered brick dust; to produce a fine gloss use another buff with dry whiting. Or the surface can be made smooth by scraping with a piece of glass, and then rubbing with sand paper, finally polishing with rottenstone on a piece of old cloth.

Glues.—To resist water, boil 1 lb. of common glue in 2 quarts of skimmed milk; for gutta percha, 2 parts of common black pitch and 1 part of gutta percha; to resist heat or moisture, mix a handful of quicklime in ¼ lb. of linseed oil, boil them to a good thickness, and then spread it on tin plates in the shade, and it will become very hard, but may be easily dissolved on the fire as glue.

Filling.—One quart of boiled linseed oil, one quart of spirits of turpentine, and the same quantity of Japan dryer, then mix with it 1½ pounds of corn starch. Apply to the work with a good stiff brush; when nearly dry, but not sticky, rub off with a clean cloth, after which let stand until it is hard dry, then rub down and varnish or polish as may be required.

Filtering Varnish.—Pour the varnish through muslin, which will prevent dirt, etc., from going through.

COMMANDER CHEYNE'S PLAN FOR REACHING THE NORTH POLE.

PROPOSED NEW BRITISH POLAR EXPEDITION.

Our readers are probably aware that an influential Central Committee has been formed in England, to which forty-nine Provincial Committees are affiliated, for the purpose of organizing an expedition to the North Pole on the plan recommended by Commander Cheyne, R.N., who is strongly of opinion that balloons will form an important element in all future Arctic explorations. Our illustration depicts the three balloons as ready to start from the winter quarters of the ship during the first week in June, their destination being the North Pole. The average temperature in the early part of June is about 25° Fahrenheit. The baloons are named *Enterprise*, *Resolute*, and *Discovery*, each will be capable of lifting a ton in weight, the three carrying a sledge party intact, with stores and provisions for fifty-one days. The ascent will be made on the curve of a roughly-ascertained wind circle, a continuation of which curve will carry them to the Pole, but should the said curve deflect then the required current of air can again be struck by rising to the requisite altitude, as proved by experiments that different currents of air exist according to altitude; this fact Commander Cheyne himself observed when, in charge of the Government balloons in his last expedition, he sent up four at the same moment to different altitudes, being differently weighted; they took four different directions to the four quarters of the compass, giving him his first practical idea of ballooning in the Arctic regions. Captain Temple's experiments with the war balloons from Woolwich Arsenal have fully confirmed this important desideratum in aerostation. About thirty hours would suffice to float our aeronauts from the ship to the Pole, should all go well. We asked Commander Cheyne how he was going to get back; his answer was cautious—"According to circumstances," he said. "My first duty is to get there. When there, leave it to us to get back. We have many uncertainties to deal with, and a definite programme made now might be entirely changed when the time came to carry out the journey south. Condensed gas would be taken in steel cylinders, hills would be floated over by expansion and contraction of the balloons, and in the event of any accident occurring, we always have our sledge party with sledge, boat, stores, and provisions for fifty days intact and ready for service." Scotland has taken up this novelty in Arctic exploration with avidity, and England, though more cautious in the matter, has at last given her adhesion to the project being carried out. Canada is likely to join, and Commander Cheyne has received an invitation from the Canadian Minister of Finance, Sir Samuel Tilley, K.C.B., to deliver his lectures in Canada, with the promise of a warm reception.

SIR WILLIAM FOTHERGILL COOKE.

The projector and constructor of the first telegraph line in England, Sir William Fothergill Cooke, died recently. He was born at Ealing, in 1806, and after graduation at the University of Edinburgh, spent five years in the service of the East Indian Army. On his return he took up the study of anatomy and physiology first at Paris, continuing at Heidelberg. At the latter place, in 1836, his attention was directed to the subject of electricity, to which he soon devoted himself exclusively. He constructed an experimental telegraphic instrument, which he took to England and endeavored to introduce on the Liverpool and Manchester Railway. This was two years after Professor Morse had privately demonstrated the success of his invention. Associating himself with Wheatstone, Cooke perfected his invention, so far at least as to make it practicable, and in June, 1837, Cooke and Wheatstone together took out the first patent for an electric telegraph, the mechanism of which, however, was quite unlike that of the Morse instrument. The first line constructed by Wheatstone and Cooke was finished early in 1839, and several other lines had been set up in England before Morse's Washington and Baltimore line was constructed in 1844. Cooke was knighted in 1869, and pensioned in 1871.

New Publications.

We are in receipt of *Lamb's Illustrated Catalogue of Ecclesiastical Work*. In some of past numbers we gave several illustrations of church furniture from designs by Cox & Co., of London, but the cost of freight and duty combined has always been a drawback to the importations to the Dominion of church furniture and other ecclesiastical work. We recommend all interested in this subject to obtain a circular from the firm, J. & R. Lamb, 59 Carmine street, New York. The price of the catalogues is as follows:—Woodwork and Furniture, 10c.; Metal and Stone Work, 10c.; Banners and Embroideries, 10c.

Correspondence.

To the Editor of THE SCIENTIFIC CANADIAN:

Sir.—In reply to "R. J.," in your July issue, I would state, that traps to water-closets, &c., as ordinarily constructed, are a delusion, and but very imperfectly perform the duty expected of them.

I do not know what is considered a proper seal, but it has been demonstrated that a three inch seal will only resist a pressure of four ounces to the square inch, and, further, that it only requires from three to four hours for the gases in the soil pipe to impregnate the water in the trap and make their presence known in the hopper. In addition to this the seal can be broken by what is known as "syphoning," as well as by suction caused by the discharge of a large volume of water from the bath pan, or another closet emptying into the same soil pipe.

"R. J." is perfectly correct in his supposition that the water in the trap is always foul; this is especially the case during the night, or when the closet has not been used for several hours, and in the morning when the lever is raised a small magazine of foul air is at once discharged through the hopper into the room. Neither can he depend upon several flushings clearing all the soil out of the trap.

Let your correspondent construct his closet on the "Downward Ventilation" plan, and he will find that not only will he have perfect safety from the assent of foul air, but will also have the room in which it is situated ventilated.

This consists in inserting a breathing pipe into the soil pipe of the hopper, six or eight inches above the level of the water in the trap, and at such an upward angle therefrom that paper or other foreign matter cannot block its orifice. This breathing pipe should not be less than three inches in diameter, and can be made of galvanized iron, having the seams and joints well soldered. It must then be carried to a chimney in which there is a constant draft (usually the kitchen chimney is the best). Now let that bright and beautiful pan at the bottom of the hopper be entirely removed, its presence there is only an obstacle to the free ventilation of the closet.

If this simple mode of ventilating is only properly carried out, there will be a constant current of air downwards through the hopper and into the breathing pipe, thence to the chimney, where all the gases are deodorised and disinfected by mingling with the smoke from the fire below. Yours, etc., N. T.

Toronto, July 25th, 1879.

DRUG TAKING MANIA.

Women are rather more given to drug taking than men, though both are bad enough in this respect. Here is what one of our most eminent physicians has to say on this subject:

"Dr. Holmes has said that it would be well for the world if most medicines were thrown into the sea; that it might be bad for the fishes, but it would be better for mankind. For this unasked and impertinent suggestion he has received a good deal of orthodox censure, which I have now to share with him, for I am of the same opinion as Dr. Holmes, and this opinion has long been a part of my Christian faith. That the major part of the world does not agree with us is plain. Indeed most people seem to think that the chief end of man is to take medicine. Babies take it in their mother's milk; children cry for it; men and women unceasingly ask for it. Shrewd men have taken advantage of this instinct, and in most civilized nations it is to-day one of the chief articles of manufacture and commerce. It is one of those things which are never permitted to be out of sight; but are thrust upon you in the nursery, in the streets, upon the lamp posts and upon the curbstones, along the highways, from the rocks which border the rivers; the medicine chest follows you at sea, as if the sea itself, a vast gallipot of nauseants, were not enough. One might naturally suppose that the supply would at length exceed the demand! but it does not. Everywhere the people are stretching out their arms and begging for medicine, blessing him who gives and cursing him who withholds. They believe, in their simplicity, that if medicine does no good, they can at least do no harm. They imagine, also, that there is a medicine which may be regarded as a specific for every human malady, and that these are known to science, and that therefore we have the means of curing all diseases; but the people imagine a vain thing. Whatever medicine is capable, when properly administered, of doing good, the same medicine is equally capable, when improperly administered, of doing harm; and drugs often substitute a malady more serious than that which they were intended to cure. The Irishman said his physician stuffed him so with medicine that he was sick a long time after he got well.—*Dr. Frank Hamilton.*

JEWELLERS' AND WATCHMAKERS' NOTES.

(*From the Horological Review.*)

RESTORING TEMPER OF SOFT WIRE.

To Secretary Horological Club:

The advertisement of "Jenkins" Patent Pin Point, in the March number of the *Circular*, suggests the use of the following method of restoring the temper of any kind of wire after having been hard soldered. For pin tongues, fasten the point securely in the pin vice. Hold the point end with a pair of flat plyers. Turn the vice, thus twisting the wire, which will give it a spring temper without injury to the form of the wire.

EBERSOLE.

Mr. McFuzee said that when the wire was not too soft, this would give considerable elasticity, although not equal to draw or roll temper. If the tongue showed roughness after twisting, it could be removed by burnishing.

DEFECTIVE DETACHED LEVER ESCAPEMENT.

Secretary of the Horological Club:

I shall be thankful for any detailed information you may give me, through your Club, pertaining to grinding off locking faces of club escape-wheel teeth; the best manner of moving pallet jewels forward and adjusting them accurately in their slots; and how to turn down an eccentric pallet arbor. This information is desired to learn best practical mode of remedying too shallow pitched escapements, and rounded front corners of club-wheel teeth. I have a small American lathe. O. M. K.

Mr. Uhrmacher said that the teeth should not be ground off at all. By grinding them back far enough to square up the rounded front corners, the length of the incline on the ends of the teeth would be shortened, and the impulse angle of the escapement lessened by that amount. The proper remedy for a defective wheel is to replace it with one which is properly formed and perfect.

It will also be easier to fit a new wheel than to turn an eccentric pallet arbor, to remedy a shallow escapement. In most cases, however, the pallets can be moved forward on the arbor enough to correct a shallow pitching. Directions for doing this, and also for moving and adjusting the pallet jewels, are given in Excelsior's articles on the detached lever escapement, published in the *Circular* about two years ago. It is seldom advisable to move the pallet jewels, as it produces a radical change of the entire wheel-and-pallet action. But if they have become loose, they must of course be adjusted in position, and Excelsior's articles tell how it should be done. Every workman should study them carefully, both for the practical information and processes given, and also for the knowledge of the principles on which the escapement is based, and which should govern our operations, that is conveyed.

REMOVING TARNISH AND BLUEING.

Secretary of Horological Club:

Will some of your honorable body state the best receipt for removing tarnish from the bright parts of a watch *quickly*, without injuring the surface of same? Also, for removing blueing from a pinion that has been heated? S. E. G.

Mr. O'Lever said there was no way of brightening the gilded parts without affecting the surface at least a little. But with proper care, the injury would be very slight. The most common way is to dip the tarnished pieces in a weak solution of cyanide of potassium. If dirty or greasy, they should first be washed with soap and water, and a brush more or less stiff, according to the surface, and the thickness and nature of the gilding. Some scour the pieces in soap and water containing enough of ammonia to give it a strong smell. Spots could be removed by applying a little of either cyanide or ammonia solution to them, with gentle rubbing. Care must be used, as, if the plating is thin, either solution will take it all off, if used too strong or too long. The ammonia process is preferable when there are steel parts on the pieces, which are inconvenient to take off, as the cyanide is liable to rust them.

Blueing is generally removed by weak muriatic acid,—say one drop of acid to five of water. The piece is either dipped in this, or rubbed with a bit of peg-wood wet with it. As for himself, he did not favor the use of acids for that and other purposes, so much as many workmen seemed to. He thought it better to polish off the pinion with fine oil-stone dust, and finish up with sharp or hard rouge, used on a slip of boxwood with oil,—being careful, of course, not to grind the pinion leaves any more than enough to take the color off, as too much scouring would alter their shape.

WHAT TO DO WITH A MAGNETIZED WATCH.

Secretary of the Horological Club:

Please inform me, through the columns of the *Circular*, what course to take with a watch that has become magnetized? I know of a fine English lever watch, that was magnetized by the owner holding a magnet near the balance-wheel. Is it ruined for correct time? A. E.

Mr. Horologer replied that a magnetized watch was worthless for keeping time. No dependence could be placed on its correctness, nor could it be told in what direction its error would show itself. His own opinion, as was well known to the Club, was that there was no way to thoroughly demagnetize steel parts, which had unfortunately become charged with magnetism, except to heat them red hot. That view was also taken by so excellent an authority as "Excelsior," in his book. Others, however, were confident that it could be done without heating. This subject has been discussed at different meetings of the Club, some three years ago, and reports would be found in our proceedings, published in the *Circular* at that time. Mr. E. could try the methods there given, if he choose, and satisfy himself as to their value.

Secretary of Horological Club:

Will you please tell how Morrison's gold and silver solution, for electro-plating without a battery, can be made more durable? I have used it according to directions, and the process does as recommended, but seems easy to wear off. It don't seem as hard as it ought to be. There is probably some one of your members who can give me some light in regard to it. It is highly recommended for small jobs, but don't seem to last long. W. W. J.

Mr. Electrode suggested that perhaps Mr. J. did not get on a coating thick enough to be durable. If the directions were well followed, there could be no trouble but that, and that could be remedied by longer exposure in the solution.

BAD TEMPER AND INSANITY.

Passionate people—the hasty kind—who flare up in a blaze, like fire to tow or a coal to powder, without taking time to inquire whether there is any ground for such pyrotechnic display, and then get more furious when they find out there was no cause for their fiery feats, may learn a useful as well as a serious lesson from an item in Dr. Blanchard's report of the King's County Lunatic Asylum, that "three men and three women became insane by uncontrollable temper."

We all feel a sympathy for one who has become demented from loss of kindred, from disappointment, and from a hard lot in life; but we can have no such feeling for quarrelsome, ill-natured, fretful, fault finding, complaining, grumbling creatures, the greater part of whose every day life tends to make those whose calamity it is to be bound to them as miserable as themselves. Bad temper is a crime, and like other crimes, is ordained in the course of nature to meet, sooner or later, its merited reward. Other vile passions may have some points of extenuation—the pleasure, for example, which may attend their indulgence; but ill-nature—that is a fretful, fault-finding spirit, in its origin, action and end, has no extenuating quality; and in the application of the old principle, "with what measure ye mete, it shall be measured to you again," will find a most pitiable end. Therefore, with all the power that has been given you, strive and strive for life, to mortify this deed of the flesh. Watch hourly, watch every moment against the indulgence of a hasty temper, as being offensive to yourself and contemptible in the eyes of your fellow man—contemptible because for the person who possesses it, and knows it, yet indulges in it, and makes no effective efforts to restrain it, no human being can have any abiding attachment or respect, founded as it is in low morals, or low intellect, or both.

SAWDUST mixed with blood, or some other agglutinative substance, and compressed by powerful pressure in heated dies, is formed into door-knobs, hardware, furniture trimmings, buttons, and other useful and decorative articles; oyster shells are burned to make lime; the waste of the linseed oil manufacturers is eagerly sought after as food for cattle; the waste ashes of wood fires are leached for potash; river mud is mingled with chalk, and burned and ground to make the famous Portland cement; the finest glue is made from the waste of parchment skins, and even the slag that has served for years only to decorate the hillsides around mining camps is now cast into paving and building blocks.

SIGHT AND READING.

M. Javel, in a recent lecture, tries to answer the question, "Why is reading a specially fatiguing exercise?" and also suggests some remedies for this fatigue. First, M. Javel says reading requires an absolutely permanent application of the eyesight, resulting in a permanent tension of the organ, which may be measured by the amount of fatigue or by the production of permanent myopy; secondly, books are printed in black on a white ground. The eye is thus in presence of the most absolute contrast which can be imagined. The third peculiarity lies in the arrangement of the characters in horizontal lines, over which run our eyes.

If we maintain, during reading, a perfect immobility of the book and the head, the printed lines are applied successively to the same parts of the retina, while the interspaces, more bright, also affect certain regions of the retina, always the same. There must result from this a fatigue analogous to that which we experience when we make experiments in "accidental images," and physicists will admit that there is nothing more disastrous for the sight than the prolonged contemplation of these images. Lastly, and most important of all, in M. Javel's estimation, is the continual variation of the distance of the eye from the point of fixation on the book. A simple calculation demonstrates that the accommodation of the eye to the page undergoes a distinct variation as the eye passes from the beginning to the end of each line, and that this variation is all the greater in proportion to the nearness of the book to the eye and the length of the line.

As to the rule which M. Javel inculcates in order that the injurious effects of reading may be avoided, with reference to the permanent application of the eyes, he counsels to avoid excess, to take notes in reading, to stop in order to reflect, or even roll a cigarette; but not to go on reading for hours without stopping. As to the contrast between the white of the paper and the black characters, various experiments have been made in the introduction of colored papers. M. Javel advises the adoption of a slightly-yellow tint. But the nature of the yellow to be used is not a matter of indifference; he would desire a yellow resulting from the absence of the blue rays, analogous to that of paper made from a wood paste, and which is often mistakenly corrected by the addition of an ultra-marine blue, which produces gray, and not white. M. Javel has been led to this conclusion both from practical observation and also theoretically from the relation which must exist between the two eyes and the colors of the spectrum.

His third advice is to give preference to small volumes which can be held in the hand, which obviates the necessity of the book being kept fixed in one place, and the fatigue resulting from accidental images. Lastly, M. Javel advises the avoidance of too long lines, and, therefore, he prefers small volumes, and for the same reason those journals which are printed in narrow columns. Of course every one knows that it is exceedingly injurious to read with insufficient light, or to read too small print, and other common rules.

M. Javel concludes by protesting against an invidious assertion which has recently been made "in a neighboring country" (Germany no doubt), according to which the degree of civilization of a people is proportional to the number of the short-sighted shown to exist by statistics; the extreme economy of light, the abuse of reading to the detriment of reflection and the observation of real facts, the employment of Gothic characters and of a too broad column for books and journals, are the conditions which M. Javel believes lead to myopy, especially if successive generations have been subjected to these injurious influences.—*London Times.*

BREAKING UP SLAG WITH ROCK SALT.

Editors Press:—An item gathered in Carson we judge worthy of especial note for the benefit of all, gas makers in particular. In the furnaces of gas works there always gathers a very hard, solid slag, very difficult to remove even with iron bars. The attendant in the works at Carson told us that, by accident, he found that throwing on this hot slag, after the coke was drawn out, a handful or so of common rock salt rendered this slag, in a few minutes, easily drawn out like coarse, pebbly sand. If one handful should not loosen up the whole mass, another handful could be also thrown in, and the result was certain; the slag could all be drawn forward the same as ashes. This fact must be of thousands of dollars' value to the many gas manufacturers in the land, and it is free for their use. Experimenting will make evident the best manner of using the salt for the purpose.

Carson, Nev. S. V. B.

EPIDEMICS.

The limitation of epidemic pestilential disease, as the yellow fever, typhus and typhoid, diphtheria, etc., is at all times a question of intense interest to every thoughtful person. The July number of the New York *Sanitarian* contains interesting and valuable matter upon the subject of epidemics, which we unhesitatingly appropriate:

The cholera is a product of the jungles of India and Burmah, and the yellow fever is as surely of West Indian origin. That it is an exotic as relates to the United States is the opinion of the last national commission; and that it never originates *de novo*, except in its primal birth-place, whatever elsewhere may be the excess of heat moisture, filth, and vegetable and animal decomposition, is almost demonstrated, perhaps established. As to communicability, it is certainly conveyed from individual to individual, not precisely by what we understand to be direct contagion, but through various media, especially by bed and body clothing, by articles of furniture, by apartments, cars and steam and sailing vessels, by baggage and by cargoes; and these propagators, deriving from the sick the pestilential material (intentionally not called germ), hold it with wonderful tenacity, and convey it to mankind with intense effect. Both may be held at bay by quarantine and literally "fenced out." In 1851 cholera prevailed in Southern Europe and in Algeria, but not one case occurred that year in Spain by reason of vigorous quarantine. Two years later, when the embargo was not strictly maintained, it ravaged the Spanish peninsula. It always followed the lines of travel and was always carried by mankind. The infectious germ might be long in germinating, but it could always be traced to individuals. Quarantine, to be effectual, however, must have a very wide applicability. It will not suffice to limit it to vessels from foreign ports. It must extend to all conveyances for the transportation of passengers and merchandise—must have relations with municipal, State and national authority. It is estimated that the cost of the late yellow fever epidemic in loss amounted to $200,000,000.

Typhoid fever is certainly communicated through a tainted water supply exposed to the taint of infected vaults. Poisoned springs have been traced to this infection, and in a celebrated English diary case, where poisoned milk was claimed to have been sold, scientific examination disclosed the fact that the milk had been contaminated through the cows having lain upon ground manured from infected vaults. Another source is in the ice supply, often taken from shallow ponds in the neighborhood of large cities, freezing not destroying the germ as supposed. The air in localities becomes contaminated from sewage deposits; and Budd states, as early as 1859, that the germ of this disease never originates *de novo*, but proceeds from a special and specific poison, capable of great diffusion and preserving its noxious qualities for a long period, even if buried for many months. In England the preventability of typhoid fever is so thoroughly established that an innkeeper who has a guest ill with it, is held criminally responsible if any other case could be traced to the one under his roof. By this means infectious substances are destroyed and the spread of the disease prevented. Boiling water applied to the discharges is said to destroy the infection. But when the substance is allowed to escape as sewage it must be disinfected by prompt measures.

Diphtheria is much more prevalent and much worse in localities supplied with bad water. The microscope can detect a few of the germs of epidemic diseases either in the water or in the system, and the only sure method is to watch the slightest approaches of disease and investigate the sources of our water supply, whether in city or country. Chlorine gas, from recent experiments, seems to be a disinfectant as well as a deodorizer. This greenish-colored gas effectually seizes upon and destroys any hidden germs existing in dwellings, ships, etc. This gas has been used successfully at Bellevue hospital and other places. We must purify and quarantine. Mediums of communication have been made available to epidemics as well as to mankind in his business affairs.

Eucalyptus in a Cold of the Head.—Prof. Strambio, in a note in an Italian medical journal, says that notwithstanding the failure of all remedies hitherto recommended for the immediate cure of a cold, he wishes to communicate to the profession the great success he has found attending a new one in his own person, and to ask them to test its efficacy. He found prolonged mastication and swallowing of a dried leaf or two of the *Eucalyptus globulus* almost immediately liberated him from all the effects of a severe cold.

Machine Construction & Drawing.

(From *Collin's Elementary Science Series.*)

(*Continued from page 253.*)

circumference into 16 equal parts, and the distance AA′ into 8 equal parts. Through the points I, II, III, &c., draw the cam shown in dotted lines, as for fig. 162; if the roller were a point, or the *knife edge* of a sliding bar, this would be the required cam; but the roller has a diameter of 2″, therefore, from the points A′, I, II, III, &c., as centres with a radius of 1″, describe arcs of circles inside the dotted cam; a curve touching these arcs will be the outer edge of the required cam.

91. The following are the dimensions of its several parts:—Thickness of rim *c* 1″; width of rim *h* 3″; diameter of shaft *a* 3″; key *g* $\frac{7}{8}''\times\frac{1}{2}''$, 6″ long; diameter of boss *b* $5\frac{1}{2}''$, and $4\frac{1}{2}''$ through; the arms *f* are $\frac{3}{4}''$ thick, and 2″ wide at the narrowest part, increasing to $2\frac{1}{4}''$ for the longest arm; the others are in the same proportion; inside the rim and outside the boss is a feather *d* $\frac{3}{4}''$ wide and $\frac{3}{4}''$ thick; on each arm there are two feathers *e* $\frac{3}{4}''$ thick and $\frac{3}{4}''$ deep, increasing to $\frac{7}{8}''$ in the longest arm. The inside of the rim *c* and the feather *d* are curves parallel to the outside of the rim.

Fig. 164 is a front-elevation, fig. 165 is an end-elevation, and fig. 166 is a sectional end-elevation, made by the plane SP, fig. 164.

92. During one half revolution of the cam, as the radii *increase* from CD to CL, the roller is moved outwards from A to A′; but in the return half revolution the radii *decrease* from CL to CD, it is therefore necessary to apply some means of keeping the roller in contact with the cam, which may be accomplished by means of a spring or a weight, or by using another roller B, and connecting the two with a link, so that to produce the return of the roller A the cam acts upon the roller B, and thus brings back A, together with the slide attached to it.

93. Inking-in a Drawing.—It is usual to put drawings of machinery in ink, whether *working* or *finished* drawings, since by constant use the blacklead lines would remain only for a very short time. Indian ink is the kind of ink used; it may be obtained either in the solid or liquid state: the former will be the best for the general student to obtain it in. Sticks of a good quality can be had for one shilling and upwards; cheaper qualities are not to be recommended. Having prepared the ink for use by rubbing it in a clean slab with a little water, and having satisfied yourself that it is of the required shade, by trying it with your drawing-pen on the margin of the drawing, commence to ink-in. But, before doing so, the following general hints will be of service to the student:—Clean off with india-rubber all surplus blacklead, leaving the lines just visible, as the lead is liable to get between the nibs of the pen, and so cause the lines to be irregular. When you have supplied the pen with ink, before using it try it on the margin of your drawing, so as to get the line of the required thickness. Never put away your pens with ink in, but clean them with a piece of wash-leather or linen rag; it will also be necessary to clean between the nibs occasionally while using the pens.

94. The following order should be observed in inking-in:—First ink-in all circles, portions of circles, and curved lines, to which straight lines are to be joined, keeping both the nibs and the needle point of the bow-pen as nearly perpendicular to the drawing board as possible; if the nibs are inclined too much to the surface of the paper the circular lines will be irregular in thickness, and if the needle point is inclined too much the hole will be enlarged, which is objectionable. The pen for drawing straight lines, or curved lines by means of moulds or curves, should be held nearly perpendicular, being inclined a little towards the right and outwards, so that the point of the pen may be seen. The lines are to be drawn from left to right, as in penciling. Particular care should be taken in joining a curve and a straight line; the best way is to commence the straight line from the curved one, and not try to join the former to the latter. If the lines of the drawing, both full and dotted, are correctly shown in pencil, it is immaterial whether the full lines are put in first and then the dotted ones, or otherwise; but if this is not the case, then begin by inking-in the lines which are *furthest from the plane upon which the view of the object is projected*, as such lines will be in full; the outline* of the object will also be in full, the remaining lines must be determined by the ordinary principles of projection.

95. The beginner should be extremely careful in inking-in his drawings, so as to avoid having to use the knife, or any other means, for scraping out or erasing a wrong line; it will therefore be advisable for him to pencil-in all lines as they are to be inked-in.

After considerable practice he may deviate a little from this order; but, as a rule, the less it is deviated from the better, as the dotted lines should be distinguished from full lines; not necessarily by dots of equal length, but just sufficient to show the difference.

96. Shade or Dark Lines.—In the examples given up to Plate XXIII., except in Plate II., we have considered the drawings to be plain outline drawings, having all the lines, which form the boundaries of the surfaces represented in each figure, of the same thickness; we will now explain the use of *shade* or *dark lines*.

The figures in Plates XII. to XXIII. may be taken as types of those termed *working drawings*, that is, drawings from which the object is to be constructed; in such drawings all the lines are to be of the same thickness. For *finished drawings*, which are usually made to a small scale ($\frac{1}{8}$ and under) and used for the purpose of reference, &c., shade lines are often employed, whose chief use is to convey to the mind a better idea of the form of the several parts of the object, and to give what is considered by many to be, a better finish to the drawing; however, their use is a matter of taste. In Plate II. shade lines are employed. Figs. 190 to 192, Plate XXVI., represent, as a finished shade-lined drawing, the pedestal shown in Plate XXIV.

97. For the purpose of shade-lining drawings, the light is assumed as coming from the left-hand and from behind the observer towards the object, and at such an angle that the projections of each ray † are inclined to the horizontal and vertical planes at an angle of 45°.

Figs. 167*a*, 167*b*, Plate XXIIIA., are the plan and elevation of an object made up of plane surfaces, having a square hole through it. The lines *ab* represent the direction of the rays of light; those lines upon which the light falls directly are fine lines, the remainder are made thicker, and are termed *shade* or *dark lines*. We may say generally, for elevations, the shade lines are put on the *right-hand* and *bottom edges* of projecting surfaces; where two surfaces

* By the term *outline* we mean the boundary lines of the object, outside of which there are no lines.

† The rays are considered to be parallel.

are in contact, if the upper one does not project beyond the lower one the shade line is not used, as shown in the bottom line of fig. 167*b*; the object is supposed to be resting on a horizontal plane. In the case of sections and hollows, the shade lines are on the *left*, as shown in fig. 168*b*. Figs. 167*a* and 168*a* show how shade lines are employed for plans; fig. 168*a* is a sectional plan.

98. For cylindrical objects there is a little difference in the use of shade lines. Figs. 169*a*, 169*b*, represent in front and end-elevation a portion of a shaft; fig. 169*a* is *shaded*; along the line *ab* the *light* is most intense, gradually decreasing towards *gh* and *cd*; along *cd* the *shade* is greatest, and gradually decreases towards *ab*, *ef*; if now we put a shade line for *ef*, the effect which the shading produces is destroyed; for this reason shade lines are not employed for cylindrical objects,* except for the ends and projecting parts, as *fh*, fig. 169*a*, and *ab*, *cd*, and *ef*, fig. 171*b*.

The circular ends are represented as shown in figs. 169*b*, 170*a*, and 171*a*, the circular line increasing in thickness from the points *a*, *k*, to *c*, fig. 169*b*, where it is thickest. In hollow cylindrical objects the inside and outside are shade-lined, as shown in fig. 170*a*, and sections of the same have shade lines, as shown in fig. 170*b*.

Fig. 170*a* is an end-elevation, and fig. 170*b* a front sectional elevation. It is important to notice the difference in the use of shade lines for *plans* and *elevations*; if we consider fig. 170*a* to be a plan, and fig. 170*b* an elevation, then the shade lines as shown would not be correct.

Figs. 171*b*, 171*a*, represent in front and end-elevation a shaft having a neck and collars, upon which are shown the usual shade lines. The angles formed by the collars and the shaft are filled-up, as shown, with a curved surface, and the outside edges of the collars are rounded; these curved surfaces are not shade-lined, for a similar reason as that given for fig. 169*a*.

99. Conical objects are treated in a manner similar to that of cylindrical objects, as shown in figs. 172*a*, 172*b*, which are respectively plan and elevation of a portion of a right cone. The elevation, fig. 172*b*, is assumed to be raised above the surface AB, that is to say, its lower surface *cd* is not in contact with another surface, therefore the line *cd* will be a shade line. If the lower surface of the cone rested upon a surface larger than its own, the line *cd* would not be a shade line. The plan, fig. 172*a*, has a shade line, as in the case of the circular ends of cylinders, for its bottom surface *cd*, but not for its top surface *ef*; if the bottom surface were in contact with a surface larger than its own, the circular shade line would not be used.

Figs. 173*a*, 173*b*, represent in plan and sectional elevation a portion of a hollow cone, upon which are shown the shade lines for the position of the object indicated by the figures. If the bottom surface were in contact with a surface larger than its own, the line *cd*, fig. 173*b*, and the outer circle in fig. 173*a*, would not be shade-lined. The two right-hand edges of the section, fig. 173*b*, are shade lines, as would be the case if the object were a hollow cylinder.

Figs. 174*a*, 174*b*, represent in plan and elevation a portion of a bolt with a hexagonal head, the part next to the head being cylindrical. The object is resting upon a plane, as shown in fig. 174*b*; the bottom and two right-hand edges of the head are shade lines. The circle in fig. 174*a* is shade-lined, as in the previous examples, and three sides of the hexagon are shade lines.

* However, if we consider the use of shade lines to be a matter of taste, and therefore liable to difference of opinion, we may state that in many cases they are used for cylindrical objects.

Figs. 175*a*, 175*b*, represent the same object in front and end-elevation; fig. 175*a* shows two faces of the head, and fig. 175*b* shows the under side of the head and the end of the cylindrical part of the bolt. The object in these figures is assumed not to be resting upon a surface; if, however, it did, then the bottom line in each figure would be a fine line, unless the surface upon which it rested was smaller than the surface of the object.

If the view, plan, or elevation, of an object is inclined at the same angle and in the same direction as the projections of the rays of light, as in fig. 176, the lines of the view which are parallel to these projections are fine lines. Fig. 176 represents the elevation of the bolt shown in fig. 174*b*, the centre line *ab* of which is inclined at 45°, and slopes from left to right, having the same inclination and direction as the rays of light; the lines *cd*, *ef*, &c., which are parallel to *ab*, are fine lines. The lines *df* and *gh*, which are at right angles to *ab*, are shade lines. If we consider fig. 176 to be a plan, the lines *df* and *gh* would be fine lines; and *ek*, *lh*, shade lines. In the examples of shade lines which have been given, we have considered each of the straight lines in the views of an object to be of the same thickness; and also the thickest part of each circle to be of the same thickness. Sometimes there is a difference in the thickness of the shade lines of a drawing, which is governed by the distance and inclination of each line from the assumed source of light.

By a proper use of shade lines one view of the drawing of an object will convey a much better idea of the form of the object represented, than if they were not used; cylindrical forms can be distinguished from other forms by the omission of the shade line in the former; and projecting surfaces can be distinguished from other surfaces, and also from recesses, by the position of the shade line. Where dotted lines are used in shade-lined drawings, they should be all of the same thickness.

100. Working and Finished Drawings.—We will now give examples of the two chief kinds of drawings used, taking a *Pedestal* or *Plummer-Block* as the object for representation. In Plate XXIV. is shown an ordinary *working drawing* of the whole pedestal (figs. 180 to 183 are added for another purpose, as will be explained shortly); the dimensions are not given, as the parts are shown in detail in Plate XXV. The cast-iron and brass portions are shown in Plate XXV. in detail with all the dimensions added and also the radii of the arcs of circles: this may be taken as a type of drawings such as should be supplied to the *Pattern* or *Model Maker*, along with Plate XXIV., which shows the arrangement of the whole as put together. The wrought-iron work is also drawn in detail for the *Smith*. In Plate XXVI. is shown the pedestal as a *finished* shade-lined drawing.

101. Pedestal or Plummer-Block.—In Plates XXIV. to XXVI. are shown in elevations and plans, a pedestal as defined in Art. 29, page 29. Fig. 177, Plate XXIV., is a front-elevation, the right-hand half being in section, as made by a vertical plane S_1P_1, fig. 178. Fig. 178 is a plan, a portion of which is in section, as made by a horizontal plane $S_{11}P_{11}$, fig. 177; and fig. 179 is an end-elevation.

A is the *body* of the pedestal which supports the *steps* B; attached to A is the *sole-plate* or *base-plate* C, by which the pedestal is connected by bolts E to the frame of the machine, either directly, or by means of an intermediate bracket; D is the *cover* or *cap* connected to the body by the bolts F, the object of which is to keep the top step in contact with the shaft; on the top of the cap is an *oil-cup*

(*Continued on page 284.*)

Useful Information.

Can a Steam Pipe Set Fire to Wood?—At the Crescent Steel Works in this city, a steam pipe two and one-half inches in diameter, carrying 90 to 100 pounds pressure, was laid underground about three years ago, encased in common pine boards about one inch thick. A few days since occasion was had to dig up the pipe, and the whole length of the wooden drain was found to be charred, and apparently burnt, about three-fourths of the thickness of the wood, the other fourth being partially rotted. The whole inside of the drain was turned to charcoal, with here and there spots of white ashes, showing the ignition had actually taken place. It seems probable that if the casing had not been excluded from the air by the earth covering, it would have blazed and been entirely consumed. It is generally believed that a steam pipe cannot set fire to wood, but this case seems to prove the contrary, and it may explain the origin of many mysterious fires. It indicates at least that care should be taken to prevent the close proximity of easily combustible material to steam pipes carrying a high pressure of steam. The temperature of steam due to a pressure of 100 pounds per square inch is about 337° Fahr.—*American Manufacturer.*

Presence of Mind.—Prof. Wilder gives these short rules for action in cases of accident: For dust in the eyes, avoid rubbing; dash water into them. Remove cinders, etc., with the round point of a lead pencil. Remove insects from the ear by tepid water; never put a hard instrument into the ear. If an artery is cut, compress above the wound; if a vein is cut, compress below. If choked, get upon all fours and cough. For light burns, dip the parts in cold water; if the skin is destroyed, cover with varnish. Smother a fire with blankets, etc.; water will often spread burning oil and increase the danger. Before passing through smoke take a full breath, and then stoop low, but if carbon is suspected, walk erect. Suck poison wounds, unless your mouth is sore, enlarge the wound, or, better still, cut out the wound without delay, holding the wounded part as long as can be borne to a hot coal, or end of a cigar. In case of opium poison, give strong coffee and keep moving. If in water, float on the back, with the mouth and nose projecting. For apoplexy, raise the head and body; for fainting, lay the person flat.

Flavoring Meat on Foot.—M. Monclar, a noted agriculturist in France, advocates the flavoring of meat on foot, by appropriate feeding. He says that by flavoring the food of cattle, sheep, pigs and poultry, their flesh may be rendered much more agreeable to the palate than it often is. He is substantially right, for reasoning by contraries, we know that rabbits, quail, deer, etc., which feed and browse upon the artemisia and bitter seeds, have a disagreeable flavor when eaten. Any flavor may be given the meat—mint, anise, thyme, etc., and several tastes may be given the meat, or a compound flavor be added by a variety of flavors of any selection. For invalids particularly, or for epicurean palates, the common meaty flavor can be modified in flavor to suit the palate, and the aversion to healthy, nutritious meat be overcome by a delicious conglomeration of sweet flavors. We hope to see the experiment tried in this county.

Formation of Coal.—E. Fremy holds that there are several kinds of isomeric cellulose, constituting the skeleton of plants. Coal is not an organized substance. The vegetal impressions presented by coal are produced as in shales or other mineral matters. The chief substances contained in the cells of plants under the double influence of heat and pressure produce bodies having a great analogy to coal. The pigments, the resin, and the fats of leaves, if submitted to heat and pressure, yield compounds which approximate to bitumens. The vegetable matter which gave rise to coal has undergone, first, the peaty fermentation, the coal being then formed by a secondary transformation.

Enamel for "Porcelain" Kettles.—Grind together 100 parts of powdered calcined flints (or white quartz sand, free from iron), 50 parts of calcined borax (borax glass), and 20 parts of kaolin (white potter's clay), pass the mixture through an 80-mesh sieve, and mix it with water to form a thin paste. Line the clean vessel with this and let it dry slowly. Then fuse together 125 parts of white glass, 25 of borax, and 20 of soda; powder when cold, and make into a thin paste with four parts of soda and a sufficient quantity of hot water. Cover the first coating with this, and, after thoroughly drying, heat in a muffle until the glazing has properly fused.

A New Paint for Plastered Walls.—An excellent paint for ceilings and walls has been invented by a German named Reissig. It prevents the formation of fungi, and renders the surfaces coated with it impermeable to fluids or vapors, and capable of being washed down with boiling water without injury. This paint is a solution of about 50 grammes of stearate of soda in 1,000 grammes of spirit having a specific gravity of 66. The solution may be given any desired tint by the use of the aniline dyes, or of ocher, ultra-marine or such other colors as are not subject to decomposition.

To Preserve Natural Leaves.—The fresh leaves are spread and pressed into a suitable dish with alternate layers of fine, thoroughly dry sand, as hot as the hand can bear. When the sand has cooled they may be removed, smoothed, and dipped for a few moments in clear French spirit varnish, and allowed to dry in the air. By many melted white wax is preferred to varnish. This latter must not be too hot. The dried leaves are dipped in the melted wax, drawn several times over the edge of the vessel to remove excess, and hung up until the film of wax is thoroughly cooled and hardened.

Preserving Insects.—A. Laboulliere recommends plunging the insects, in the fresh state, into alcohol which has been saturated by digestion with arsenious acid (1½ pint will take up about 14 Troy grains of arsenic). The living insect put into this preparation absorbs about 0.003 of its own weight. When soaked in this liquid and dried the specimens are safe from the ravages of moths, *anthrenus* or *dermestes.* This treatment does not affect the color of blue, green or red beetles, if dried after soaking for 12 to 24 hours. *Hemiptera* and *orthoptera* can be treated in the same way; also the nests, cocoons and chrysalides of insects.

Protecting Vulcanized Rubber.—To protect vulcanized rubber against the action of oils and fats, Herr C. Schwanitz, Jr., of Berlin, works in the rubber by rolling through heated rollers a mixture of 6 pounds of prepared chalk, 3.2 ounces of sulphur, 1.67 ounces of litharge and 1 pound of glycerine of 1.23 specific gravity. In order to vulcanize articles made and shaped from this material, they are placed in a bath of glycerine, and all exposed to a pressure of steam of two to three atmospheres.

A Brick-Lined Tank.—The *Metal Worker* says that some years since Prof. Chandler, President of the New York Board of Health, built a tank which was not only serviceable but cheap. He had made of stout plank a large box carefully braced, and lined it with bricks, each one of which was dipped in melted coal-tar just before it was laid in place, the coal-tar serving instead of mortar. A thin coat of this substance was spread over the inside, which made the tank thoroughly water-tight.

Gutta-Percha Solvents.—Caoutchouc and gutta-percha are both quite soluble in naphtha, benzole and carbon disulphide. The latter, when mixed with about 6% of absolute alcohol, is one of the best solvents. The solution is performed in the cold (best in the open air), as it would not be safe or economical to heat these volatile and inflammable liquids. Exposed to the air the solutions soon evaporate, leaving the gums in their original condition.

Indelible Ink.—The *Apotheker Zeitung* gives the following formula: 1.75 grammes aniline black are ground up with 60 drops hydrochloric acid and 42 grammes alcohol, and the liquid is diluted with a hot solution of 2.5 grammes gum arabic in 170 grammes water. If the aniline black solution is diluted with a solution of 2.5 grammes shellac in 170 grammes spirit instead of gum water, the result is an ink suitable for writing on wood, brass or leather.

Brass Casting from Old Metal.—A white scum of oxide sometimes forms very rapidly, and going into the molds with the metal makes the castings porous and rotten; especially is this the case when old metal is used. To prevent, stir the molten metal well with a stick of green wood, and sprinkle with a little dry argol and sal ammoniac before pouring.

Solid Emery Wheels.—Many of the best wheels are cemented with vulcanized rubber, borax or zinc chloride (or oxychloride) and barium carbonate; other materials, such as feldspar and clay, alkaline silicates, litharge and japan, shellac, and other resinous and gummy matters, albumen and lime, etc.

Cement for Bisulphide Prisms.—A good cement to fasten the sides of bisulphide of carbon prisms is made of a mixture of good glue and concentrated glycerine, the composition used for making rollers in printing presses.

Lime Water.—Agitate an ounce of pure caustic lime in a pint bottle nearly filled with water, and after the lime has subsided decant the clear supernatant liquid. It must be kept in well stoppered bottles.

NEW USE FOR PAPER.—A great diversity presents itself in the various useful purposes to which paper, or *papier mâché*, has been applied of late years. Besides ornamental articles, clothing, bedding, stamps, boxes, barrels, picture frames, furniture, stovepipes, chimney-pots, bricks, partition walls, carriage and car wheels and boats, it would seem as if the inventive ingenuity of manufacturers has succeeded in adapting this single substance to some new use every day. The last remarkable application of *papier mâché* is the manufacture of a revolving dome for the astronomical observatory of Prof. Greene, of the Polytechnic Institute at Troy. This dome has an internal diameter of 29 feet, and if constructed in the usual manner, would weigh five or six tons and require powerful and complicated machinery to manipulate it, besides also requiring foundations of considerable depth for its support; whereas the total weight of the paper dome will not exceed a ton and three-quarters, and, mounted on pivots working in iron grooves, is capable of being revolved in any direction required without the assistance of any machine or apparatus of any kind. The paper is put upon a light framing of wood, and is, by means of a special preparation, rendered fully as hard and even more rigid than wood.

COMMUNICATIONS WITH LIGHTHOUSES.—A new description of rocket, called the "buoyant rocket," has been produced by the Royal Laboratory Department, at the request of the Board of Trade. A rocket was required as a means of communication between the shore and lighthouses a few hundred yards from the main land during bad weather, and in circumstances under which the ordinary life-saving rock apparatus by which a line is conveyed to a wrecked vessel would be unavailable. The laboratory have answered the demand by adopting the old-fashioned Congreve rocket to meet the required end. A small iron tube containing the composition is enclosed in a casing of cork, and fitted to a stick in primitive fashion, with a line made fast to the extremity, and the simple arrangement has admirably succeeded. Three of the rockets have been tried at Shoeburyness, being fired from a trough at the surface of the sea, and plowing a direct course through the water with a strong line attached, by means of which an assistant or a boatload of provisions could be conveyed to the lighthouse keeper.

WIND GAUGE.—A simple apparatus for continuously recording the direction of the wind, constructed by M. Redier, is now in use at the observatory at Lyons. A weathercock of suitable form is supported by a sort of tripod of grooved wheels running upon a circular rail of steel (the wheels having individually a horizontal axis, but collectively a vertical). From the weathercock passes down a vertical rod to connect with a cylinder (placed with axis vertical), which is supported below by a steel pivot resting on a plate of agate, and is guided at the upper part by horizontal pulleys. Thus each movement of the weathercock is transmitted to the cylinder. The latter has wound round it a sheet of paper, graduated vertically and horizontally (the vertical divisions representing the hours, the horizontal the directions), and a pencil applied to the paper is moved in vertical directions by clock-work. It will thus be seen that the tracing obtained on the paper indicates the successive positions taken by the weathercock, and, accordingly, the direction of the wind for any given time.

NEW ANTISEPTIC SALT.—During some experiments in separating sugar from molasses, a double salt of borate of potassium and sodium was found, that proved to have valuable antiseptic properties. This salt is now manufactured on a commercial scale, and costs about 10 cents a kilogramme or five cents a pound. It is obtained by dissolving in water equal quantities of chloride of potassium, nitrate of sodium and boric acid, filtering and evaporating to dryness. The salt is said to be quite deliquescent, and must be kept in tight bottles. It is quick in action, retains its qualities for a long time and has no injurious effect upon the taste, smell or healthfulness of the substances to which it is applied. It has already found a use in making sausages, in preserving meats, in tanning and in butter-making. A small quantity of the salt added to milk will preserve it in good condition for a week. It is also used in preserving beers and wines, and is being made the subject of experiments in several other directions.

CHINESE PORCELAIN.—The Chinese subject the greater part of their porcelain to but one firing, first drying the pieces sufficiently in the air to prepare them for glazing. This plan they are able to pursue, because the nature of the material is such that it resists the entrance of water. Their glaze is much superior to any in use in the European potteries, but it requires the most intense degree of heat for its fusion, and considerable art is consequently required for the management of the fire, as well as in the construction of their ovens. These are built in the most substantial manner, so that when the fire is at its greatest height the hand may be applied to the outside without any fear of burning.

SELENIUM CAMERA.—The *Scientific American* refers to some very ingenious and curious applications of selenium, in which its peculiar property of changing its electrical conductivity when exposed to light varying in intensity, is utilized. The several devices are the invention of Mr. George R. Carey, of Boston, Mass. Perhaps the most curious of these instruments is the selenium camera obscura, which is capable of transmitting, *telegraphically, an image of any object and making a permanent* impression of it at a distant point. In this case a person may sit before the camera in New York while his photograph is made in Boston.

A NEW process for the production of a superior artificial stone is described to consist of the employment of a thorough mixture of six parts of fine sand and one of slacked lime, which is exposed for about three days to a high temperature under a pressure of some three atmospheres. The result is affirmed to be the partial decomposition of the silicious particles with the formation of silicate of lime, which acts as a cement, so that the mass, when cooled down to the ordinary temperature, hardens. This hardening process is said to continue for some weeks after exposure to the air, and the final product is declared to be as hard and solid as good sandstone.—*Mining Journal.*

WORKING STEAM AT HIGH PRESSURE.—It is well known that great efficiency in steam engines is obtained by an increase of pressure and the use of expansion. To accomplish this, the point lies not so much with the engine as with the boiler, engineers finding no difficulty in working an engine with steam at 150 to 200 pounds per square inch; therefore Mr. Walt, an eminent Liverpool engineer, thinks there is no limit to the practical working pressure. Some engineers will be inclined to differ with this opinion, as the management of steam used expansively in simple reciprocating engines at ranges of pressure much exceeding those named, is considered by many risky practice.

THE DEEP MINES OF THE WORLD.—In reply to the letter of Mr. H. Musgrove and others, Lake City, Colorado, inquiring as to the depth of the deepest mine now being worked in the world, we may say, this distinction probably belongs to the Adalbert mine, Austria, in which the workings are probably carried on through a perpendicular shaft 1,000 meters—3,280 feet deep. This is a lead-silver mine, and has been worked many years. The next deepest mine on the continent of Europe is the Viviers coal mine in Belgium, 2,847 feet deep.

STEEL-FACED IRON PLATES.—A cast-iron mold is divided into two sections by means of a transverse plate of thin sheet iron. The two metals are then poured into the respective compartments. The sheet iron partition prevents the mixture of the metals and facilitates the welding by itself being brought into a state of fusion. It is said that the product is well adapted for safes, and that it resists drills.

SOFT STEEL BEING USED FOR TIN PLATES.—A correspondent of the London *Mining Journal*, who appears to be well informed, states that very large quantities of tin plates made from steel are branded charcoal and best charcoal, and so exported; and these plates, he affirms, are exceptionally well received, especially for stamping purposes, in the United States.

NEW DYE.—Sulphoamidoazobenzolic and sulphoamidoazotoluolic acids have been made permanent canary and orange yellow dyes by the conjugation of the sulpho-acids with amidoazobenzol and amidoazotolual, the excess of acid neutralized by dissolution in alkali and concentrated. The colors are dyed in a slightly acid bath.

SIXTY-THREE years of age is said to be the grand climacteric or turn of life, a critical period for masculine humanity, more men dying at that age, or near it, than at any other, leaving accidents and violent deaths aside. A like critical period for feminine humanity is 47 years.

TO CUT A HOLE IN GLASS.—To cut a round hole in a pane of glass of any required size so as to save the pane, use a copper tube of the size of the required hole; revolve it in contact with the glass, and supply it with emery and water.

THE HOTEL DE VILLE.—The Hotel de Ville in Paris, the old seat of the Municipal Government, which was destroyed in 1871, is far advanced in rebuilding, and will be completed in 1881, at a total cost of about $4,400,000.

G; the oil passes down the hole M through the step on to the shaft; to distribute the oil over the neck of the shaft, *oil-ways* N (see also figs. 188, 189, Plate XXV.) are cut in the steps. For millwright purposes there is generally a packing of wood inserted between the base-plate and the frame, to which it is connected, as shown in Plate XXVI.; but for many purposes this lining of wood is not employed, as the object is to get a rigid connection between the pedestal and the frame, corresponding as nearly as possible to the case where the pedestal and frame are cast together. Where the wood packing is not used, the whole of the bottom surface is *planed*, or more commonly *chipping-pieces* H are cast to the base-plate, so as to reduce the amount of surface to be planed or chipped; the chipping-pieces are shown in dotted lines, their width and depth vary according to circumstances, from ¼″ to 1″ wide and ⅛″ to ½″ thick.

To allow of a slight change of position of the pedestal, and for convenience in fixing, the holes K through which the bolts E pass are elongated, as shown in fig. 178; after the exact position has been determined, pieces of hard wood or metal are inserted at the ends, between the base-plate and the *lugs* on the frame, to prevent the possibility of the pedestal moving lengthwise. The body and base-plate are made of cast-iron and are cast together, the cap is also cast-iron; the steps are usually made of brass, but the top step is often made of cast-iron; the bolts are made of wrought-iron, those for the cap are ½″ diameter, and those marked E are ⅝″ diameter. The dimensions for the body, cap, and steps, are marked on the figures in Plate XXV.; the radii of the circular arcs are also shown, which should be the case in all working drawings. On each side of the cap and body of the pedestal are facings O, whose surfaces are in contact with the *flanges* P of the steps. The body of the steps is cylindrical, but thicker at the bottom and the top than at the sides, as shown in figs. 187 to 189; chipping-pieces Q are cast at each end next to the flanges. The space between the steps is to allow of their being brought together as their inner surfaces wear; the space between the cap and the body of the pedestal is for the purpose of regulating the position of the top step.

102. The figures on Plates XXIV. and XXV. the student will be able to draw without any special instructions, excepting perhaps the curve *a′b′a′*, fig. 179, which is the intersection of the cylindrical part *aba*, fig. 178, of the body of the pedestal with the interior of the cylindrical surface *cd*, *c′d′*. Figs. 180 to 183 show half the curve drawn full size; the method employed is similar to that used in former figures, and the construction lines show clearly how the curve is determined. If the angles at *a*, fig. 178, are filled-up, as is shown in dotted lines on the left-hand half of the figure and in fig. 191, there would be no line of intersection, and we should have the end-elevation as represented in fig. 192.

103. In Plate XXV., fig. 184 is a front-elevation of the pedestal with the steps and bolts removed; fig. 185 is a plan of the same with the cap removed; and fig. 186 is a plan of the cap. In figs. 184, 185, we have shown the chipping-pieces H on the base-plate. The steps are shown in figs. 187 to 189; the left-hand half of fig. 187 is in section; fig. 188 is a plan of the top step, showing the oil-hole, the oil-ways N, and the chipping-pieces Q; fig. 189 is a plan of the bottom step, showing the inside in full lines. The cylindrical surfaces of the steps are not concentric, on account of the difference in the thickness of metal at the bottom and at the sides; for small steps this difference is not always taken into account, the thickness at the sides being made the same as at the bottom. Figs. 177 to 179, and 184 to 189, are drawn to a scale of ½; figs. 180 to 183 are drawn full size.

104. The usual proportions for the several parts are as follow*:—

The diameter of the neck	=	D
Thickness of base-plate	=	D × ·3.
Thickness of cap	=	D × ·4.
Diameter of bolts (if 2 used)	=	D × ·25.
Ditto (if 4 used)	=	D × ·18.

Thickness of metal at bottom = 0·15″ + from 0·09 to 0·12 × D.
Thickness of metal at sides = ·75 of thickness at bottom.

105. In Art. 96 we stated the purpose for which *finished drawings* are usually made; there are several kinds of such drawings, but we shall confine ourselves to simple line drawings. The object for which the drawings are required must decide what kind of drawing is to be made; if there is a good scale working drawing of the whole machine, then the finished drawing may be simply an outline drawing without dotted lines, the lines may be all of the same thickness, or shade lines may be added according to taste. If however the drawing is required for general reference, then the dotted lines should be shown; the teeth of wheels should also be shown, and the centre lines omitted in all such drawings.

As an example of the former kind of finished drawings we have shown the pedestal, figs. 190 to 192, Plate XXVI. In this example shade lines are used as explained in Arts. 96 to 99. As there are no lines introduced but what have been explained, the student should have no difficulty in drawing the figures.

106. We have given in Plates XXIV. and XXV. examples of working drawings, as explained in Art. 100, page 75; we shall now give further examples of such drawings, including those for the smith. The object selected for the examples is the *Slide-Rest of a Horizontal Boring and Surfacing machine*, made by Messrs. Fairbairn, Kennedy, and Taylor, Leeds. In this example we shall treat of the colouring of working drawings, and one of the plates, showing a section, will be coloured.

In making working drawings, the draughtsman must exercise his judgment by selecting such plans, elevations, sections, and details, as will best explain the form and arrangement of every part of the machine which he wishes to represent; and, in addition, the drawings should show the extreme positions of each of the moving pieces.

In making sections, it is sometimes convenient to assume the object cut by a number of section planes, all the sections thus made being projected upon one view; that is to say, instead of making one section of the whole object, two or more sections are made of different parts, and each of these projected upon one view. All such sections should be made by parallel planes, and the position of each should be indicated by lines in the view of the object from which the sections are projected. By this means we can show the parts we wish, without making separate views for each section; however, there is a limit to the number of sections, and in no case should they be so numerous as to destroy the simple and correct reading of the drawing.

In the following example we shall show, by a simple case, a sectional elevation upon which are projected sections made by three different planes (see fig. 197, Plate XXVIII).

107. Slide-Rest.—In all Machine Tools there is employed a cutting instrument or *tool*, and the positions and motions of this tool depend upon the kind of work

* Taken from Molesworth.

which it is designed to perform. In the example we have selected the tool is carried by the slide-rest, and the material to be operated upon is made to rotate; however, for some purposes this order is reversed, the material being carried or supported by the slide-rest, or by another slide. The different motions which can be given to the tool when it is carried by the slide-rest will be stated further on.

In Plates XXVII., XXVIII. is shown in elevations and plans the slide-rest mentioned in Art. 106. Fig. 193, Plate XXVII., is a plan, and fig. 194 is a sectional front-elevation or longitudinal section. Fig. 195, Plate XXVIII., is an end-elevation, takeni n the direction Y, fig. 194; fig. 196 is a plan of part of the bottom piece D; and fig. 197 is a sectional end-elevation or cross-section. The slide-rest is attached to a compound slide, of which A is the top of the top slide; by means of this compound slide the slide-rest, as a whole, can be moved in two directions in the same plane, one parallel to the axis or centre line CC of the machine, and the other at right angles to it.

The slide-rest proper consists of three movable pieces D, G, and N; the bottom slide G can be moved backwards and forwards along the slide A at right angles to the axis CC; it is fixed in any required position by the bolts B, B. In the top part of D there is a circular T-headed slot or groove E, in which are placed bolts F, F. The bottom portion H of the slide G is circular, and is in contact with the slide D, the two surfaces being similar, except that D has a circular groove, and H has two bolt holes; the two slides are connected by the bolts F, F. In the common vertical centre KK of the slides is fixed a pin or pivot R, round which the slide G can be turned; when the required position is determined, the two slides D and G are firmly connected by the bolts F, F. In the top portion of the slide G there is a screw L*l*, which can be turned round in its bearings, but is prevented from moving lengthwise, in the direction of its axis; attached to the screw is a nut M.

N is the top slide or tool rest which slides upon G; the two slides G and N are connected by means of the inclined surface O and the strip P; the nut M is fixed to the slide N, and the motion of N is obtained by turning the screw L*l*. Attached to the slide N are four bolts and nuts, the former are marked Q; S, S are clamps by means of which, together with the bolts Q, the tool or cutter is fixed to the rest N. The strip arrangement is similar to that given in Art. 31, page 30; the angle which the inclined surface makes with the horizontal plane varies between 50° and 60°, according to different makers. The screw L*l* has a circular collar T, which fits into a recess in the slide G; outside the collar is a plate U, through which passes the end *l* of the screw; a portion of the end *l* is of a square cross-section, and upon this is placed a handle or lever when the screw is to be turned round. The collar of the screw and the plate are in contact; the latter is attached to the slide by means of two set-screws V, V, and thus the screw is prevented from moving lengthwise.

The dotted lines *aa'b'*, *cc'd'*, fig. 194, Plate XXVII., show the extreme positions of the top slide N; it is advisable in most cases to show the extreme positions of moving pieces, so as to see at a glance whether or not the moving piece can occupy the positions which it is intended it should.

In addition to the scale of the drawing being given, the dimensions, of at least the principal parts, should be marked upon the drawings, even in the case of full-size drawings. In Plate XXV. the dimensions are given; in Plates XXVII., XXVIII., and XXIX., the principal dimension lines are shown, but the dimensions are omitted. In fig. 194, Plate XXVII., the dimension lines are not shown, on account of the colouring, but they should be shown in the drawing.

108. In Plate XXIX. are shown the pieces of the slide-rest which are made by the smith; such drawings are called *Forge drawings*, drawings of *Forge work* or *Smith work*. Forge drawings are generally made full-size, except in the case of very large pieces, and have all the dimensions added; not only those which the smith requires, but also those necessary to finish the article, as the forge drawings pass into other hands besides the smith's. The dimensions put on forge drawings are *finished dimensions*, so that the smith must make allowance for the material which has to be cut away in the different operations each piece has to undergo. It is usual to mark, in writing or otherwise, those pieces which are to be finished, as, *finished all over*, or *bright*; those not so marked being left in the *black*, that is, as they leave the smith.

In Plate XXIX. are shown two ways of marking the pieces, and the quantity of each piece required. In the case of screws, worms, &c., the pitch or number of threads per inch, the hand, right or left, and whether single thread or otherwise, are marked upon the drawings; sometimes the threads are drawn by one of the approximate methods given in figs. 96 and 98, Plate VIII. There are many other notes to be made upon the drawings which depend upon circumstances, but as these vary considerably, we can only indicate the more general cases.

In Plate XXIX. are shown the following figures:—Figs. 198, 199, are front and end-elevation of the screw L*l* for the slide G. Figs. 200, 201, are front and end-elevation of one of the screws Q for the tool clamps S, S. Figs. 202, 203, are front and end-elevation of one of the nuts for the screws Q. Figs. 204, 205, are front and end-elevation of the pin or pivot R. Figs. 206, 207, are plan and front-elevation of one of the clamps S for holding down the tool or cutter. Figs. 208, 209, are front elevation and plan of the plate U for holding the screw L*l* in position.

The set-screws and bolts, except the bolts or screws Q, are not shown in this example; they are, however, generally put on the forge drawings, whether they are made by the smith who makes the other parts or not.

109. We shall consider it unnecessary to enter into a description of the drawing of the figures in Plates XXVII., XXVIII., and XXIX.; however, we will explain more fully the sections, figs. 194 and 197. Fig. 194, Plate XXVII., is a longitudinal section, as made by a plane passing through the centre of the screw L*l*, fig. 193; one of the clamps S is also in section; the cylindrical parts, as the screws L*l*, Q, Q, and the pin R, are not shown in section. Fig. 197, Plate XXVIII., is a cross-section, as made by the three planes $S_{\prime}P_{\prime}$, $S_{\prime\prime}P_{\prime\prime}$, and $S_{\prime\prime\prime}P_{\prime\prime\prime}$, fig. 193, Plate XXVII.; we have only shown such portions of the sections, made by these planes, as will explain more fully the connection between the several pieces, which is, in fact, the object of making such sections.

The figures on Plates XXVII., XXVIII., are drawn to a scale of ¼; those on Plate XXIX. to a scale of ½.

110. Colouring of Working Drawings.—In the examples given in this book, except fig. 194, Plate XXVII., we have employed diagonal lines to distinguish sections from other surfaces (see foot-note to page 23); these lines convey no idea of the kind of material of which the several parts are made; but by employing

RIVER TAMING IN ENGLAND.

The English Government is now at work on a problem which is engaging attention in this and in other parts of the world, viz., the devising of some method by which the surplus water from the mountains may reach the sea without the destructive floodings of the low lands, which now follow the rain storms or snow meltings on the highlands. In England, this flooding of low-lying districts has become more destructive during recent years, because the systematic ditching and underdraining of the uplands give quick passage through the soil into the rivers to the surplus water which formerly was long held on the surface or percolated but slowly through the soil. We find but meager information concerning the provisions of the act which is now before Parliament for the averting of floods, and can do but little more than state the fact without description of methods proposed. It may be said, however, that the subject has been studied by a royal commission and that a scheme has been elaborated from the report of their investigations. The *Agricultural Economist* thinks that the whole project is endangered by the fact that the proposed act orders that a part of the expense of carrying off the water shall be taxed upon the uplands whence the waters come. This, our exchange thinks, will awaken much opposition to the contemplated improvements. We suppose the uplands will hold that as water is prone to run down hill, it is no fault of the hill, but the iniquity is rather in the water, and if those below do not care to suffer injury they must get out of the way, or else corral the water so that its destructive power is held in check. This it is proposed to do by widening the rivers, and the power to carry out these improvements is to be vested in "River Conservancy Boards," who shall have full authority to condemn adjacent property, mill rights and the like, as their plans may require. One recommendation of the report is, that all arterial streams insufficient to carry their waters after heavy rains be widened very considerably indeed, and that the new banks be formed gradually shelving down to the banks of the stream, that they may be available to bear grass either for mowing or for feeding of stock, when the waters are low. If this were carried out, the conservancy boards would no doubt let these river banks by the season, the revenue derived from which would lighten the taxation for the conservancy rate. Although most of the rivers would require considerable widening, this shelving bank system might, in a great measure, prevent the waste of land which would take place if conducted on any other principle.

In addition to preserving the lowlands, it seems that the system of upland reservoirs, for irrigating low land meadows, is also contemplated, and this the *Economist* regards as a very promising feature. This has also been proposed for our own turbulent rivers. It is interesting to note the testimony brought forward in England in favor of irrigation, and comparing their moist climate with our arid one, we can but say if irrigation will do these things in the green tree, what will it do in the dry? Our exchange says that if "there is one thing we are behind in more than another in our British husbandry, it is in making that extensive use of water which is made on the continent and in the East by processes of irrigation." It then proceeds to read English feed growers the following lesson: "The recommendations of old Arthur Young for laying out fresh water meadows might still be studied to advantage by the owners and occupiers of numerous districts, and as to benefits derivable therefrom, the same writer records an instance where nearly five pounds an acre was realized for the feed of a water meadow during six weeks of spring, and that nearly two tons per acre of hay was reaped from the land afterwards the same summer, which, together with the after-grass in autumn, made a splendid return. Yet when the same meadow could not be irrigated owing to some dispute respecting the water rights, very little whatever was grown on it."

These propositions to curb rivers from their wild work and harness them forever in the service of the farm, is one of the most interesting and important which is now advanced for agricultural engineers to reduce to practical operation.

The Earth Belongs to China.—Dr. Schliemann has found Chinese vases and gauze linen on Trojan soil, dating 1,200 years before Christ. They were on this coast in the fifth century, and are now taking possession of it by right of prior discovery. Li-Fang-pao contends that the Hyperboreans were Chinamen, while here it is claimed that the Lepers are Chinamen.

To Insulate Wire.—Shellac varnish makes a good insulator for wire, provided the wire is wound before the varnish becomes thorougly dry.

IMPROVEMENT IN FIRE ESCAPES.

We recently witnessed from the upper window of the old post-office some very successful performance of a new fire-escape patented by Edward M. Ball, of Stanstead, Quebec, Canada. The invention it is claimed will permit the escape of any number of persons (one at a time) from a window, roof, or portico of the upper stories of buildings of any height.

It consists, first, in inclosing within a case of iron or other metal a spool (carrying a rope of sufficient strength) connected by gearing to a coiled spring, which as the person descends, will be wound up, and thus made to serve to rewind the rope on the spool, in order that another person may take advantage of the means thus afforded for escape; second, in a metallic friction-strap brake, automatically worked by a governor, which serves to regulate the speed of descent to a sufficiently moderate degree to prevent injury when reaching the ground.

A A′ is the case; B, the cap; C, the spool; D, the intermediate double gear-wheel, and E the spring.

Figure 1 represents a vertical transverse section taken on the line $z\ z$ of the case; Fig. 2, the cap B, a portion of the spool C, and the governor of a machine embodying the invention. Fig. 3 is an interior sectional view, taken on the line $y\ y$, Fig. 1, of the cap B and friction-strap m. Fig. 4 is a sectional view on line $x'\ x'$ of Fig. 2.

The case is composed of two parts, A being the cylindrical part, with the vertical ribbed plate surmounted by the eye e, and A′ the back, being a ribbed plate conforming in shape to the contour of the spring E, double gear-wheel D, and spool C, the plates A A′ and the cap B serving as a frame, in which are the bearings for the machinery within.

The spool C is journaled at one end in the cap B, and at the other in the back A′ of the case. Near the left-hand end of the spool-shaft s is mounted and securely fastened thereto a pinion, w, which gears with the periphery of the wheel D, the smaller wheel of which gears with the wheel v, mounted on the shaft s. The coiled spring E is hooked to this shaft in the usual manner, the outer end of the spring being attached to the pin t in any substantial manner.

The spool C may carry any kind of rope; but I prefer to use wire-rope composed of very fine wire. The rope should be wound on the said spool in such a manner that when unwinding the tension of spring E, by means of its connection, will be increased to the extent necessary to rewind the rope.

A person being attached to the free end of the rope (which passes through the case by the opening o at the bottom of the cylindrical portion), by means of a belt or other safe contrivance, the speed of descent is regulated by the governor, composed of the parts and operated as follows:

The weights $a\ a'$ are rigidly connected by arms $i\ i'$ to the heads $j\ j'$, respectively, which are pivoted on the pins $h\ h'$, screwed or otherwise secured to the contiguous flange of the spool C. The head j carries a pin, k, the said flange carrying a similar one, g. Inwardly projecting knobs $l\ l'$ enter a connecting block, d, having for its axis the spool-shaft s, thus connecting the weight a with the one a', making the centrifugal force of the latter to supplement that of the weight a. The centrifugal force generated by the motion of the spool C separates the weights a and a', which, swinging on the pins $h\ h'$, causes the pins g and k to approach each other, and they, being connected to an ordinary metallic friction-strap, m, which encircles the inwardly circular portion of the cap B, cause the said friction-strap to be drawn closely in contact with it, creating friction, which arrests the speed of the spool C and its connections. To counteract the centrifugal force of the weights $a\ a'$, and prevent them acting until the requisite speed is attained, the spring f is provided. Said spring is secured to the connecting block d, as shown in Fig. 1, its free end bearing on the head j. The tension or force with which the spring so bears determines the tension of the friction-strap m, and, consequently, the speed of descent, a stiffer spring causing the revolutions of the spool C to be more rapid.

Location of the Garden of Eden.—Of the four rivers which encircled the Garden of Eden in Genesis, the Phrat and Chiddekel have long ago been identified as the Euphrates and Tigris. A cuneiform monument in the British museum has a series of geographical names, and among them occur Pisan and Guchan, both canals of the Euphrates. Pisan was a canal running south of the Euphrates, and in the epoch of Alexander the Great, went under the name of Pullakopas canal; it is the Pisan or Pischon of the Bible, and Guchan is the Gihon. The Hebrew people had therefore placed the cradle of the human race in the vicinity of Babylon.

Health and Home.

HOW TYPHOID FEVER MAY BE PROPAGATED.

In a recent number of the *Popular Science Monthly*, Ely Van De Warker, M.D., of Syracuse, N.Y., under the title "Typhoid Fever Poison," reports seventeen cases of the fever in an isolated suburb of the city in which there were but fourteen houses. The first case was imported; thence through the overflowing of the privy in which all the excrement of the patient had been thrown, a well became contaminated. All the persons who were taken ill used this well. It was the constant or occasional source of supply of seven of the fourteen families. No cases occurred in the households who did not drink from this well. Some cases were developed in every family who drew water from it. The families who escaped were exposed to every other influence but that of this particular well; their own water supply was the same, less the privy contamination. It is not unlikely that their own wells received some of the overflow from their own vaults, but as these were free from typhoid poison, no ill results ensued.

About eight years since, Dr. Flint, who has studied and written a great deal on the subject, became satisfied that a source of typhoid fever existed which was little dreamed of, and which at first thought would seem impossible. This source, as he then enunciated it to his home medical society (and not to his knowledge having been before suggested), is found in *ice*. If this idea is thoroughly investigated, it will not appear to be very problematical. In the first place, the poison is not destroyed or impaired by freezing (some one long ago remarked that ice often masks or conceals what it does not kill). Now, whence comes our ice supply? Often from shallow reservoirs in the midst of neighborhoods of large towns purposely made to receive surface drainage from all around, under the erroneous idea that no harm will ensue, as freezing is supposed to purify and render harmless what might otherwise be objectionable. Great quantities of ice are taken from canals, from creeks, from stagnant ponds, and from streams that are either the natural or artificial recipients of surface drainage, of the outpourings of sewers, and of uncleanliness from various sources. The danger from ice taken from improper places is not only from that which is drunk, but from its use in refrigerators and preservatories, where milk, butter, fruits, vegetables and meats are subjected to its saturating influence as it vaporizes. Several instances have fallen under the doctor's observation where the disease, by the most careful investigation, could not be traced to any other source; and if we accept as a fact the statement positively made by Budd in the London *Lancet*, in July, 1859, that it never originates *de novo*, but proceeds from a special and specific poison, which is capable of diffusion to a great extent, and which preserves its noxious qualities for a long period, even if buried for many months, we cannot reject the hypothesis of ice infection; and it is hoped that it will be made the subject of very thorough and careful investigation.

THE EFFECTS OF DRINKING COFFEE.

The brown beverage prepared from the berry, improperly so-called, of the Levant leads more than half the world vanquished in its triumphal train, mocking the energetic and barbarous means employed to combat it and check its march. It has found innumerable friends and willing subjects, not only in Europe and Africa, but in America. In the Orient and in Middle Germany it has become the national drink, England and Russia alone preferring the tea-canister to the coffee-pot. The reason of this extended popularity, and the physiological action of coffee have not hitherto been clearly understood. Prof. C. Binz, an investigator to whom we are indebted for an explanation of the action of alcohol, has also rendered a service by carefully examining the active constituents of coffee, namely, coffeine, the empyreumatic substances produced during the burning, and its potash salts.

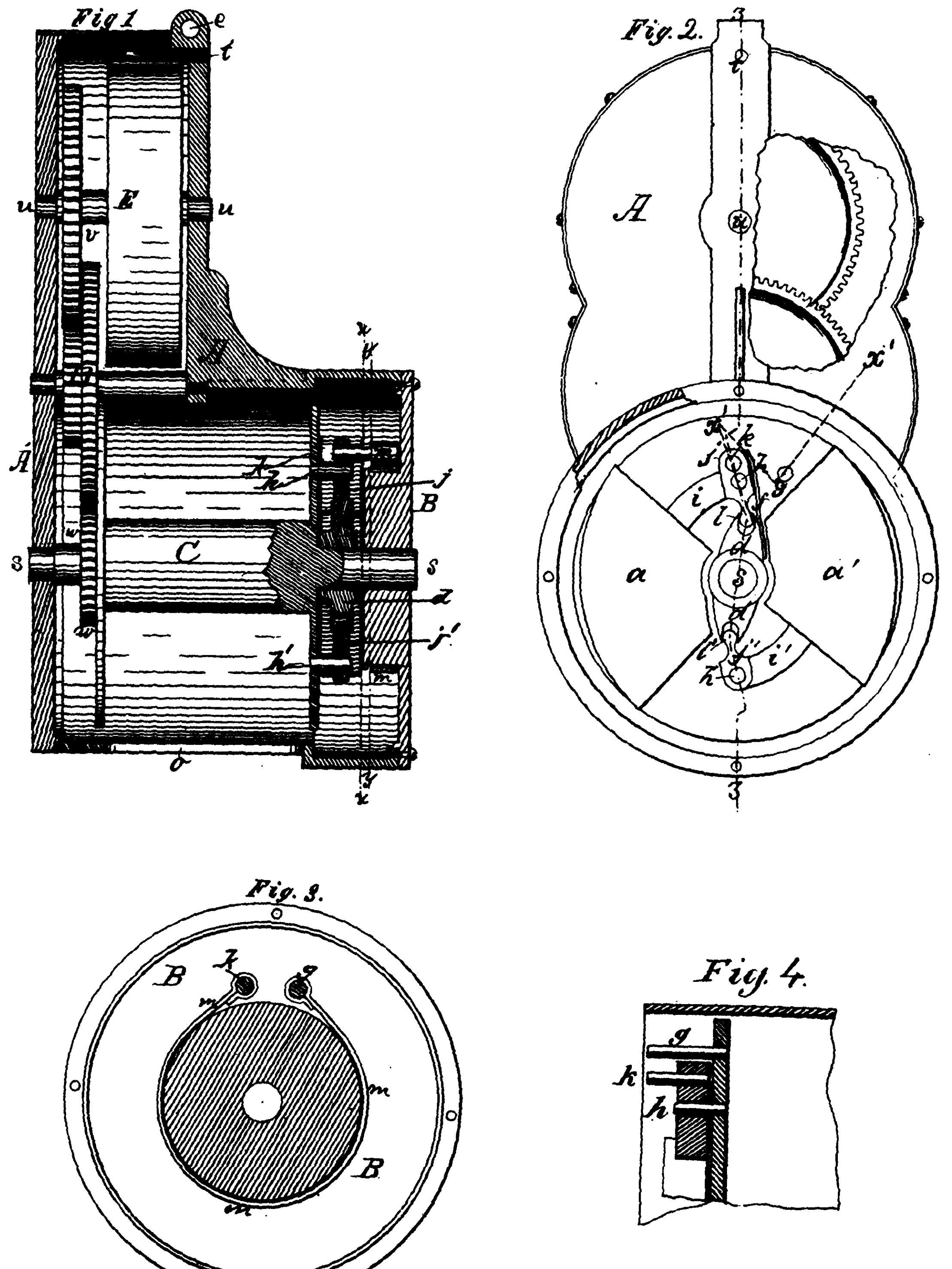
Moderate doses of caffeine produce an increase of bodily temperature without any symptoms of illness being perceived at the same time. Large doses, which caused perceptible stiffness of the muscles, disquiet, and flow of saliva, were attended with increase of temperature, reaching a maximum in one or two hours, and then decreasing somewhat, but frequently lasting for hours. This action of caffeine renders it an antidote to that of alcohol, and it is employed to counteract the effects of opium also. Experiments made upon dogs show that it is able to check the fall in temperature caused by alcohol, and to produce a continued wakefulness in place of the stupefaction of opium.

Empyreumatic compounds found in burning, and called in France *caffeon*, consisting chiefly of burned oils and bitter principles, also contribute to the action of coffee upon the system. To test their action when isolated from the caffeine, Binz employed the aromatic distillate of a strong decoction of coffee, which smells strongly of coffee. It caused increased activity of the heart with more frequent breathing, and reduced the pressure of the blood.

The increase of temperature assigned to caffeine, by Binz, can result only from an increased decomposition and consumption of material. For most coffee drinkers, the real effects of the drink are due solely to the moderate excitement of these oils.

Cold Feet and Sleeplessness.—The association betwixt cold feet and sleeplessness is much closer than is commonly imagined. Persons with cold feet rarely sleep well, especially women. Yet the number of persons so troubled is very considerable. We now know that if the blood supply to the brain be kept up sleep is impossible. An old theologian, when weary and sleepy with much writing, found that he could keep his brain active by immersing his feet in cold water; the cold drove the blood from the feet to the head. Now, what this old gentleman accomplished by design, is secured for many persons much against their will. Cold feet are the bane of many women. Light boots keep up a bloodless condition of the feet in the day, and in many women there is no subsequent dilatation of the blood-vessels when the boots are taken off. These women come in from a walk, and put their feet to the fire to warm—the most effective plan of cultivating chilblains. At night, they put their feet to the fire and have a hot bottle in bed. But it is all of no use; their feet still remain cold. How to get their feet warm is the great question of life with them—in cold weather. The effective plan is not very attractive at first sight to many minds. It consists first in driving the blood-vessels into firm contraction, after which secondary dilatation follows. See the snow-baller's hands. The first contact of the snow makes the hand terribly cold, for the small arteries are driven thereby into firm contraction, and the nerve-endings of the finger-tips feel the low temperature very keenly. But, as the snow-baller perseveres his hands commence to glow; the blood-vessels have become secondarily dilated, and the rush of warm arterial blood is felt agreeably by the peripheral nerve-endings. This is the plan to adopt with cold feet. They should be dipped in cold water for a brief period; often just to immerse them and no more, is sufficient; and then they should be rubbed with a pair of hair flesh-gloves, or a rough Turkish towel, till they glow, immediately before getting into bed. After this, a hot-water bottle will be successful enough in maintaining the temperature of the feet, though, without this preliminary, it is impossible to do so. Disagreeable as the plan at first sight may appear, it is efficient; and those who have once fairly tried it, continue it, and find that they have put an end to their bad nights and cold feet. Pills, potions, lozenges, "night-caps," all narcotics, fail to enable the sufferer to woo sleep successfully; get rid of the cold feet, and then sleep will come of itself.

Hearing and how to Keep It.—Lindsay & Blakiston, 25 South Sixth street, Philadelphia, have published a valuable work under the above title. The book is Vol. I. of a series of American Health Primers edited by W. W. Keen, M.D. From the mass of information contained in it we learn that the ear should not be tampered with, sweet oil and other greasy substances should never be dropped into the ear; they make it heavy, sticky and cloggy. The oil soon becomes rancid and affords a fit soil for the growth of a fungus which may entirely destroy the hearing. Poultices should be avoided both in eye and ear, for they are apt to induce proud flesh. Care should be taken of the bodily comfort, warmth, etc., and the ears protected against cold drafts and other changes. Great care also should be taken not to pull the ears of children, or "box" their ears, a practice which may endanger the hearing in after-life. If the ear should become affected through any cause a simple treatment should be adopted. If the ear runs, it should not be stopped up with cotton or any other substance. The matter must be allowed free egress, and the syringe should be gently used with lukewarm water. The great delicacy of the ear requires the gentlest manipulation, and all the nostrums advertised to drop in it, or sponges to scrub it out, must be avoided. As to the eye bright colors and pleasant objects are grateful, so to the ear sweet music, pleasant company, etc., are beneficial. Brightness of nature and cheerfulness of character have more to do with the preservation of health than is dreamed of.



BALL'S IMPROVEMENT IN FIRE ESCAPES.—(SEE PAGE 286.)