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SCIENTIFIC CANADIAN

MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

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THE FEASIBILITY OF TEACHING TRADES IN CONNECTION WITH OUR PUBLIC SCHOOLS.

IN a country where our industries are rapidly growing and will soon be broadcast over the land; where the agricultural and manufacturing interests are the mines from which she must draw her wealth and build up her power, is it not time that the teaching of trades should form a distinct branch of education in our public schools? With more of the Kindergarten in our educational method, children may have a readier grasp of technical principles, and there may be much greater animation in the learning than is now often the case. Whatever there is in knowledge, capable of being taught by sight and touch and research into properties, should be taught demonstratively, and for children the indigestible subjects of history, rhetoric, and grammar may well be spared until the years of maturity. With greater attention to this range of instruction in our elementary schools, there can, in addition, surely be instituted in our industrial centres, large and well-equipped technical schools, supported with illustrative apparatus and scientific instruments, and above all, placed in charge of capable teachers with enthusiasm as well as ability for their work. It would be impossible to carry out in these schools, in an applied manner, the higher education which we desire to see operative in the workshop. If, as in France, masters with large factories giving employment to hundreds of employées, would form technical schools of their own, for their apprentices or young workmen, they would in the end be gainers. But in whatever way technical instruction is given, the lesson must be made attractive. Teaching is only dull in incompetent hands, and machinery must be provided for practical purposes. Let there be some inducement held out to the young mechanic, even if it go to the length of giving him higher wages or a reward, or giving him a spare hour provided he devotes it to his trade or school. He would be worth more to his master, and eventually prove a superior workman. When the young mechanic is at his trade one may reasonably feel assured that he will not change it aimlessly, and that a special technical education is not thrown away upon him. If by such well-directed endeavours anything may be done to raise the artisan in capacity and skill and to dignity in his labour the effort is well worth making.

We are, in this country, entirely devoid of system, other than the negligent rule of thumb. There is no training, no technical education for young mechanics; they are not taught to know the reason of the methods they are directed to follow, that the principles underlying practice are not only too much ignored, but that masters and foremen are themselves too commonly very imperfectly acquainted with the principles; that the knowledge of tools and their scientific use, and why they are most serviceable in certain shapes, is little imparted; that, in short, the boy is not carried onward in his work, so as to become a more intelligent and better workman than the man whom he will eventually succeed. In Germany, France and Switzerland, marked progress has been made in the establishment of schools which enable the boy, as it were, to carry himself through the school to his trade without experiencing any abrupt cessation of mental application on the commencement of physical toil. The education of a youth is adapted to his life, and in some instances, he is even made a competent workman before he leaves school. There are apprentice schools, and there are schools preparatory to apprenticeship, and there are institutions for "technical instruction to the apprenticeship of a regular factory or workshop, or to the apprentices of some industry." The result of this educational effort abroad—associating the training of the hand with the training of the mind—has been very encouraging. It has perceptibly benefitted the industries to which the system has been applied. We are warned that we shall never take our place in the race for superiority unless we try something of the kind, and it is time that our attention was drawn most strongly to it.

So far the establishment of Mechanics' Institutes in this country has been a complete failure, and the Government grant, of $400 per annum to each, may be said to be entirely thrown away. The mechanics, as a body, take little interest in these institutions, and they are mainly frequented by non-mechanical men. There is nothing in connection with these institutions in Canada that is attractive to the working mechanic, and he feels himself in them out of place. It is a question whether it would not tend to greater advantage to the mechanics of the country for Government to withdraw these grants altogether, and apply the funds to technical schools and to the machinery and apparatus necessary to teach by practical illustration. There is no more important question now before the country than that of reform in the class of education to be taught to the masses, and an effort must be made to bring that change about as soon as possible.

ARCHITECTURAL DESIGN.

The principal faults in architectural design in the present day appear to lie in the direction of unrestrained or undisciplined ambition, or in false taste, which leads the young architect to tell all he knows, and sometimes more, at a single effort, as if he never expected another opportunity. Or, on the other hand, an endeavour to produce something so different from others and so startling in effect, in the expectation to distinguish himself in his profession by one stroke over others whose knowledge of its rules has been a life-time study.

Repose by these young men is condemned, and in place of it we find a fidgetty, over-conscious display of knowledge in their first buildings, in which too often all rules of architectural proportion, taste and design are violated; facades loaded with inappropriate and meretricious ornamentation, and appearing, when viewed with a calm critical eye, like an overdressed, vulgar woman.

Although the conditions under which the profession is practised to-day, is wholly different from those which prevailed some years ago, the mental equipment with which the young architect now starts forth on his career is very different from the lesser opportunities which architects not a quarter of a century ago possessed.

The extraordinary multiplication of books and photographs, and the admirable course of instruction offered in our colleges, joined by a singular revival of enthusiasm for the art, has given him immense advantages, and he has only himself to blame if he has not the examples of all styles of ages at his finger ends, as well as in his portfolios and scrap-books. In fact his danger arises not from want of technical knowledge, but from intemperance and disorder in the use of it.

The great danger that the young architect is likely to fall into is a feeling of independence of fixed principles, an inclination to start off the road travelled so long in safety by others, and strike out something piquant and unique for himself. From the want of fixed principles his mind wavers and his ideas are visionary. This year it is English gothic, the next in the reign of Queen Anne, the year after the French Renaissance, or perhaps a mixture of every style, by way of being eccentric, and an audacious defiance of the plain rules of common sense or the requirements of common convenience as by a real achievement of art.

We trust that the day is not far distant when a restraint will be put upon this wild license of practice, and that good taste and judgment will take the place of the medley of styles and meretricious ornamentation which offend the eye in so many of the buildings which form the street architecture of some cities in Canada. With the encouragement given to Art Education, under the patronage of His Excellency the Gov.-General and H. R. H: the Princess Louise, false taste in design will receive a check.

Publications.

VICK'S FLORAL GUIDE.—We are in receipt of this beautifully got up and instructive work for 1880. No family, having a taste for the cultivation of flowers, should be without a copy of this really elegant publication. It contains no less than 500 elegant illustrations of every variety of flowers, and is a perfect guide for the florist in the selection of seeds or bulbs for the coming year. The work is forwarded post free for the small sum of five cents and the *Floral Monthly* is only $1 per annum. Both are published by James Vick of Rochester, New York State, who is well-known in the floral world for his nurseries and high floral culture.

HINTS TO CORRESPONDENTS.

No attention is paid to communications unless accompanied with the full name and address of the writer, and with postage stamp if a reply by letter is required.

Name and addresses of correspondents will not be given to inquirers.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

The volume for 1879, containing *Collin's Machine Construction and Drawing*, can be obtained on remitting $1.50.

Scientific Items.

CAVES OF PREHISTORIC MAN IN MORAVIA.

Respecting the discoveries which have just been made in certain caves in Moravia some interesting details are published in the Augsburg *Allgemeine Zeitung*. For some months past excavations have been going upon the Kotoutsch hill, near Stramberg, which have already brought to light a large number of remains of the highest scientific interest. The work has been carried on under the direction of Herr J. Maschka, a master at the Realschule of Neutitschein, who has conducted the operations in the most systematic and careful manner. The spots where the most important discoveries have been made are the two caves of Schipka and Tchertova Dira (or the Dwarf's Cave). The objects which have been found, and the position in which they were discovered, proves in the clearest possible manner that both the caves mentioned were inhabited by men in prehistoric ages. The cave of Schipka, the roof of which had partly fallen in, was, it is shown, occupied by human beings in the oldest stone age, or palæolithic period, while the occupants of the Dwarf's Cave lived at a later era, when man was already, to some extent, acquainted with the use of metals. It is further evident that the caves were occupied by man at a period contemporary with the existence of the mammoth and cave bear, as at a depth of one metre, among the remains of these animals, there were found bones which had been burnt and others which had been artificially fashioned. The objects obtained in the Schipka cave comprise thousands of bones of antediluvian animals, as the mammoth, rhinoceros, cave-bear, horse, cave-ox, stag, reindeer, &c. Further, there are thousands of seperate teeth and horns of these animals, besides numerous well-preserved stone and bone tools, which were dug up as far down as three metres below the floor of the cave. In the uppermost layer of the cave floor the excavators also found seven objects in bronze consisting of a celt, five concentric rings, and one ring with a rectangular cross or wheel with four spokes. In the Tchertova Dira the discoveries include bones of the cave-bear, reindeer, edelhirsch, primeval ox, &c., besides numerous pieces of horn showing artificial work and many well-preserved bone objects and tools, such as awls, or bodkins and pins or needles pierced with holes, three and four edged arrow heads, rough and unpolished stone tools of flint, jasper, and chalcedony; fragments of very different kind of earthenware vessels, with and without graphite coating, which had been made by hand, without the use of the potter's wheel, and which are covered with characteristic ornaments. Further, there are some three-edged arrow-points of bronze, with a hole for poison ; there are teeth pierced with a hole, mussel shells, whetstones, and bobbins for spinning. On the crown of the hill above this cave extensive patches of ground on which there had been fires have been found, and immediately under the turf, along with numberless fragments of pottery, there were dug up fragments of graphite vessels, stone tools, and, among other things, a knife 117 millimetres in length, a polished ball with a hole through it, and various bronze and iron objects. As in Austria, cave remains of this kind, with the exceptions of the Vypusthek Cave, have never been discovered, and as in all Central Europe they have but seldom been found, it is readily understood that these excavations are exciting the keenest interest among anthropologists, and it is to be hoped that the researches may be fully and thoroughly carried out, as it is to be anticipated that there are still many more objects of interest yet to be brought out of their hiding places, where they have lain for thousands of years, in order to help to clear up the mystery of man's first appearance on earth. By the result of the excavations we have above described the series of discoveries in reference to the original human inhabitants of central Europe has been considerably extended. The nearest spots in middle Europe, where discoveries have been made similar to those in Moravia, are in the south-west of Germany, thus leaving a wide interval in which nothing of the kind has up to the present time been found.

A NEW PEOPLE.

The Arctic explorer, Prof. Nordenskjold, found a new race of people in the Arctic regions in latitude 67° 7′ north, longitude 137½° west from Greenwich. They are known as the Tschuktschi, and are described as savages because their civilization is not very far advanced. But the Professor is enthusiastic in his testimony to their excellent qualities—social, domestic and national.

They are described as distinctly differing from the Esquimaux tribes ; and though it is not yet decided to what race they belong, they are thought to be related to the Kamtchatkadales and Koriaks.

Some very interesting and valuable details have been collected by Nordenskjold and his staff as to their ethnography and history. About 250 years ago they were distinguished and gallant warriors. The discoverers have gathered a valuable assortment of the arms and armor of that period. Many of these implements are preserved among the families, whose habits are no longer aggressive. Very noticeable are their cuirasses, carefully wrought out of mammoth ivory, and fashioned with a remarkable resemblance to the old Roman panoply. Their spears and bows are made of whalebone, wood and ivory, spliced and bound with the sinews of the reindeer, and showing an advanced perception of artistic ornamentation on the part of the makers. One hundred and fifty years ago the famous Russian, Col. Paulovski, commanded an expedition sent against them from Siberian settlements. In his first engagement with them he was badly worsted. He subsequently defeated them, but with heavy loss to his own troops, and has recorded such a tribute to their valor as Pyrrhus bestowed upon the Italian legions which he overthrew. A mild form of disease is averred by the natives to have been left behind by his soldiery and to be still in existence.

Strangely enough they have no government, no laws, and almost no religion, if any. A Russian starost is their nominal ruler, but has neither authority nor influence. In fact, there seems to be no necessity for the exercise of either the one or the other, for his subjects are evidently an exceptionally excellent and well-disposed people. The foreigners were on terms of intimacy with thousands of them, and never saw or heard of a single case of quarreling among them. Perfect harmony prevailed in the villages and families. Women have great influence, and are treated by the men in all respects as their equals and with much politeness and deference. The language spoken by this tribe is peculiar, and as far as has been yet determined, shows no affinity to others.

The features are less Mongolian in type than are those of the Esquimaux or the other indigenous tribes of Siberia. The hair is generally, but not invariably, black, and the complexion is decidedly light. Young women are often very fair, handsome, and of perfect symmetry and fine proportions. The men are tall, above the medium height of man's growth, some of them attaining to very little short of the splendid stature of the best specimens of humanity in northern Europe. One woman is mentioned to me as being of gigantic size, so large, in fact, that she might well be shown for money. One of Nordenskjold's attaches has a note—I regret at this moment inaccessible to me —of her height and bulk, the former being over seven feet. They are omnivorous in their diet.

THE PHYSIOLOGY OF RECREATION.

So much, then, for the meaning of recreation. The next point that I shall consider is the physiology of recreation. It may have struck some readers as a curious question, why some actions or pursuits should present what I may call a recreative character, and others not. For it is evident that this character is by no means determined by the relief from *labor*, which these actions or pursuits secure. A week on the moors involves more genuine hard work than does a week in the mines, and a game of chess may require as much effort of thought as a problem in high mathematics. Moreover, the same action or pursuit may vary in its recreative quality with different individuals. Rowing, which is the favorite recreation of the undergraduate, is serious work to the bargeman ; and we never find a gardener to resemble his master in showing a partiality to digging for digging's sake. If it is suggested that it is the need of bodily exercise which renders muscular activity beneficial to the one class and not to the other, I answer, no doubt it is so partly, but not wholly ; for why is it that a man of science should find recreation in reading history, while an historian finds recreation in the pursuit of science ? or why is it that a London tradesman should find a beneficial holiday in the country, while a country tradesman finds a no less beneficial holiday in London ? The truth seems to me to be that the only principle which will serve to explain the recreative quality in all cases is what I may call the physiological necessity for frequent change of organic activity, and the consequent physiological value of variety in the kinds and seasons of such activity. In order to render this principle perfectly clear, it will be necessary for me very briefly to explain the physiology of nutrition. — *George J. Romanes, in Popular Science Monthly for October.*

Speculations as to the Lapse of Time involved in producing the enormous changes that geologists have noted have a special interest when applied to the problem of the antiquity of the human race. In this particular case, also, the probabilities of a serious error are incomparably smaller than in most speculations of a similar character, from the fact that the time that has elapsed since man made his appearance is, comparativery speaking, so trifling, that the evidence of his advent and existence are in many localities well preserved, and the sequence of natural changes not obliterated. Prof. Mudge has presented some interesting evidence relating to the antiquity of man, in the *Kansas City Review of Science*. He starts by assuming the correctness of the generally-accepted opinion among geologists, that man was on the earth at the close of the Glacial epoch, and presents evidence to prove that the entiquity of the race cannot be taken at less than 200,000 years. After the Glacial epoch, geologists have recognized, by their effects, three others, namely, the Champlain, the Terrace, and the Delta, all supposed to be of nearly equal length.

His argument for estimating the duration of these epochs is about as follows : He takes the case of the Delta of the Missisippi, and notes the fact that, for a distance of about 200 miles of this deposit, there are to be observed buried forests of large trees, one over the other, with interspaces of sand. Ten distinct forests growths of this nature have been observed, which must have succeeded one another. "These trees are the bald cypress of the Southern States. Some have been observed over 25 feet in diameter, and one contained 5700 annual rings. In some instances, these huge trees have grown over the stumps of others equally large, and such instances occur in all, or nearly all the ten forest beds." From these facts it is not assuming too much to estimate the antiquity of each of these forest growths at 10,000 years, or 100,000 years for the ten forests. This estimate would not take into account the interval of time—which doubtless was very considerable—that elapsing between the ending of one forest and the beginning of another. "Such evidence," concludes Prof. Mudge, "would be received in any court of law as sound and satisfactory . We do not see how such proof is to be discarded when applied to the antiquity of our race. There is satsfactory evidence that man lived in the Champlain epoch. But the Terraee epoch, or the greater part of it, intervenes between the Champlain and Delta epochs, thus adding to my 100,000 years. If only as much time is given to both these epochs as to the Delta epoch, 200,000 years is the total result."

THE PRACTICAL USE OF SCIENCE.

The adulteration of various articles of food has of late become so alarming, and the various processes are so skillfully conducted that the aid of science is being called in to assist in the detection of such practices, in order that the offenders may be more readily brought to justice. The French authorities are just now wrestling vigorously with those engaged in palming off upon the public a spurious article of olive oil, the adulterations of which have become so universal that it is difficult to get a pure article anywhere in the European market. According to the *Correspondence Scientifique*, the government recently referred the matter to a special committee of the Academy of Sciences, which has recommended the use of a new instrument which is called the diagometer. The instrument, which has been devised by Prof. Luigi Palmieri, has its action based on the differences in the electric conductivity of oils. Pure olive oil has very feeble conductive properties, which (as is also the case with other oils) increase with the amount of impurities added. The only oils that are known to compare to olive oil in respect to their low conductivity are the oils of pine-seed and hazel nuts; and these, fortunately, are too expensive to be used in the adulteration of the former. The conclusions of the committee on the practical value of the diagometer have not yet been announced; it is noted, however, that its use demands considerable manipulative skill. For the correctness of this abstract we refer to the London *Chemical News*.

Butter is another article to preserve the purity of which the aid of the scientist has been invoked. In reply to such a demand Herr Fisher asserts that the examination of butter by polarized light with a magnifying power of about 200 to 300 diameters, affords a much more certain criterion of its purity than a specific gravity test. Examined in this way, fictitious butter shows not only the globular drops and salt crystals characteristic of genuine butter, but likewise other more or less developed crystals. The author also finds this method may be applied to the determination of different kinds of fats, inasmuch as each of these show characteristic colors in polarized light. Mutton tallow, for instance, always give a blue tone; cocoa butter gives colors passing from the brightest green to the deepest red; the fat of oxen gives green and white luminous effects; while small bright green semi-lunar and vermicular bodies appear in common light. Hog's lard shows many colors, especially red and blue—yellow, which is characteristic of cocoa butter, being absent.

PETROLEUM AS FUEL.

A method of using petroleum as fuel for steam-boilers has been recently tried at Pittsburgh (U.S.) with, it is said, complete success; and, as oil can be had anywhere in the region of the wells for about 70c. a barrel, the company who hold the patent believe that the invention will be readily taken up, especially by the owners of steamboats. It resembles, according to the journal of the Franklin Institute, in its principal features, many of the forms previously described—air, steam, and oil-spray being injected into a suitable fire-box. The spray is said to be immediately converted into inflammable gas, becoming a pure, bright, powerful flame, devoid of smoke and producing intense heat. To accomplish this result extremely simple machinery is used. A small hole is drilled into the iron front of the fire-box, and into this passes a tube, which branches as it leaves this point into two pipes. One of these connects with the boiler itself, and the other with the receptacle containing crude oil. At the junction of these pipes there is an aperture for the admission of atmospheric air. Valves of peculiar construction regulate the quantity of steam or oil admitted into the furnace. This is all the machinery required, but its operation, according to the *Pittsburgh Telegraph*, is wonderfully complete and remarkably successful. The little steamer *Billy Collins* was selected for the test, and was fired up at 9 a.m. A preliminary blaze of wood under the boiler raised the small quantity of steam necessary to start the burner into operation. The oil valve was opened a trifle, the steam valve ditto. The petroleum trickled into the feed pipe, was caught up by the steam, and both plunged into the depth of the fire-box, a mass of many-tongued, roaring, brilliant, flame. As the pressure of steam increased, this flame grew in fury and intense heat, roaring through the entire length of the boiler with a sound like the coming of a thunderstorm. The needle of the steam-gauge climbed rapidly up the dial, and in twenty minutes the safety-valve blew off at 120 lb. pressure. Here was a boat puffing through the water with no sign of smoke from her chimney, no speck of soot in flue or fire-box, no firemen, no opening of furnace doors, no dirt, no coal going in, no clinkers or ashes to be seen anywhere. A turn of the hand regulated the terrible flame that seemed trying to overpower the limits of the furnace, and another turn of the hand brought the fire down to a quiet little flame a foot or two long. During the forenoon occupied by the test about 20 gallons of crude oil were consumed, and it was estimated that with oil at one dollar per barrel this fuel was equivalent to coal at six cents (quantity not stated) in heat-producing value, other things being equal. But other things are not equal by any means, the journal referred to declares, and everything is in favor of oil as against coal. The labor and the expense of "firing up" are dispensed with, and the engineer can regulate the flame as he does the steam in his engines. The danger from sparks and flying cinders is entirely done away with. The space occupied by oil, as compared with an equal quantity of coal, is very much less, and this much is gained for cargo. Further, the wear and tear upon boilers, grate, bars, &c., is infinitely less; and, it seems scarcely necessary to add, the comfort of passengers is greatly enhanced by the absolute freedom from dirt of all kinds. It is urged that to ocean-going steamers this device must prove of great value. A tank of oil situated at a remote end of the ship would hold fuel sufficient for a double trip and supplant the great coal-bunkers, with their attendent dirt. It is also maintained that the new furnace is full of promise for railway locomotives also.

AFRICAN PROJECTS.—The French government is reported to have appointed a commission to conduct investigations preliminary to the construction of a railway across the Desert of Sahara to the river Niger, and French engineers are said to be now at work exploring the line of the proposed road as far as the Laghouat on the south. M. Saleillet, an engineer, has been charged with the examination of the unexplored regions lying to the east of the colony of St. Louis, in Senegal, as far asTimbuctoo. This gentleman advocated, at a late meeting of the Paris Geographical Society, the construction of a railroad from Dakkar, on the Atlantic, to St. Louis; the opening of the river Senegal to navigation as far as Bafoulabé, and the union of the Senegal with the Niger by means of a canal from this point to Bamakou on the last named river. The Niger is now navigable from Bamakou to Timbuctoo, and lower down for a distance of 1,500 miles. The total expense of this work M. Saleillet places at $5,000,000. The population that it would unite in commercial relations is about 87,000,000. The country it is proposed to open by these several projects is represented as being rich in various commercial products, and peopled by intelligent races, who, it is believed, would favor, rather than hinder, their execution. The Government Commission is said to have approved M. Saleillet's plans, and the survey for the canal is to begin at once.

OXIDATION OF IRON AND STEEL WHEN IN CONTACT.—Mr. G. Radcliffe, in a paper read before the Iron and Steel Institute of Great Britain, incidentally mentioned a case in which steel boiler-plates, which had been exposed to the same conditions as adjacent iron-plates, had distinguished themselves by pitting more than the latter. The steel plate next to the iron one was oxidired considerably more than any other. This fact would appear to point to a species of galvanic action set up by the contact of the two varieties of metal in an exciting liquid, the steel playing the part of the positive element. Mr. Radcliffe does not attempt, however, to offer an explantion, but simply concludes that, under the above-named circumstances, it will not do to place iron and steel side by side.

CARBON IN COMETS.—It is generally believed that some compound of carbon exists in comets, and it has been assumed that the bright lines in the spectra of these bodies was due to that compound being in an incandescent state. G. J. Stoney has advanced another hypothesis. He suggests that the bright lines are caused by the light of the sun falling on the compound of carbon, and rendering it visible in the same way that light renders the moon, the planets and other opaque objects visible, the vapor of carbon being opaque to the particular rays which appear as bright lines in its spectrum.

RECENT experiments, it is said, seem to show that chlorine, which has hitherto been classed as one of the elements, is a compound, one of the elements of which is oxygen. It is known by chemists that ozone has a higher density than oxygen in its usual state, the explanation given being that the ozone molecule has three atoms oxygen, whereas the ordinary oxygen molecule consists of but two. On heating ozone the density is decreased, and the gas becomes plain oxygen. In this case, one of the "elements" must probably be struck from the list.

BRAIN GROWTH.

The question is often asked : "How long does the brain of an individual continue to grow?" Some have an idea that it attains its full growth at the age of 20 years ; and we have seen assertions, professing to be from medical authority, that the brain attains its growth at about 14 years ; but no close observer, no phrenologist who has had opportunity to measure thousands of heads, and to measure not a few of them, say once in five years for twenty-five years, will believe a word of it.

In many cases the brain will increase in size till a man is 60 years of age, provided he have a healthy, vigorous body, and live correctly, so far as diet and labor are concerned, and the mind be kept in an active, but not over-excited state.

Any sharp observer may enter 50 churches in succession, when the congregations are full, and he will readily see that the grey-headed father, sitting at the head of his family with his son 25 years of age by his side, will have a considerably larger head than his son. In numerous cases this can be remarked in looking up and down the aisles. The old gentlemen's heads are the largest. If we revisit the same church 30 years afterwards, we will find the energetic son with grey hair sitting at the top of the pew, and his son at his side ; and the older man will have a head larger than the hopeful son—showing that it had been growing up to 50 years of age or beyond. We have just received a letter from Mr. L. N. Fowler, of London, which contains one remarkable passage. Mr. Fowler says : "I shall send you soon the phrenological character of Sir Josiah Mason, of Birmingham, England. In 1864 I measured his head, which was 23½ inches ; in 1869 it measured 24 inches ; and now, in 1879, it measures 24¾ inches, plump ; and he is now in his 85th year.

The law of growth, in respect to the brain, is the same as that relating to growth of body. If a muscle, or set of muscles, be called into frequent and efficient exercise, they become thereby hungry for nutrition ; and when the blood is passing those parts, the nutriment carried in the blood is absorbed by the parts needing it, and they become enlarged. A broken bone needs at the point of fracture bone-making material, and the blood which carries nutrition for every part, as it passes the region of the fracture, loses by affinity the material which the bone wants to repair the fracture. As the blood passes a flesh-wound, that part of the blood adapted to heal the wound is taken up and used where it is required. Let a person exercise the brain in the intellectual or thinking region and the forehead will grow, while other parts remain stationary. Persons engaged in rough, laborious business need the exercise of the base of the brain, and that part of the head will grow ; but if the labor require also the active exercise of the intellectual organs, the two regions will become enlarged considerably. Those who devote themselves mainly to moral and esthetical subjects will be found with a larger top-head ; and those who have body enough to give adequate support to the whole system, including the brain, will be able to increase the size of the brain year by year by the general exercise of all the faculties until old age. The body increases in size in old age, why not the brain? Generally there is not vigour enough in the vital system to sustain the body and push the development of brain beyond the age of 50 ; but there are cases which we happen to know, proving brain growth until after 60 years of age.

Some persons think it impossible for the brain to increase in size after the bones of the skull have become hard and strong. When the brain requires more room in any part, the bone material of the skull is gradually absorbed or dissolved, and, like lime-water, is taken up by the circulation to be reorganized into new adjustments of the skull, large enough for the brain. The clam shell is as thick as a human skull and much harder, yet a clam will double his size in two or three years, during which time the entire shell will have been reconstructed on a larger pattern in every direction. The clam is never imprisoned or cramped by his shell ; he is, like the brain, simply protected and shielded as by a friend. The shell is alive, and so is the human skull, like the finger nails, or the hoofs of animals, and capable of rapid growth, though the process be to us imperceptible.—*Phrenological Journal.*

A Plastic Cement is a recently patented French product, which is called after its inventor, "Jannin's Cement." It is simply composed of a mixture, in suitable proportions, of yellow oxide of lead—that known in trade as "Massicot" is preferred—and glycerine ; other metallic oxides and coloring matters may be added to the above mixture, according to the character or color that may be desired. The cement may be made to possess more or less stiffness by varying the proportions of glycerine—the larger the percentage of the latter, the softer the cement, and *vice versa.* This cement is represented to be especially adapted for molding objects which demand an extreme delicacy in the lines of the cast, such as engraved blocks and plates, forms of printing type, photoglyptic plates, etc. It is affirmed that it sets in a few minutes under the influence of a gentle heat, and then admirably resists heat and pressure. When set, it is said to make a good substitute for lithographic stone. It is also recommended for artistic reproductions such as fac-similes of terra-cotta, the colour and sonorousness of which it closely imitates. It does not shrink in setting. Our authority for the above is the *English Mechanic.*

The Durability of Timber.—As showing the durability of timber the fact is cited that the piles of a bridge built by Trajan were found, after having been driven some sixteen hundred years, to be petrified four inches, the rest of the wood being in its ordinary condition. The elm piles under the piers of London bridge have been in use more than seven hundred years, and are not yet materially decayed, and, beneath the foundation of Savoy Place, London, oak, elm, beach, and chestnut piles and planks were found in a state of perfect preservation, after having been there for six hundred and fifty years. Again, while taking the old walls of Tunbridge Castle, Kent, England, there was found in the middle of a thick stone wall a timber curb which had been enclosed for seven hundred years ; and some timber of an old bridge was discovered while digging for the foundations of a house at Windsor which must have been placed there prior to the year 1396.—*New York Sun*

Silvering Mirrors.—Some time since the Academie des Sciences offered a prize of 2,500 francs for a method of satisfactorily and permanently silvering mirrors, and which should save the workmen the danger of exposure to the effects of mercurial vapors. The prize has been awarded to M. Lenoir whose process is substantially as follows : The glass is first silvered by means of tartaric acid and ammoniacal nitrate of silver, and then exposed to the action of a weak solution of double cyanide of mercury and potassium. When the mercurial solution has spread uniformly over the surface, fine zinc dust is powdered over it, which promptly reduces the quicksilver and permits it to form a white and brilliant silver amalgam, adhering strongly to the glass, and which is affirmed to be free from the yellowish tint of ordinary silvered glass, and not easily affected by sulphurous emanations.

Photo Decoration of Metals.—Herr Falk's photographic method consists in coating the metallic surface with a photographic film, which is then exposed under a transparent positive ; by this arrangement the parts lying beneath the dark places of the positive are not affected by the light, and are consequently capable of being etched. With curved surfaces a print taken in fatty ink on paper by a photographic method is transferred to the metal, and all the parts covered with the ink are by this means protected from the etching. It is a peculiarity of this process that the etching fluid colors all the etched places black, and this adds considerably to the effect of the whole.

Eye-Dyeing.—"A learned German doctor," says a Paris paper, "has discovered a means of dyeing the eyes of animals in general, and of man in particular, any color that he pleases. He is accompanied on his travels of propagation by a dog with a rose-colored eye, a cat with an orange-red eye, and a monkey with a chrome-yellow eye. But the most curious specimens of his art are a negro with one eye black and the other blue, and a negress with one eye gold-colored and the other silver-white. The doctor says the process of transformation, far from injuring the sight, strengthens and improves it."

New Coloring Matter.—Mr. T. L. Phipson reports to the French Academy of Sciences the discovery of a new rose-red coloring matter, which he has succeeded in extracting from the little blood-red alga, found at the base of damp walls. It resembles no other known color, and exhibits considerable analogy with the hæmoglobine of the blood. It is the first time that a substance of this kind has been met with in the vegetable kingdom.

Appearance of the Tongue in Gastric Disorders.—Dr. Wilson Fox gives, as valuable aids in the diagnosis of gastric disorders, the following conditions of the tongue :

1st. Dyspepsia, with strict atony of the stomach. The tongue broad, pale and flabby, the papillæ generally enlarged, more especially at the tip and edges.

2nd. Dyspepsia from irritative causes. The tongue is redder than usual; often of a bright florid color, or even raw-looking. It is often pointed at the tip, which, together with the sides, presents an extreme of injection, the papillæ standing out as vivid red points. This form is often associated with apthæ, and is most common in scrofulous children and phthisical adults.

3rd. Dyspepsia, from excessive or hurried eating, is apt to present a tongue uniformly covered through the greater part of its surface with a thick fir, whitish or brownish, with some degree of enlargement and redness of the papillæ at the tip and edges.

4th. Neuroses of the stomach display a tongue which, as a rule, is clean, though often pale, broad and flabby.—*Lancet.*

A NEW THERAPEUTIC AGENT.

A new method of treating cancerous growths, tumors, etc., consists in subjecting the parts to a stream of hot, dry air. This is proposed and has been successfully applied by Dr. G. A. Keyworth, of England. By means of a foot bellows he caused air to pass through a glass vessel containing calcic chloride, then through a heated iron tube, and thence directed the hot, dry air against the surface of a cancerous sore. The treatment was continued for an hour, the effect being to relieve the pain and cause the parts heated to shrink and dry up very considerably. It is believed that this new method will prove valuable when proper appliances are employed to maintain and disect the supply of air.

Milling.

CLEANING AND PREPARING WHEAT FOR GRINDING.

The cleaning of wheat preparatory to its reduction to flour is a matter of prime importance to the miller, as upon its condition when passed to the burrs, depends the quality of the flour product.

The impurities, which it is not only desirable, but essentially requisite to remove, may be divided into two classes, viz.: First, those that are mixed with, but form no part of the berry; and, second, those that adhere to and are an integral portion thereof.

The first class embraces all extraneous substances, straws, sticks, stones, other grains, seeds, dust, etc., and numerous devices for facilitating the operation of separation are offered the miller.

Little, if any, trouble is experienced in removing impurities larger or smaller in size, or of greater or less specific gravity than the wheat berry, but the complete separation of garlic (*allium sativum*) and cockle seed (*agrostemma githago*) has, under many circumstances, proved difficult of accomplishment, and, in many American mills all effort to eradicate these seeds has been abandoned.

Cockle, when ground with the wheat, imparts to the flour a bluish cast and a slightly bitter taste. Garlic imparts a pungent aroma, readily discernible before baking by a person with sensitive olfactory nerves, and obnoxiously apparent when the bread is taken from the oven, or during the process of mastication. Of course the presence of these foreign ingredients detracts from the market value of the flour, lessens the margin of profit if merchant milling is carried on, and detracts from the reputation of the custom miller; hence it is highly desirable that such deleterious substances should be thoroughly separated from the wheat before reduction.

The separation of the second class of impurities involves the necessity for nicer manipulation, and concerning it many theories and various practices are advocated and adopted.

Every miller admits the importance of removing the furze and chit from the berry, but how best to accomplish it without breaking the bran, is a question that has many answers, and each answer many upholders.

The old-fashioned beater principle has been very generally discarded as too harsh in action, with too strong tendencies to break the berry or the bran.

We hear many millers speak enthusiastically of the advantages to be derived by the "action of wheat upon wheat," but as yet we have no knowledge of any device where this much-lauded principle has been successfully elaborated, nor have we faith to believe that its action would attain all desirable results. That it would effectually remove the furze from the ends and exposed surfaces of the berry can hardly be doubted, but that any action would be had upon or in the crease of the berry is questionable.

In England the practice of "washing" the wheat obtains to some extent, but for reasons which should be obvious we cannot approve of it. If the wheat is sound, it can do it no good to soak it in water, and if unsound and imperfect, it must be evident that its capacity for absorbing impurities, which by the action of water may to some extent become dissolved, is greatly increased.

In Austro-Hungary decorticating by chemical process has been attempted upon limited quantities of wheat with very satisfactory results. The following is the *modus operandi*: In fifteen lbs. of English sulphuric acid one hundred pounds of wheat are allowed to stand from fifteen to twenty minutes; it is then removed and thoroughly washed in fifty pounds of pure water; it is then subjected to a second bath in water, in which a little soda has been dissolved, after which it is carefully spread out upon linen cloths to dry.

By this method wheat (with the exception of the crease) has been very nicely decorticated, but as its adoption would necessitate the erection of large dry-rooms, and as the process is necessarily slow and expensive, it can hardly be called practicable.

The ending-stone is quite extensively used in Austro-Hungary, and its use is classed by some as among the reducing operations, but by others, and we think properly, as among the cleaning processes, as by its use only the fibrous portion of the berry is removed. They are usually constructed of sandstone, and are set sufficiently far apart to allow the wheat to roll over in such manner that the end of the berry is brought into contact with the stone, by which it is denuded of the furze and a portion of the chit. Some millers of that country combine ending with the first reduction, but this practice is not adapted to present American systems of milling, as the first flour thus obtained is of too low a grade to be saleable in our markets.

The ending-stone, like every other device employed to clean grain, has its staunch supporters, and as staunch opponents, and while both sides can probably adduce plausible reasons for the positions they assume, it is barely possible that one may overestimate and the other underrate the advantages of this process of grain cleaning.

One writer advocates their use "down even to the exclusion of the germ." Another says in his "opinion the action of the ending-stone is even more detrimental than any 'beater' ever made." Without advocating or condemning their use, as American millers will undoubtedly satisfy themselves by practical tests of the benefit or damage to be derived from their employment, we would suggest that those who are in favor of their adoption state specifically why they do so, and those opposed do the same.

Ending-stones have been, as is well known, in use for a long series of years for hulling oats and buckwheat in this country, and the fact that for many years past, and even at the present day, they are in use in a number of the best mills in Austro-Hungary for the purpose of cleaning wheat, indicates that some of those who uphold their employment have substantial reasons for so doing.

The favorite cleaning machines of to-day in the United States are probably those denominated brush machines, and large numbers of them are annually exported to Great Britain and Ireland and the continent, indicating that they possess some one or more valuable features not obtainable in other classes of cleaning machinery, which meet the wants of many millers. In this country they sometimes follow the Smutter, and sometimes are used exclusively.

Many forms of brush, casing, and operation have been devised, but all are provided with a suction fan, which draws away from the grain the impurities as rapidly as they become detached by the action of the brush.

The action of the brush is not harsh, and as the machines are usually adjustable, so that the amount of brushing to which the wheat shall be subjected can be regulated at will, their use would appear to be both beneficial and desirable for some portions of the cleaning operation, and especially as the crease of the berry is by this process more apt to be acted upon than by any other with which we are at present acquainted. It is questionable, however, whether by the employment of the brush alone, satisfactory results will be obtained upon all varieties of wheat. Zealous advocates of the brush recommend that two, three, or even more of them be employed, and that the wheat be passed from one to the other until thoroughly cleansed or "scoured;" but we are of opinion that it will be beneficial to use the Smutter upon some of the harder varieties of wheat, as the operation of cleaning will be greatly facilitated without detriment to the bran.—*The Milling World.*

IMPROVING PROSPECTS OF TRADE.

(*From Martineau & Smith's Hardware Trade Journal.*)

There no longer appears reason to doubt the advent of that better day for which all who are in business have anxiously longed, bringing with it a return at least of activity if not of prosperity, and to a considerable extent dispelling the gloom which has so persistently overhung our industries. The symptoms of reviving trade were first manifest in the United States, where the transition from a paper currency to a genuine specie basis reacted in extinguishing panics and fluctuations in the money market and in restoring confiuence. Commercial stability in the United States is always accompanied by energetic speculation and rivalry in enterprises,—success in which is calculated not so much on immediate as on future needs. This reaction from lethargy to briskness operated in the stimulation of our own markets, and orders of gratifying magnitude began to pour in for iron, and for steel rails, and other manufactures. The movement thus initiated has now taken broader scope, and from most of the iron and mining centres comes the welcome intelligence of furnaces being blown in, collieries re-opened, and workshops employing larger numbers, and even running full time. Not alone in the production of raw material has the revivifying glow of dawning prosperity been diffused. It has been felt in different departments of skilled labor, and so cheering is the outlook that many are inclined to believe we have actually seen the worst of the bitter period of depression, and that English industry and inventiveness, instead of drooping, will reassert a powerful ascendency. It is even maintained that were our Transatlantic cousins to cease their patronage, the stimulus which has been given to trade would by no means die out, any such general reaction having intricate ramifications. It may not be that the high prices which have been obtained will continue, but we may expectantly trust that the business transactions of the future will be remunerative and encouraging, and not as in the immediate past, a matter of dubiety whether there has been loss or profit.

At a time like the present, manufacturers should more than ever be on their guard to sustain the credit of good workmanship in whatever they produce. And we also think that workmen should have a considerate and thoughtful regard for the interests of trade by laboring with head and hand honestly, and avoiding strikes as a lever to the raising of wages. They have by no means been the deepest sufferers during these years of despondency. Employers have been on the brink of ruin while awaiting the commercial revival. But there are signs that the warning so frequently given is held as cheap by the agitator and his dupes, and we may anticipate a most untimely recurrence of the usual revolts by which labor adjusts its accounts with capital. In contrast with these painful and violent remedies, will be the fair settlement of trade difficulties by arbitration, and let us trust that its principle will be approved as applicable to an increased proportion of disputes.

A HOROLOGICAL BUREAU.

Arrangements are now being perfected for the establishment of a horological bureau in connection with the Sheffield Scientific School at New Haven, Conn. A suitable building will be erected, a telescope mounted, clocks placed, and every possible convenience arranged to make the bureau as perfect and complete as possible. Mr. Waldo, the gentleman who is to have charge, is already upon the ground and directing the progress of the work.

There are already one or more establishments of the kind in the country—notably the one at Cambridge, which supplies the time for the railroads converging at Boston. But the supply of approximately correct time is the only use for which this and other observatories of the kind in this country have hitherto been employed, while the chief object of this new observatory, in addition to determining time, is the rating of watches, a thing which has not yet been attempted in this country.

To rate a watch is "to determine the rate of its gain or loss in respect to true time." Swiss watches are rated in Europe, and have been greatly improved thereby. No American watches have ever yet been rated, and manufacturers in this country are placed to disadvantage in consequence. Work of this kind has always been considered government work, or the work of scientic associations. It is now, for the first time, to be inaugurated here, under the direction of a liberally endowed association. This bureau will add nothing to the educational advantages of Yale, but will be simply a scientific work.

In initiating the work, after everything is in readiness, a sidereal clock will be started, as nearly correct as possible, after which observations will be made, to get absolutely correct time. In arriving at such a result, the sun is not the central point; but some of the numerous clock's stars, as they are called, whose time is known, will be selected and observations made at night, although with the larger stars observations may also be made in day time. The sun will be abandoned, because one observation in twenty-four hours is not enough; an observation may be made with each star every twenty-four hours. New Haven time will be taken, but New York time will be furnished also. The Waltham Company will send 100 or 200 watches for rating, as soon as everything is ready. "Rating" for private parties, we presume, is paid for, and will form, to some extent, a source of revenue to the bureau. This bureau will probably furnish standard time for the whole country, as time can be sent by telegraph and computed for any known longitude.

GELATINE NEGATIVES: WILL THEY KEEP?*

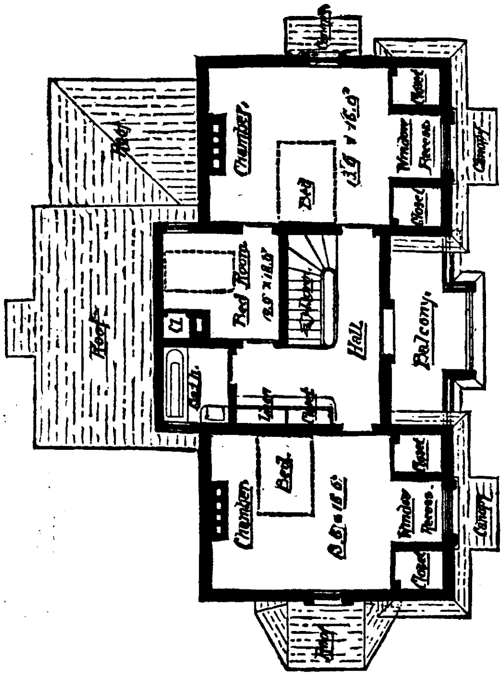
From the day I first developed a gelatine plate in October last until the present time I have been so satisfied with the fact that the "new" system of taking negatives is better than the "old" that I have never gone back to collodion and nitrate bath. For portraiture, groups out of doors, view, interiors, and copying, not one wet plate has been used, and the consequence is that I have now about 5,000 gelatine negatives. Everything has been satisfactory as to rapidity, rich detail, brilliancy, and convenience; but occasionally I have been dreadfully annoyed and alarmed as I have looked at my increasing stock of negatives, at the tendency of the gelatine to absorb damp, and so spoil some of my best productions—so alarmed that I have had secret forebodings that after all I must abandon my "new love." I have again and again asked myself—What are all the advantages, &c., if the negatives will not keep? Many negatives taken lately have been for publication; suppose that after a few dozen prints have been made the negative is spoiled, what about future orders?

During the past few months negatives have been brought to me from the printing-room quite spoiled, apparently through simply being caught in a shower of rain, for printing out of doors has been a risky kind of work of late. In my negative-room a pane of glass was broken, and the damp atmosphere attacked scores of negatives and so damaged them that they could not be printed from; in fact, these films are so sensitive to moisture that if in retouching a negative a wet finger be used to remove a mark the negative is injured at once.

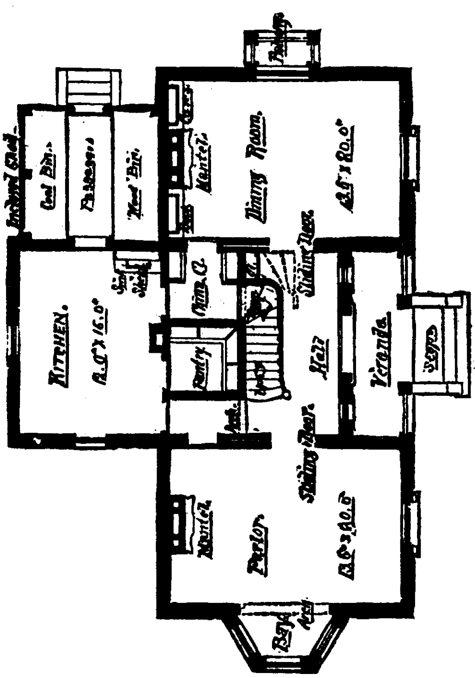
All my negatives, of course, are varnished, and all kinds of varnishes have been tried, but none I have used will prevent the damp from going through it to the gelatine. It has been suggested to me that imperfect fixing and washing was the cause, or that some trace of hypo. was left in the film. Showing one of these negatives to an eminent west-end photographer he decided that, without doubt, hypo. cyrstals were present. Now, however, hypo, may behave itself with collodion, it is a well-known fact to gelatine workers that whenever it is left in a gelatine plate the *film will never dry*; and, as I am careful to test for hypo. by washing the plate until the droppings from it are colourless on white paper, I knew it was not imperfect washing. Soaking in alum was suggested by a very successful maker of the plates.

At one of the weekly meetings of photographers—which, by the by, is forming one of the most practically useful meetings one could wish for—I presented a few negatives to show the effects on damp, etc. Amongst them was one which had been soaked for two hours in a saturated solution of alum. This negative was dried and varnished, exposed to rain-drops for a few minutes, and in a short time the unmistakable swelling commenced, proving the fallacy of the idea that you can make gelatine into leather by soaking it in alum!

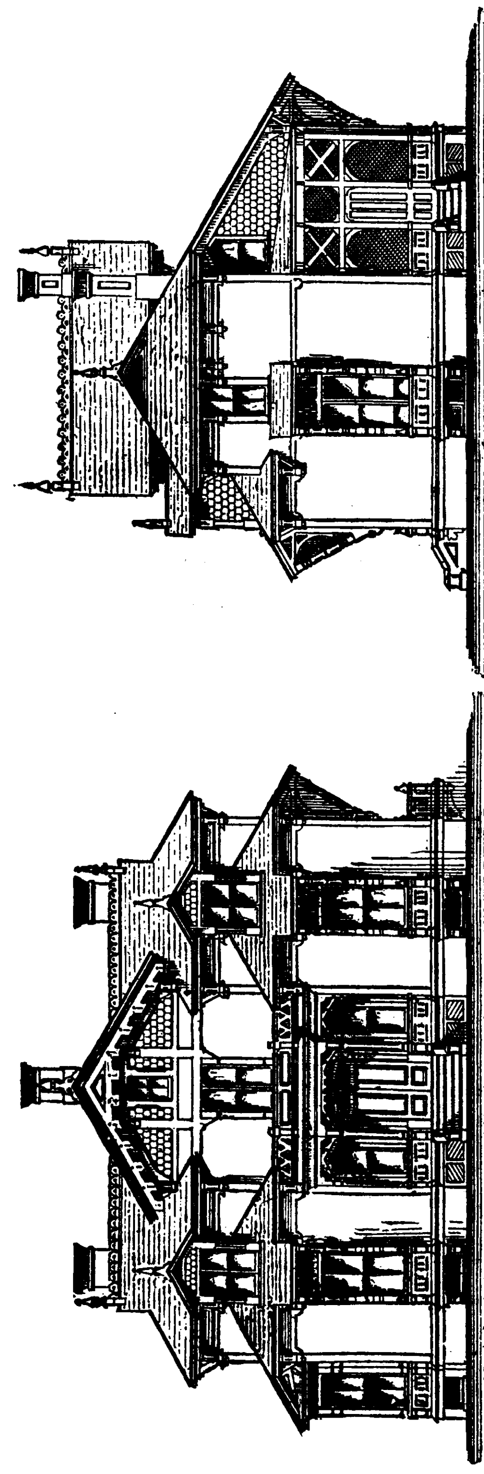
Now for the prevention and cure:—For the last four weeks I have had a negative purposely exposed to the weather, and, as every London photographer knows, it has been damp enough. This negative is as perfect to-day as on the day I put it out of doors. It was treated thus:—After thoroughly desiccating the gelatine by heat it was allowed to cool, then coated with plain collodion, and afterwards varnished. I know by experiment that benzole and India-rubber will protect a negative in a similar way, but I would not recommend it. In reference to those negatives that have been damaged: if they are carefully revarnished I find but very slight traces of the previous markings will be left.



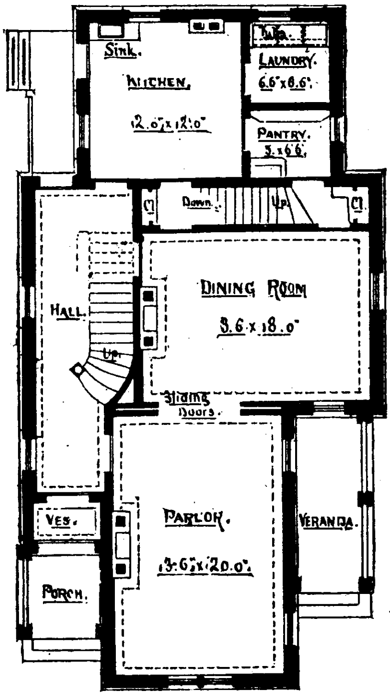
SECOND FLOOR PLAN.



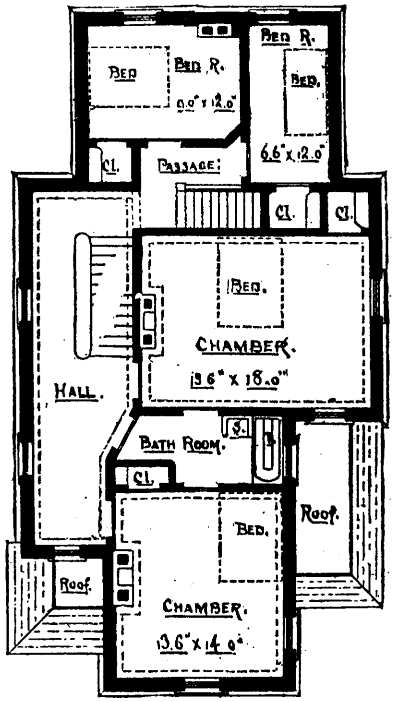
FIRST FLOOR PLAN.



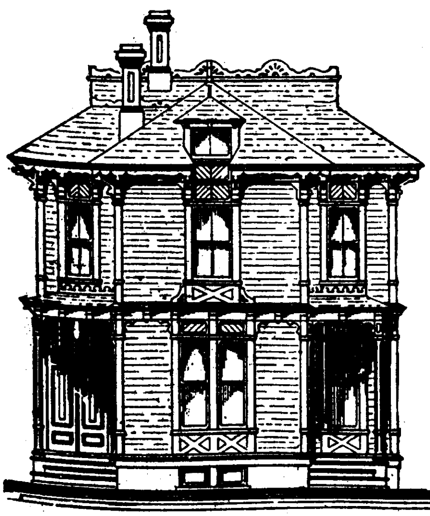
FAMILY HOUSES—NO. I.



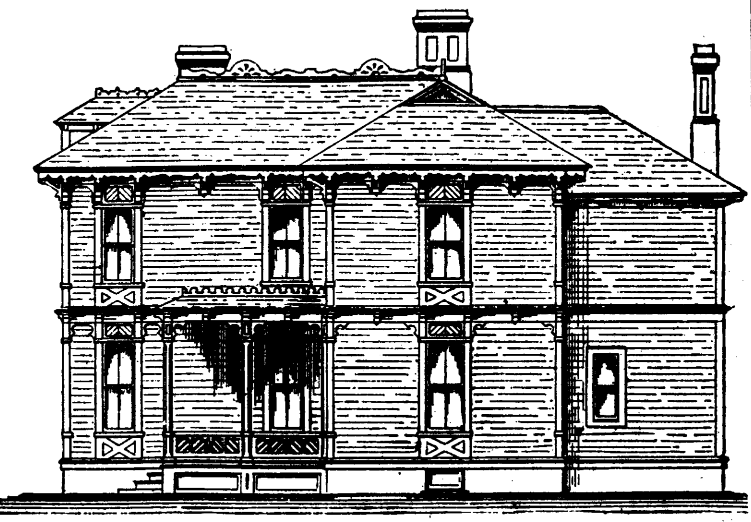
First Floor Plan.



Second Floor Plan.



Front Elevation.



Side Elevation.

FAMILY HOUSES—No. 2.

Practical Hints.

DESIGN AND WORK IN CABINET FURNITURE.

By A. Cabe.

The accompanying sketch is a design for a wardrobe, executed in American walnut. This suite is suitable for a bedroom of large dimensions, and consists of the wardrobe here shown, a six-posted bed, cheval glass with pedestals, washstand, night commode, three chairs, and a towel horse, together with window cornices to match.

The American walnut is generally straight in the grain, and with little or no figure. In the present design the whole is solid, no part being veneered, and all the cuttings and chamferings are ebonized.

The wardrobe consists of a base or plinth, 5 in. deep, on which rest four carcases. The low carcase in the centre contains three drawers; it is 2 ft. 6 in. high, and 3 ft. 5 in. across the face; over it is a carcase, same depth and breadth. It has two broad pannelled haffits, and a door with a mirror in the centre. Inside this carcase are three shelves. The two wings are each 24 in. square and 5 ft. 6 in. high. They are used for hanging garments, and are fitted with brass hooks for that purpose. The three cornices are made separately, and fixed in their places with screws. The cornices consist of a ⅝ square fillet, a 2 in. frieze, then a 1½ in. cavetto, and over it an inverted ovolo, and over all a blocking course, 2 in. high, and cut as shown. The doors and outer gables are framed of 1¼ in. wood. These frames are checked (not grooved) on their inner edges for the panels, the latter being fitted in after polishing, and fastened with beaded slips, 3-16 in. thick. The gables of the inner carcases need not be walnut to the back, only about 4½ in. on the front edges being necessary. In the lower carcase they are 1¼ in. thick, as also the shelves between the drawers. These latter, are, however, only 4 in. broad, with fillets of the same thickness going to the back on which the drawers run. The gables of the upper centre carcase are of ⅞ wood. The two broad haffits on either side of the mirror are framed of ⅞ in. wood, with the panels let in from behind. The mirror frame, which acts as a door and is pivot-hinged, is of 1¼ in. walnut. The carving on top and bottom rails of doors is executed before the doors are framed together. The base is constructed of solid black walnut ⅞ in. thick, and secret dovetailed at the corners, and the same with the cornices. It may also be done by making base and cornices of ⅞ pine, and clamping with ⅜ in. walnut, mitreing the corners. In this case a molding has to be made and planted on upper edge of base, to conceal the fir. The whole job is dull polished; and finished with mediæval brass mounting.

Gilding Fretwork, etc.—The first thing to be done is to whiten the work. To do this scrape some whitening very fine, place it in a pipkin with a lump of gilder's size, and water sufficient to make it of the consistency of thick cream, when heated over a fire; then, with a camel-hair pencil, paint it on the object several times, allowing each coat to dry before applying the next. When the several coatings have raised it to the thickness of 1-16 in. set it aside for twelve or more hours, to harden; when hardened smooth the surface with very fine sand-paper first, and finally with a piece of cork; when using the cork frequently dip it in water, and, when practicable, use it in a circular motion. Thus far successful, the next thing is to lay on the gold. To gild, then, dissolve some gilder's—not common size—in water, and heat, and with a full brush lay it on the surface of the object. Cut the gold lead, on a pad of buff leather, with a clean cut of the knife (much easier said than done; perseverance, however, with the cost of a book or two of gold mutilated, and a large amount of patience exhausted, will overcome the difficulty), to the size required; take these up on a tip (a row of long hairs placed between two bits of cardboard)—the professional way to do this is to strike the hair of the tip against the gilder's own whiskers or hair—and gently lay them on the surface of the object, taking care that each succeeding piece slightly overlaps the preceding. When dry, a small piece of fine sponge, dipped in a weak solution of size water, should be gently passed over it, to give a uniform appearance. If the bright gold requires to be deadened, deep ormolu should be used in a similar way after sizing. The yellow used for the ungilt portions consists of gilder's yellow, dissolved in size water, and is put on with a brush.

Dissolving Glue.—The amount of water necessary to dissolve the glue in practice is to put plenty of cold water on the glue and let it soak over night; in the morning pour the excess of water all off, and it will be found that the glue is much swollen and softened, and requires nothing more than a moderate heat—a little below the boiling point of water—to become liquid. As the better qualities of glue absorb much more water that the inferior kinds, the quantity of water necessary to dissolve say one pound of glue, is quite variable, therefore no reliable measure can be given. It is the same with isinglass, which is nothing, but another kind of glue. Gum ragacanth takes still more water; this and the gum arabic are dissolved in as much water as will give to each the consistency of thick syrup. The same is done with the solution of shellac in alcohol; when all are mixed and white lead added, it has a tendency to become thicker, but this is corrected by the glycerine and alcohol, which are not absolutely necessary for the sticking qualities, but only serve to preserve the mixture, as without them it soon spoils by the deterioration to which glue is subject when kept in a liquid state in closed bottles. If you leave the bottle open, and let the glue freely evaporate, adding water when it becomes too thick, you can keep small quantities of glue and mucilage without alcohol, any length of time, but not in closed bottles.

Imitation Oak Floors.—A simple and beautiful method of giving to floors an almost perfect appearance of oak or waluut has come into vogue in London, and is largely increasing in popularity. The method consist in putting one ounce Vandyke brown in oil, three ounces pearl ash, and two drachms dragon's blood into an earthenware pan or large pitcher; on this mixture is poured one quart boiling water, and the whole stirred with a piece of wood. The article may be used hot or cold. The boards are first smoothed with a plane and sand-papered, the cracks being filled with plaster of Paris, and then a stiff brush is dipped into the stain, and with this it is well rubbed in—the brush being rubbed lengthwise of the boards. Only a small piece is prepared at a time. By rubbing in one place more than another, an appearance of oak or walnut is more apparent. When quite dry, the boards are sized with glue size, made by boiling glue in water and brushing it in the boards hot, and on this becoming dry, the boards are papered smooth and varnished with brown hard varnish, or with oak varnish—the first-named kind wearing better, and drying quicker if previously thinned with a little French polish, a smooth brush to be employed in applying it to the boards.

Imitation Ivory.—Harris' patented imitation ivory is made by dissolving 100 grammes of glue in one litre of water, 50 grammes of alum in 1 litre of water, and mixing 50 grammes of good bleached cellulose with 3-5 litre of water. The moulds are carefully oiled with a mixture of equal parts of goose-grease and lard; then a mixture is formed, in an earthen vessel, of 75 grammes of the glue solution, 200 grammes of the cellulose water, 200 grammes of water, 250 grammes of finely-sifted gypsum, and 200 grammes of the alum solution. The mass is placed in moulds by a spoon, shaken so as to remove bubbles, and left to set and thicken. It is then removed from the molds, covered with a woolen cloth, the superfluous water pressed out, and after it has completely stiffened the fat is removed by hot water. It is then dried and soaked in a hot mixture of equal parts of wax and stearine. After cooling, it is brushed until the ivory lustre shows itself.

Black Enamel.—If wood is immersed in sulphuric acid it is dyed a jet black, and when dry can be polished by rubbing with a bone spatula; but what would suit best, I think, is the following:—Grind up very finely some drop black in water, put the paste in a cup and mix it with a little size or very thin glue, brush the wood over with this, let it dry, sandpaper it and give it another coat, allowing that to dry well, and again apply some worn emery or sandpaper. If well covered you may now French polish, when you will have a brilliant black surface. If it is not a flat surface, brush over with a coat or two of polish varnish, made the same as French polish, only a little thicker.

Embossing Wood.—The wood to be ornamented is first worked out to its proposed shape; then with a blunt steel tool, the pattern is made, by driving it cautiously so as not to break the grain of the wood, till the depth of the depression is equal to the intended prominence of the figures. The ground is then reduced by planing or filing to the level of the depressed part. After which the wood being placed in water, the part depressed will rise to its former height, and thus form an embossed pattern. Another process is to use metallic dies, which are made red-hot, and then pressed on the wood. The pattern being thus burnt in, the chased portions are brushed out, and the design finished by hand.

Setting the Mad to Cure the Mad.—At an asylum in Vienna (says the *Union Médicale* quoting from the *Danube*) a novel method of treatment has been adopted. The director has established a lithographed journal for circulation in the asylum, and he induces the patients to contribute to it. Especially he encourages them to refute the manias of their comrades. The man who believes his nose to be made of sugar candy and liable to dissolve, he says, can argue with excellent logic against the folly of his friend's theory that his beard is a tender plant and needs frequent watering. As a rule, they are able to discuss with good sense all subjects except those which concern their peculiar delusion.

Stains for Leather.—The following processes are recommended by M. Reimann. For a blue color: Dissolve 10 grammes of aniline blue and five grammes of size or glue in 1,000 grammes of water. Brush the leather over well three times with this solution, allowing it to dry thoroughly between each operation. Finally polish with yoke of egg. For a lilac color: Dissolve 10 grammes of tannin in a litre of water, and brush the liquid well into the leather. Then, immediately afterwards, brush it over three times with a solution of 5, 10, or 20 grammes (according to the depth of color required) of violet methyl in a litre of water, wash over with pure water, and finally polish by rubbing vigorously with a preparation of 10 grammes of isinglass, and the same quautity of pure glycerine in 100 grammes of water.

Preserving the Eye.—Surgery can justly boast of a new conquest. When an eye is severely wounded the healthy one is in danger of being impaired by "sympathy." To preserve the good eye, it was hitherto the practice to remove the injured one. Dr. Boucheron has discovered that by cutting the ciliary nerves the "sympathy" is stopped, and this dispenses with the necessity of removing the injured organ. Forty surgeons have thus operated successfully.

Polishing Horn.—The surface must first be prepared by scraping with a steel scraper; the polish 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 rotten stone on a piece of old cloth.

Polish for Walnut Wood.—Mix with two parts of good alcoholic shellac varnish, one part of boiled linseed oil, shake well, and apply with a pad formed of woolen cloth. Rub the furniture briskly with a little of the mixture until the polish appears.

CARVING FRET WORK.

By Thomas Stopher.

Fret work, however simple, is capable, with proper treatment and proper tools, of receiving much improvement. The most elaborate and well attached patterns are susceptible of receiving some of the most beautiful and life-like touches of the carver's art, especially in the case of bas-reliefs in hard wood. A few remarks from my own experience, and from the love of wood carving I have always had, may throw a little more light and information upon the art. Many persons have not the slightest knowledge of how the work is performed, believing, as I have often been told, that it is all done with some kind of knives. They call fret work carving; in fact, almost any kind of scroll work, curved mouldings, moulded panel work, composition castings, *papier maché*, etc., passes with most people for carving. Some years ago a Burnt Wood Carving Company set up and succeeded in a method of using iron moulds, heated sufficiently to burn away the wood to certain shapes, by this means reproducing a great variety of good examples of wood carving. The work required a little cleaning up, and great quantities were floated off in cabinets, mantel-pieces, etc., as genuine carving. The deception soon became exposed, and I believe the company burnt their fingers and collapsed.

A gentleman lecturing a short time ago upon Art Furniture, observed that "the country was literally flooded with tons of rubbish, a libel upon the very name of carved furniture. Perhaps allowance ought to be made for a lack of knowledge in this respect. We have just passed a period of very excellently constructed furniture. We cannot blame the manufacturer or the purchaser so very much, for the very reason of its cheapness. To see rooms grandly furnished at half the cost of good work, and yet have all the appearance of genuine, is a tempting and powerful inducement to purchase, but there is very little doubt the time will come when this false economy will betray its own worthlessness." Imitation of old work, especially carving, has been and is carried on to almost a faultless pitch, and as an extensive desire exists to possess real old work a few practical rules will assist to guide the purchaser. If the hand is carefully passed over old work no unpleasant or sharp edges can be felt, but if the work is imitation, staining must be resorted to to match the color, the edges, with their recent sharp cut of the tool, can be easily detected, for all the most careful sand-papering cannot entirely remove them. Burnt wood carving and composition have no edges at all, and there is a most entire absence of undercutting. There is no reason why old material should not be judiciously made up, guarding against blending together the extremes of different styles of framing, moulding and ornament. The success of the undertaking depends entirely upon the knowledge possessed by the manufacturer of different styles. The purchaser ought also to make this latter a question of study. We are sometimes at fault with regard to the age of buildings, furniture, etc., owing to tastes for styles of work receding, just as we now occasionally see highly ornamented buildings designed and carved out by architects in fifteenth, sixteenth and seventeenth century work. Fashion has played a considerable part in the development of a love for wood carving, and scarcely any house of well-to-do persons would be considered furnished without its little bits of Swiss or German carving, and very often these are quite the lions of the drawing-room, and visitors are most profoundly informed they were purchased by their informant himself on a Continental tour, with the additional stereotyped information, as I have often heard, that all this kind of work is performed by shepherds and boys and girls, during the long winter evenings, with pocket knives. I should like to see some of their charming little chamois executed by this means.

Carvers are divided into various classes in the trade, and are recognized as ship carvers, chair carvers, cabinet carvers, architectural carvers, carvers and gilders, and stone carvers. Carvers and gilders may be said to be almost a misnomer, as most of the gilders of the present time know little or nothing of carving, nor is it necessary for them, as nearly the whole branch of their ornamental art consists of prepared composition; by this means the costly and elaborately carved picture-frames of half a century ago are superseded. I am afraid this once busy and beautiful branch of the carver's trade can never return; the present excellent designs and construction carry with them the great Herculean lever of this age—cheapness. An impression exists in the eastern counties that most of our old wood carvings in our churches, old timbered houses, furniture, etc., was imported from Belgium. It is probable the carvers themselves migrated here from that country and practised the art, and no doubt a good staff of native carvers soon began to ply the calling, and local influences to have their effect upon the nature of their productions. The introduction of specimens of foliage peculiar to the neighborhood is a well-known fact, and sea weed and common forms in carvings in our churches along the coast are especially to be noticed, whilst inland the foliage of forest trees was introduced. Carvers, as a rule, stick to the effect of training. I think I may assume the rule has always held good, and that we very early possessed a great deal of carved ornament purely English, and executed by English carvers. The repetition of certain kinds of ornament all over the kingdom leads me to imagine carvers traveled from place to place to execute the work required to be done, as they do now, and after the manner of masons, who have been distinctly traced from building to building by their trade marks. We find all our tools of the present time exactly fitting the old ornaments of bygone times.

I will now endeavor to give some account of the difficulties the accomplished wood carver has to surmount. Like all other artistic pursuits the art must be practised with method. The experience that has been brought to bear upon it to bring it to its present state of perfection has been handed down from time immemorial. It takes a carver's lifetime to become acquainted with all the trickery adopted by the trade, and to attain a knowledge of all the various styles of ornament is simply impossible during the life time of a carver. Men become acquainted with a certain style, become attached to it; the result is comparative perfection, probably, in that style, with a very limited or imperfect knowledge of any other, and so the carver ends his days. Grecian, Composite, Italian, Renaissance, French, Jacobean, Rococco, Gothic, Elizabethan, Queen Anne, and Victorian, comprehend no small field of study. Some men delight in the slow tedious execution of minature works; others in the bolder flights of sculptured figures—historical, scriptural, poetical, or otherwise; others in the graceful flow of foliage, animals, birds, etc., combining probably portions of the whole range of the wood carver's art. A comparison between this, the highest walk of the artist wood carver, and the lowly efforts of the amateur fret work carver, is not intended to discourage the latter, but simply to remind him what a vast and endless field of variety is spread before him, and that, to achieve success at all, correct application and method must be the starting point.

The tools used by wood carvers consist of square firmer chisels, corner firmers, flat and quick gouges, parting tools, veiners, grounders, bent-backs, chaser, picker and point; nearly all kinds are both straight or crooked, and the number varies from sixteen to twenty dozen. My own stock consists of quite the latter number, varying in size from the 64th part of an inch to 1½ inches, and not one but is occasionally used, besides a variety of stamps for ground work, borders, etc. For sharpening the tools an oil stone and a quantity of Turkey arcansa. Charnley Forest blue stone, and thin slips of slate, to fit the various shapes and sweeps, besides the use of flour of emery and oil for all the very finest tools, and a prepared strop for producing a fine edge. It is rare that an apprentice can properly sharpen his tools at the expiration of his term, and some men never have the patience to put their tools in proper order. Perfectly shaped tools (with the exception of chisels and grounders) should have a slight curve from right to left, and should be rubbed out from the inside, as well as ground from the outside; the latter is done by getting different thicknesses of quick cutting York sandstone, and shaping to the curve of the tool before rubbing out, to make thin on the edge and wedge shaped. The crooked tools must be done on small wheels, on a spindle attached to a lathe, with emery and oil. For soft wood, tools require to be very thin (for clean cutting), and for hard wood, *vice versa*. The various forms of delicate tools to be found in a carver's perfect outfit are invaluable, and cannot often get into the hands of amateurs; and if they did they would soon become useless, on account of the skill required to keep them in proper order.

As soon as any piece of work is put into the carver's hands, his first question is how to hold and execute it without injury or soiling. The methods are very numerous, but the use of the carver's screw and holdfast are the principal. For carving fret work one method will be sufficient. A bench or plank three inches thick, of any size, faced up true, that the work may lie firm and even upon the surface, and a few small screws, after the manner of carver's screws, placed round the edges, or in the strongest part of the centre of the work, is the best method. The wood selected for fret work and carving ought to be free from shakes and knots, not too hard and steely, and yet not too soft and dead—a medium between the two extremes. The latter exists more or less in all kinds of wood. If the wood is too hard it turns the edge of the tool, and if too soft or woolly it puzzles the amateur, because even the sharpest of his tools refuse to cut it kindly. It generally happens that fine grained soft wood is best, and hard wood should be light in proportion to its bulk. It should be well seasoned to prevent curling. As I have said before, the best quality is not the most abundant. Experience will best teach what is best to use. The workman having selected the wood, and fret worked some simple pattern (one that has been prepared and outlined for carving), and secured it to his bench by the method above named, will find nothing more puzzling than the mastery of the grain. Tearing, splitting, and breaking off, are the first fruits of his labor. One general rule must be observed, viz.: commence working at all the parts to be cut deepest, and to use our term, roughed or bolstered out. Then take most tender parts, working from the weakest to the strongest parts, such as the points of leaves towards the centre. All that can be should be done without turning the work about, but rather than risk injury turn it sufficiently. Try to use both hands as soon as possible, and, whether the tool be in right or left hand, use one as a guide and defence to govern the tool from blundering forward. The wrist or arm should be pressed upon the bench to assist in government of the tool. Let the tool cut away all the wood it can fairly, but better under than over the mark. Be careful not to force the work. The shapes of tools should fit the work to be executed, and the tools should be changed as the form of the work changes. In cutting diagonally across the grain guard against tearing, using a flat tool at right angles from the direction you are working, and pare it down carefully to the shape required; draw the edge of the tool lightly over difficult parts, like a scraper, but avoid it, if possible, as it blunts the tool, and it is unwise to blunt it unless you are prepared and competent to sharpen it. Go on with regular method; avoid rambling from one part of the work to another. Guard against the childish desire to see the work finished before it is fairly begun; this weakness frequently spoils the whole undertaking. In finishing work, work away from the parts you are executing; by this means you avoid injury, breaking or soiling. A hard, short hog's hair brush is used with advantage and good effect when the carving is finished; a stiff piece of brown paper may be laid upon the completed part, to keep it clean while the rest is being executed. Tools properly prepared for such light work as fret work, ought, with the application of a properly prepared strop, to be sharp enough to work for months.

The form of leaves is executed in an endless variety of ways regardless of thickness. Although the generality of nature's forms are flat, we take unbounded liberty with them; we treat them either naturally or conventionally, terms we understand in all branches of the trade. The correct outline of most foliage should be, and is most generally followed. Leaves are formed quite flat, convex, concave, wavy, high in the middle, low or hollow on the edges, half turned, right or left, turned over or lapped over; the veins of leaves are raised, or sunk or lined out; the edges are round, saw toothed, or ragged, and often for correct and good appearance have a small square taken off their entire edges. Flowers of three, four, five leaves or more are treated similarly to leaves in many respects. Fruit, such as berries, pods, petals, or cups, are either rough or smooth. Stems are either round, square, or octagon, straight, or in short lengths, from knot to knot, or twisting. The tooling of the stems consists of straight lines, alternate straight lines, twisted lines, in hazzled zig-zag fashion, using the tool from right to left with a rocking motion. Sometimes the whole of these methods are used at once with stamps to give the appearance of the roughest bark. The form of corn is generally bold and prominent, following its ripe appearance. The grass of wheat and barley has an endless variety of twists, with fine lines running through on either side. Natural specimens are of course always the best guide, but when not attainable the beautiful and careful construction of artificial flowers can always be obtained.

HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

HEATING-SURFACES.

All radiators, box coils, flat coils, plate or pipe surfaces, arranged to warm the air of buildings, are heating surfaces.

The vertical tube radiator is now the accepted type of a first-class heater, and most all manufacturers have their own peculiar style with varying results as to efficiency, and the steam fitter or purchaser should use great caution in the selection of radiators.

The common return-bend radiator, Fig. 1, is the most widely manufactured, it is not patented, and is second to no other vertical tube heater.

The construction is simple, a base of cast iron, A, being simply a box without diaphragms, with the upper side full of holes, about 2¼ inches from centre to centre, tapped right-handed; a pipe, B, for every hole, 2 feet 6 inches or 3 feet long, threaded right and left handed, and half as many return bends, C, as there are pipes tapped left-handed.

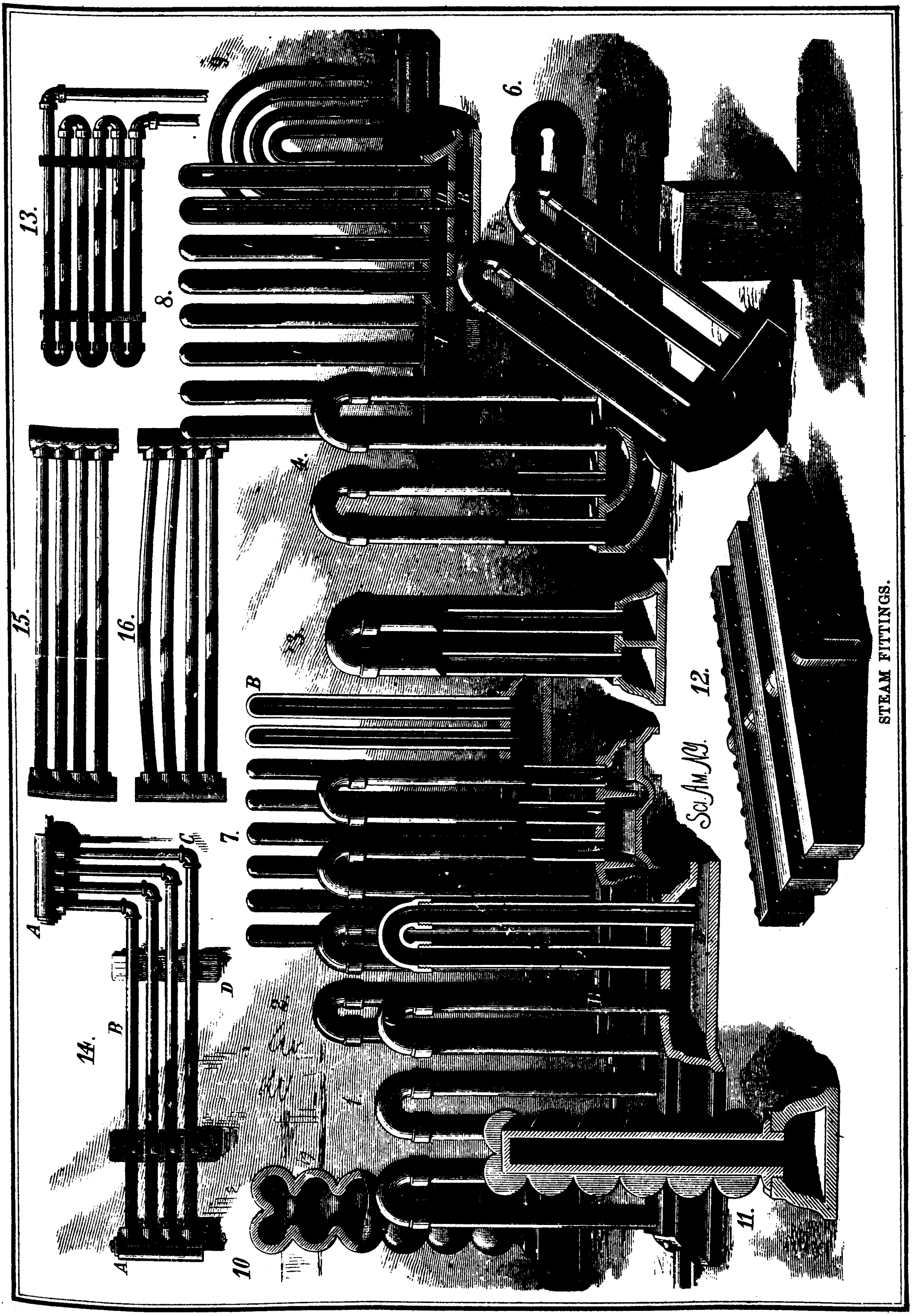
The manner of putting these heaters together is to catch the right-handed thread of two pipes one turn in the base, then apply the bend to the upper and left threads of the same two pipes, and screw them up simultaneously with a pair of tongs on each pipe, and a second person holding the bend with a wrench made for the purpose.

Steamfitters who buy bases and make only a few radiators to keep the boys at work when in the shop, should count each set of threads in, but they who make for the trade gauge their threads and pipes so as to always enter the base first. If the pair of pipes in any one bend are not plumb, screw the pipe at the side from which they lean a little tighter; this will shorten that side and draw the bend over.

I will here explain the action of steam entering a radiator, as nearly all the patents on the so-called positive circulating radiators are to facilitate the expulsion of the air and the admission of steam.

The general impression among steamfitters is that when steam enters a radiator the air is backed up and confined in the top of the pipe, and so it will be when the pipe is single and closed at the top, without any of the usual means to get it down; *this is so*, although steam is not quite one-half the weight of air, and it may seem an anomaly to the scientific engineer.

When two pipes are connected at the top with a bend, or when there is an inside circulating pipe or diaphragm of sheet iron slipped into it, the air immediately gives way and falls in the pipes nearest the inlet first; but should there be no air valve on



STEAM FITTINGS.

the radiator, the air will be crowded at first to the further end of the radiator, and should the system be a gravity circulation, without an outlet to the atmosphere, it will remain in the radiator, impairing its efficiency and often deceiving the novice, as it in time heats by contact with the steam ; but when there is a thumb cock or air valve on the radiator, usually on the furthermost pipe from the inlet, the result is quite different. In the common return-bend radiator and others of good construction the action is direct, and the pipes heat consecutively, excepting, perhaps, the pipe the air valve is on and a few near it which sometimes heat ahead of their order, on account of the draught of the air valve.

Thus when the steam enters a well-constructed radiator the air falls to the base and is driven out at the air valve, the pipe of which may be run down inside the base (as seen at D, Fig. 1), which will bring it into the lower stratum, drawing it off to the last.

This is the most simple test for a good heater, and any make of radiator that nearly always has a few cold pipes, sometimes in one part of the heater and sometimes in another, should be avoided.

Fig. 2 shows a device (patented) for making a return bend radiator positive. The pockets, A A, filling with condensed water, makes a seal which at times prevents the flow of steam along the base and forces it in a continuous stream through the pipes (see arrows in cut).

Figs. 3 and 4 show cross section of modifications of positive return bend radiators. Fig. 3 can be used as a vertical radiator only, but Fig. 4 can be used in any position from perpendicular to hoizontal, as seen at Figs. 5 and 6, and is peculiarly adapted to indirect heating.

Single tube radiators welded, or closed at the top with a cap, with an inside circulating device, are also much used ; some of them compare favorably with the return-bend radiator, but are slower in heating.

Fig. 7 shows the first of this class put on the market. A is the cast iron base, B the welded tube, and C the septum of wrought iron slipped inside the tube and projecting an inch into the base. This heater depends on the gravity of the air for a circulation.

Fig. 8 shows another heater of this class which is positive in its action. A, cast iron base ; B, diaphragm cast in base ; C, welded tube ; D, inside tube, open top and bottom and screwed into the diaphragm. The action of the steam can be seen by the arrows.

Fig. 9 shows a fire bent tube radiator very positive in its action.

Cast iron radiators are of two kinds, *plane* and *extended* surfaces.

Plane surfaces, as the trade understands them, may be either flat, round, or corrugated, provided the coring or inside surface of the iron corresponds and follows the indentations of the outside, as in Fig. 10, and all wrought iron heaters. Extended surface is understood when the outside surface of the heater is finned, corrugated, or serrated, with the inside straight, as in Fig. 11.

For direct radiation where the heater is placed in the room there is little or nothing gained by having the surface of the heater extended, and a steamfitter in calculating the extent of his heating surfaces should not take into consideration the whole outside surface of such a heater ; he should simply treat it as if the projections were cut off, leaving a flat or plane surface.

For indirect heating (the coil to be under the floor or in a flue) the result is a little different when in comparison with shallow plane surface coils, where the air cannot stay long enough in contact with them to get thoroughly warmed, but presses into the room without hinderance. In this case the extended surface gives a better result, not because a square foot of the surface can transmit as much heat in the same time, but because it hinders the direct passage of the air, holding it longer in contact and preventing stratification.

The cast iron vertical tube radiator is a quick heater, the large size of the tubes causing large and few chambers, which expedites the expulsion of the air.

Fig. 12 shows stack of cast iron extended surface radiators for indirect heating.

Sheet iron radiators are used in very low-pressure heating, the commonest form of which is the flat Russia iron heater, seamed at the edges and studded or stayed in the middle, with a space of about ⅜ of an inch between the sides. They are used in a one pipe job.

COILS.

Coils are always made of wrought iron steam pipe and fittings, and though not considered an ornament are first-class and cheap heaters.

Fig. 13 shows a *flat coil*, which is a continuous pipe connected with return bends at the ends and strapped with flat iron, which is a very positive heater.

Fig. 14 shows a miter or wall coil. It is composed of headers or manifolds, A A ; steam pipes, B ; elbows, C ; and hook plates, D.

There are many modifications of this coil, but one indispensable point in the making of it is, it must *turn a corner* of the room or miter up on the wall. The pieces from the elbows to the upper header are called *spring pieces*, they are screwed in right and left, and are the last of the coil to be put together.

If a coil is put together straight between two headers, as seen at Fig. 15, it will be like Fig. 16 when heated, and cannot be kept tight for a single day, the expansion of the first pipe to heat being a powerful purchase to force the headers asunder, and when it cannot do so it will spring them sidewise.

TO ESTIMATE THE AMOUNT OF HEATING SURFACE NECESSARY TO MAINTAIN THE HEAT OF THE AIR OF ENCLOSED SPACE IN BUILDINGS TO THE DESIRED TEMPERATURE.

The ordinary rule-of-thumb way of the average pipe-fitter is to multiply the length by the breadth of a room and the result by the height, then cut off two figures from the right hand side, and call the remainder square feet of heating surface, with an addition of from 15 to 30 per cent, for exposed or corner rooms.

In the computing of heating surfaces there is much more to be considered, and it is evident the amount of surface necessary for a good and well constructed building will not be enough for a cheap and poorly put up one.

The cubical contents of a room occupies only an inferior place when estimating for large rooms and halls, and no place at all in figuring for small or ordinary office rooms or residences, which are heated from day to day throughout the winter.

Suppose a small room on the second floor of a three-story building with only one outside wall, with no windows, but the whole furred, lathed, and plastered, with all the other rooms of the building heated and maintained to 70° Fah. ; now place a portable heater in this room and keep it there until the room is heated to 70° also, then remove it. How long will it take to cool 10° ? Answer, perhaps three hours. Now make a window without blinds, and you find it cools 10° in less than half the time. Why? Because the glass of the window being a good transmitter of heat, it is able to cool more air than the whole outside wall. You may now say : What about the inside walls and floor? Why, they actually help to maintain the heat in the room by conduction, etc., from the other rooms.

Thus the windows are the first and most considerable item. Secondly, the outside walls, how they are plastered—whether on the hard walls or on lath and furring. Thirdly, the prospect —whether exposed or sheltered. Fourthly, is the whole house to be heated, or only part of it? and, lastly, what the building is to be used for.

TABLE OF POWER OF TRANSMITTING HEAT OF VARIOUS BUILDING SUBSTANCES, COMPARED WITH EACH OTHER.

Window glass	1,000
Oak and walnut	66
White pine	80
Pitch pine	100
Lath and plaster	75 to 100
Common brick (rough)	120 to 130
Common brick (whitewashed)	125
Granite or slate	150
Sheet iron	1,030 to 1,110

In figuring wall surface, etc., multiply the superficial area of the wall in square feet by the number opposite the substance in the table, and divide by 1,000 (the value of glass), the product is the equivalent of so many square feet of glass in cooling power, and may be added to the window surface and treated the same.

The following method has given good results and is not wholly empirical. The writer has used it for many years in preference to any other:

Divide the difference in temperature between that at which the room is to be kept and the coldest outside atmosphere, by the difference between the temperature of the steam pipes and that at which you wish to keep the room, and the product will be the square feet or fraction thereof, of plate or pipe surface to each square foot of glass or its equivalent in wall surface.

Thus : Temperature of room, 70° ; less temperature outside, 0° ; difference, 70°. Again : Temperature of steam pipe, 212°; less temperature of room, 70° ; difference, 142°. Thus : 142 ÷ 70 = 0·493, or about one half a square foot of glass-heating surface to each square foot of glass or its equivalent. For each additional mile and a half in the average velocity of the wind above fifteen miles per hour add ten per cent. to the heating surface.

In isolated buildings, exposed to prevailing north or west winds, there should be a generous addition of the heating surfaces of the rooms on the exposed sides, and it would be well to have it in an auxiliary heater, to prevent over-heating in moderate weather.

In windy weather it is well known to the observant that the air presses in through every crack and crevice on the windward side of the house, and should they take a candle and go to the other side of the house they will find that the flame of the candle will press out through some of the openings. Thus the air in a house blows in the same general direction as the wind outside, and forces the warmed air to the leeward side of the house; this is why the sheltered side of a house is often warmer in windy weather.

Conditions which tend to the warmth of a house in windy and cold weather without stopping the leakage of air under doors or around windows are : 1st, blinds on the windows inside ; 2n, blinds on the windows outside ; 3rd, window shades and curtains ; and, last, papered walls. The leakages are really blessings in disguise in houses which are not systematically ventilated.

Lead or zinc paint should not be used on heaters ; several coats of lead paint may destroy their heating power from fifteen to twenty per cent. Ochre and oil, or varnishes mixed with color, are the least harmful.

How the Body is Built up.—The muscle and fat of the body, remarks the *Journal of Chemistry*, are derived from the food, and animal heat is evolved from their combustion or their combination with the oxygen admitted by the lungs. When the muscles are inactive, slow combustion goes on ; and for every grain of carbon burned, a perfectly definite amount of heat is produced. When the muscles contract, the combustion is quickened, and the additional heat is liberated in the muscles themselves. If external work be done, as in lifting a weight or hammering a nail, the heat is no longer developed in the body, but transferred to the weight lifted or the raised hammer, and is liberated when they fall, and the heat thus liberated is exactly equal to the combustion inside the body. Thus the body is an apparatus efficient beyond all others in transforming and distributing the energy with which it is supplied, but possesses no creative power. A man weighing 150 pounds, by the consumption of a single grain of carbon can lift his body to a height of eight feet, and by the consumption of two ounces, four drachms, twenty grains, to a height of 10,000 feet. Mayer maintains against Liebig and others, that the muscles in the main play the part of machinery, converting fat into the motive power of the organism. He saw that neither nerves nor brain possessed the energy necessary to animal motion, and believed they held fast or let loose muscular energy as an engineer, by the motion of his finger in opening or closing a valve, liberates and controls the mechanical energy of a steam engine. These views are now quite generally accepted by scientific men.

Horse Power of Water Falls.—Stephen Roper gives the following rule for finding the horse power of water falls : Multiply the area of the cross section of the water fall in feet, by its velocity in feet per minute ; this product will give the number of cubic feet flowing through per minute. Multiply this by 62½ pounds, the number of pounds in a cubic foot of water ; multiply this last product by the fall in feet, and divide by 33,000. The quotient will be the horse-power of the water fall. Example : With a stream or flume 10 feet ; depth, 4 feet ; area of cross section, 40 feet ; velocity in feet per minute, 150. Then, 40x150 = 6,000 cubic feet of water per minute ; 6,000x62½ = 375,000 pounds of water per minute. 10x375,000 = 3,750,000 foot pounds of the water fall ; 3,750,000 + 33,000—113 7-11 horse power of water fall.

A New Steam Packing.—A packing for the joints of steam pipes and like connections, consisting chiefly of India-rubber, plumbago and iron filings, has been recently introduced. It is applied in a semi-fluid state, soon vulcanizes or hardens by the heat, and, being metallic, is unaffected by oils. When vulcanized, its surfaces may be joined by using naptha as a solvent. It can be put between undressed surfaces, thus, in many cases, fitting is rendered unnecessary.

Replies to Queries.

QUERIES.

[1001.]—I should be glad to obtain information through your columns as to the best way to take buckles out of a saw.—Amateur.

[1002.]—I have been trying to make black and gold picture frames, but have not been able to produce a perfect or a smooth surface, any information, Mr. Editor, you can afford me on this subject will be most acceptable.—W. S.

[1005.]—I have been informed that veneers can be dyed through and through ; is this so? If so, will you or some fellow reader explain the process?

Editor *Scientific Canadian*, Montreal.

[1007.]—I have a flute, the fittings of which, being solid silver, make it very valuable, but which has a crack of some three inches length in its middle joint. As to how to fill this up without splitting the wood to a still greater extent I am puzzled. Glue I have tried ; but it only melted by the moisture which settled in the interior of the flute whilst playing upon the instrument. Some advice as to the solution of my difficulty, through the columns of your valuable journal, will very greatly oblige

A Subscriber.

REPLIES.

[1000.]—Can fix his chalk drawings beautifully by brushing a thin solution of shellac in spirit upon the back.—Designer.

[1003.]—The Editor of the *Scientific Canadian* is preparing one in classified sheets. State the class of works you wish for.

[1004.]—The treatment of mild cases is similar to that of diphtheria ; but there are violent cases, beginning with convulsions, delirium, and fainting fits, which carry the patient off so soon, that the physician has no time to save him. It is, in fact, a form of scarlet fever, of which the first symptom is dying. Such cases probably originate in the inability of the system to throw out the poisonous material which cause the eruptions. When these appear soon after the breaking out of the disease, it is, if not a favorable symptom, at least a sign that there is hope of recovery. These eruptions should be promoted, and in no case interfered with, by giving the patient a bath—a mistake which we know several physicians to have prescribed for children, who died soon after. Taking cold is also dangerous, for the same reason, as it may cause the eruptions to disappear prematurely, and the result is most always convulsions and death. Therefore the patient should be kept in a room having a constant temperature, with even more care than is necessary for diphtheria. The first symptoms are a feeling of exhaustion and vomiting, a few chills, and then a high fever with a small, irregular and intermittent pulse of 120 to 140. When the eruptions appear the fever diminishes. If nausea and vomiting continue give small pieces of ice, the same as in diphtheria. In scarlet fever the vomiting is often very distressing, and there is no better way to control it. Be careful in regard to the diet ; begin with rice-water, then beef-tea, and as soon as milk agrees let the patient have it, especially if it be a child.

[1005.]—The best way to burn slabs is on a common grate, with a blank plate 12 inches wide at each end, and grates 4 feet long and ½ inch thick. For burning sawdust to the best advantage, a different furnace is required. It should be of fire brick, detached from the boiler, with an opening in the top for feeding. The grates should be arched plates, perforated with holes. A good size for the given boiler would be 3 feet wide by 5 feet long. In mills using such furnaces it is found better economy to give away or destroy the slabs than to attempt to burn them under the boilers, the sawdust being ample and admitting of mechanical feeding.

How to Judge Leather Belting.—On cutting a piece of belting leather, one will notice the network of hide fibres interlacing eaeh other, and which, before tanning, were surrounded with gelatine. These fibres give the hide its great tensile strength, and any considerable displacement of them by the transformation of the hide into leather impairs this quality. A piece of good belt leather, therefore, when freshly cut, should look bright, with the intervening spaces between the fibres fine, even and regular. The texture should be uniform throughout, and with the utmost solidity there should be great elasticity.

—*Scientific American.*

ON THE HARDENING OF IRON AND STEEL.

The following is the paper by Prof. Akerman which was "taken as read" at the meeting of the Iron and Steel Institute, the discussion having been postponed :—

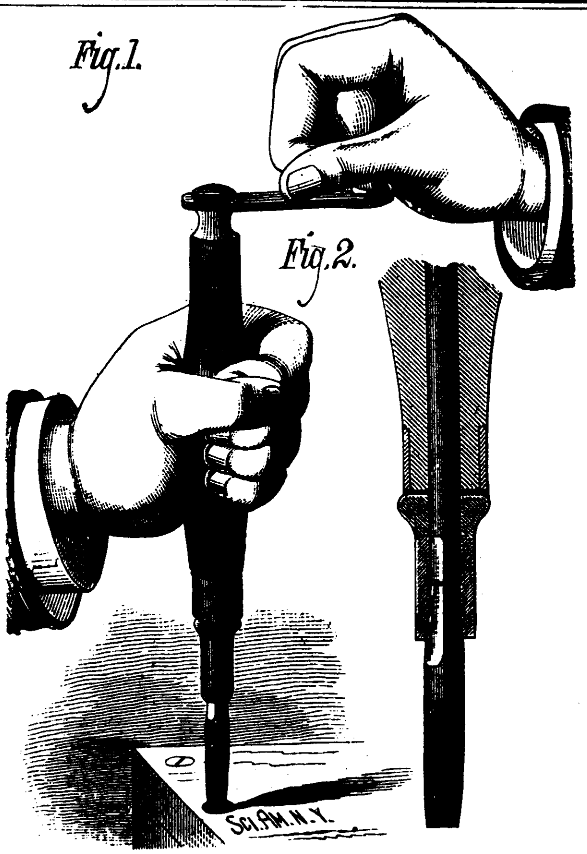
Hardening has, as is well known, been employed from time immemorial in order to make steel hard, but it is also a long time since it became known that the strength and tenacity of iron could be increased by the same operation. The knowledge of the effects of hardening, especially on iron, is, however, by no means so complete, and still less so generally diffused, as is desirable. This question has, besides, acquired increased interest through the Paris Exhibition, and above all from the Terrenoire exhibit of Siemens-Martin castings of extraordinary strength and free from blow-holes; and, as at the meeting of the Iron and Steel Institute, in Paris, I ventured to give expression to the view that the reason why the strength of undrawn Martin castings may be equal to that of drawn ingot-metal of the same degree of hardness must be sought for in the compression induced by the hardening, I have considered it to be my duty to endeavour to explain the reasons of this in greater detail. For this purpose, however, it is necessary in the first place that we endeavour to make ourselves acquainted with the nature of hardening. If we inquire what the circumstances are on which it depends, whether more or less of the so-called combined carbon in a malleable iron or steel exists as hardening or cement carbon, it immediately appears that the latter is changed into the former by a heating to a red heat succeeded by a violent forcing together, continued until cooling is almost complete; while hardening-carbon, on the other hand, is changed into cement-carbon by long-continued heating followed by slow cooling, without extra compression. In order to show that iron and carbon may be combined by pressing together more easily than otherwise, Caron upon an anvil, covered with charcoal in fine powder, hammered out quickly a strongly-heated piece of iron, which in this way was steeled on the surface, while another piece of the same iron heated as strongly, which was imbedded in similar charcoal powder, and allowed to cool in it without hammering, did not show the least sign of steeling. In the case of strong hardening of hard steel, we have the most powerful compression, for the rapid cooling produces a great difference of temperature between the outer and the inner layers of the piece, the more cooled exterior layers compressing the interior with greater force in proportion, partly as the latter are expended by being more strongly heated, and partly as the limit of elasticity of the substance is high, so that there is not too great a loss of the compressing force by the extension of the exterior layers. Again, that hammering favours the conversion of cement-carbon into hardening-carbon, or the more intimate union of the carbon with the iron in which it occurs, more than rolling, may at least, occasionally, to some extent, be attributed to the more powerful compression exerted by the hammer, but still more to the circumstance that the iron or steel, when the rolling is ended, commonly has a far higher temperature than when it has been drawn out under the hammer. For if the iron or steel be still red hot when the drawing is finished, a part of the carbon converted into hardening-carbon, or more intimately united with the iron during the compression to which it has been subjected, may be again changed into cement-carbon during the succeeding slow cooling. There is thus a very complete correspondence between the occurrence of hardening and cement-carbon and their mutual conversion in malleable iron and steel on the one side, and the relations of the combined carbon and the graphite in pig-iron on the other.

METHODS OF HARDENING.

Proceeding to the hardening, we find that experience has sufficiently shown that its effect mainly depends upon the contents of combined carbon in the iron, upon the differences of temperature between the iron or steel and the hardening fluid, and further on the rapidity of the cooling. The last-mentioned again is dependent on the quantity of the hardening fluid, its specific gravity, power of conducting heat, specific heat, boiling-point, and heat of vaporisation. Of the four liquids, mercury, water, oil, and coal-tar, therefore, the first named hardens much more powerfully than water, water considerably more powerfully than oil, and oil more powerfully than coal-tar. Further the hardening power of water is altered not only by differences of temperature, but also by the addition of different substances which change its properties in the respects just mentioned. Finally, the rapidity of cooling, so important for the degree of hardening, is also dependent on the way in which the piece is held down into the hardening fluid. For if it be kept still in a hardening fluid of low specific gravity and small conductivity and specific heat, the quantity of the hardening fluid is not of the same importance as if the piece be unceasingly moved about in it; but in the latter case the cooling of the piece is apt to be unequal, inasmuch as by the moving about the front parts are cooled somewhat more rapidly than the back ones. This is also the case if by hardening in running water we make the quantity of the hardening fluid, so to speak, unlimited. The front part of the piece, or that which is termed up-stream, is then, of course, cooled most rapidly; and in order, in such a case, to attain an even hardening it is necessary to turn round the piece rapidly and unceasingly. The layer of steam which, in the case of hardening in a substance so easily converted into vapour as water, is formed around the warm piece is an obstacle to the contact of water with it, and thus diminishes the speed of cooling along with the degree of hardening which is dependent upon it; but if care be taken that in one way or another the steam be easily and rapidly carried away as it is formed, the rapidity of cooling, on the other hand, on account of the great heat of vaporisation of water, is very considerably promoted by this conversion into vapour. Small pieces, therefore, are also very well hardened in water-dust finely distributed by means of a stream of air or steam; and the highest degree of hardening may, according to Herr Jarolimek, be attained in this way with so moderate a quantity of water that all the water-dust which comes into contact with the warm piece is brought by it into the form of steam. These influences, exerted by the formation of steam, must also be taken into consideration when, in order to attain an inferior degree of hardness, warm water is used instead of cold. It cannot accordingly be denied that there are many factors exceedingly difficult of calculation, which exert an influence on the speed of cooling and thereby on the degree of hardness. Nor is it much to be wondered at that mistakes are readily committed in hardening, and that great practice is required in order to be able confidently to reckon on a certain effect; and finally, that a workman accustomed to hardening considers that only a single method which he has been in the habit of employing can be used for a certain purpose, while another equally skilful workman can only attain the same result by a method essentially different. It further appears that the rapidity of the first cooling, from the 600° to 700° C., to which steel has commonly been heated, to 300° to 400° C., has a manifold greater influence on the degree of hardness than the succeeding cooling. Thus, Herr Jarolimek has shown that steel wire may be very well hardened both in watery vapour and in molten tin, lead, and even zinc, though the last-named metal does not melt under 400° C., while the cooling of the same steel wire from 300° or 400° to 0° C., does not cause any true hardening, however rapidly it may proceed. In order that steel wire may be hardened in this way, it is not, however, allowed to remain any considerable time in the molten bath of metal, for by long-continued heating following such a hardening the degree of hardening is afterwards diminished more and more. If it be taken out again after being dipped in the bath for quite a short time, and afterwards allowed to cool in the air, the degree of hardening for small articles is equal to that attained by ordinary hardening with the tempering following upon it.

THE EFFECTS OF HARDENING.

Of the effects produced by hardening, it was in old times mainly the hardness on which attention was fixed, and from this is derived the old saying that a substance does not take hardening if it do not thereby become so hard that a common file can no longer exert any noteworthy influence upon it. From time immemorial a distinction has also been made between iron and steel in this way, that the former, with common hardening in water, is not hardened in the sense just indicated, while steel, on the contrary, is hardened. We sometimes hear it brought as an objection against the old way of distinguishing between iron and steel, that it is difficult to determine whether a piece, after common hardening in water, is to be considered as having taken true hardening or not. But such a reason is, in fact, quite unwarranted, because, according to the old view, only the varieties approximating most closely to each other of the *hardest* iron and the softest steel can be mistaken for each other, and such a mistake is indeed of little importance when compared with the great mistake just referred to of *soft* iron for soft steel. If it be wished wholly to avoid the possibility of making mistakes between hard iron and soft steel, this even ought to be attained very easily by the method of determination, in which a sharp-edged splinter of a certain mineral—felspar for instance—scratches iron, although after being heated to a moderate red heat, it has been suddenly cooled in cold water, while steel, after similar treatment, cannot be scratched by the same mineral. The substance which exerts the greatest influence on the increase of hardness by a certain hardening process is the content of combined carbon in the iron. Iron completely free from carbon is, even after hardening in mercury, as soft as before, and an otherwise pure iron, with at most two-tenths per cent. carbon, does not become very much harder by hardening ; but, on the other hand, as the content of carbon increases, the difference in the degree of hardness before and after hardening increases more and more, so that the boundary line between iron and steel lies in general at a content of carbon of about 0·4 per cent., this depending, however, upon the iron's content of certain other substances, which, as we shall soon see, also exercise some influence on the degree of hardness. In the closest connection with the increase of the hardness by hardening stand the raising of the limit of elasticity, and the breaking strain of ultimate tensile strength and the diminution in ductility. Unfortunately the researches that have been carried out regarding these points are not yet numerous enough to enable us with figures to express completely all the changes in these respects which are caused by hardening in iron and steel with different contents of carbon, but sufficient experiments have already been made to give us somewhat satisfactory ideas on this point. A comparison shows that the effect of hardening is in general less in the case of the weld-iron, loose or open in its texture, than in that of the dense or compact ingot-iron ; but in proportion as the former even is denser or freer of cinder, hardening has a greater effect upon it, as is shown by a comparison both of the more compact Lesjöfors iron with the other sorts of iron refined in the open hearth, and of the more compact Surahammar with the other sorts of puddled iron. In order to augment considerably the strength of ordinary puddled iron, the French iron-manufacturing company, " La Compagnie de l'Horme," increases the hardening power of water by adding to it sulphuric acid. The cooling effect of water is thereby raised, and thus also its hardening power ; but in order to prevent the corrosion and rusting of the iron, it would be advisable to endeavour to attain the same result in some other way, as by the addition of some salt that would have less corrosive action upon the iron. Hitherto we have considered the influence of hardening upon iron, but if we proceed to investigate its action on steel, we find that it is chiefly by an increase in its hardness and a diminution in its ductility greater in the same proportion as the steel is richer in carbon, and the hardening fluid employed is more powerful in its action. At the same time that steel with an increased content of carbon becomes, through a certain hardening, all the harder, it becomes thus at the same time more brittle, and in the closest connection with this is the fact that in the hard steel, rich in carbon, the limit of elasticity is increased by hardening much more than the ultimate tensile strength, so that these in the strongly-hardened hard steel even coincide. Provided the method of hardening is adjusted to the degree of hardness of the steel, so that it is less powerful in the same proportion as the content of carbon in the steel is greater, it may, however, be asserted that the breaking weight is increased by hardening, even in the case of steel ; but if the hardening be too strong, the ultimate tensile strength of hard steel is thereby diminished quite rapidly ; or the steel breaks in pieces of itself either during the hardening or a short while after. It is, as is well known, on account of this brittleness or deficient ductility that the hardened steel is usually tempered or heated to 200° C. to 300° C., for thereby its ductility is somewhat increased, and its hardness at the same time also diminished. This is the case most of all with the outer layer, which of course is that which it is desired should be hardest, and to avoid this and the trouble and loss of time connected with the process just mentioned, the hardening itself is sometimes instead so modified that its effect is equal to that of a more powerful hardening followed by tempering. For such a method, however, more than common skill and practice are required, and it is therefore comparatively seldom used. For attaining this end there is sometimes used a less powerful hardening fluid, and sometimes a warm instead of a cold fluid, and sometimes the piece is held only a short time in the hardening fluid, and is taken out while it is yet warm in its interior and allowed finally to cool in the air. Further, the material may, for this purpose, be heated more gently, but it must be kept in mind in connection with this that a less heat than a gentle red heat (cherry red) in general does not induce any proper hardening ; and, on the other hand, that tool steel cannot in most cases be heated to a higher temperature than that just indicated without running the risk of becoming by hardening quite too brittle. It is thus properly only for soft steel and iron that the degree of heating can be varied to a greater extent, but it holds good specially for the latter, and, above all, for weld-iron, that the temperature must be considerably higher than for hard steel, if the proper action of hardening is to be attained. The more strongly and the longer that the iron or steel after hardening is again heated with slow cool supervening, the more completely are the effects of hardening removed ; and care ought, therefore, as is well known, to be taken in tempering ; but here we have, however, a good help in the different colours of tempering which follow one after the other. On the appearance of fracture also the hardening has an influence, the grain becoming finer.



ABRAMS' CRANK SCREW DRIVER.

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 that 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 proxmity 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 degrees Fahrenheit.

AN IMPROVED SCREW-DRIVER.—The engraving given herewith represents an improved screw-driver recently patented by Mr. George Abrams, of Philadelphia, Pa. It consists of a handle through which extends a shaft, having on the upper end a crank and upon the lower end a socket for receiving the screw driver bit. With this tool screws may be inserted and removed with much greater facility than with the ordinary form of screw-driver, as the motion is a continuous rotary one instead of intermittent. If desired the screw-driver bit may be removed and a drill or boring tool inserted in its place.

WHAT CONSTITUTES A GOOD LATHE?

BY L. F. LYNE, M.E., in *American Machinist.*

A good lathe should be capable of turning a true circle, of boring a perfectly round and parallel hole, to face off a true plane surface, and all this it should admit of doing in the shortest possible time. It is also expected that a screw-cutting lathe will produce a perfect thread, and not only is it necessary that it fulfil all the foregoing requirements a few times, but that it continues to do so year after year with the least possible adjustment and expenditure for repairs. The writer has frequently heard it remarked in the shop that "any fool can work with tools," and in many cases the observance of this principle on the part of employers and foremen is productive of harm; for while the fool is said to be able to work with tools, and the employers not wishing to employ fools in their shop, the men are obliged to get along as best they can without the tools that are actually needed. I believe in giving good men good tools, and requiring them to be kept in order. In this way a hurried job may be done in less time than it would take to get the tools ready under other circumstances.

The great aim of manufacturers now is to devise machines by which they may be able to utilize unskilled labor. The prejudices of the workmen themselves have been a great drawback to the introduction of improvements. For instance, a man who has always used a hand lathe with heel tools does not like to be set at work on any other. There is a great disposition nowadays, on the part of the men, to exercise brains as little as possible, the extent of their ambition being to get through ten hours a day, and then leave the shop and its associations until the next day. This class of men never rise to positions of honour so long as they entertain these principles. The turning-lathe is required at the present day to do a greater variety of work than ever before, hence the necessity of special lathes, some of which take their names from the particular class of work to which they are adapted.

In this article I have in mind a lathe designed to perform the greatest variety of work, such as is required in shops generally. I am decidedly in favor of a flat bed or shears for the following reasons: They are more firm and less liable to spring, and extended surface is necessary to durability. Some will argue that the large surface gives more friction. Friction is dependent upon weight not upon surface, therefore, the same care given to a V shear the carriage will move on the flat top equally as easy, if not more easily. In England most of the lathes are built with flat top shears, but in the United States it is just the contrary. Why it is so, no one pretends to say; however, "facts are stubborn things, meet them as you will"; and this is a fact—viz., whenever a special lathe is required for heavy work and durability, a flat shear is always adopted as in the case of the best axle lathes. The carriage has a better bearing on the flat shear, hence it will stand a heavier cut, and will work smoothly, whereas, on a V shear, it has a bearing only at or near the ends. The carriage can also be made lighter on the flat shear, and the extended surface will better exclude the dirt than on the V shear. An important advantage in using a flat shear is that the reduction in the thickness of carriage will increase the capacity of the lathe by allowing it to swing larger pieces of work. Let it be undertstood that "molasses," or oil resembling it both in appearance and action, cannot be used on a flat top shear, or any other, without serious trouble.

An axle lathe with a V shear would not answer, because it would wear hollow where used the most; and why should not this test recommend the adoption of the flat top shear for other lathes? It is by far the easiest to fit up and to keep in order.

The inside edges of the shears should be planed, tapering about one-eighth of an inch to the inch, so that the back head will fit into its place without lost motion, and when it does occur can easily be taken up.

In some cases the manufacturers made a V on the under side of the shear, upon one side with a correspondent shape on the clamp by which the back head is held fast, so that when the bolts are tightened the head will always be drawn up to the same side of the shears, thereby always insuring the alignment of centres. Let it be borne in mind that there are numerous strains on the bed of a lathe when at work, all acting in different directions. The strains upon the centres have a tendency to bend it in the shape of a bow, while the revolving spindle produces a severe torsional strain upon it. The bed therefore should be strong enough to resist strains in all directions, and by the use of the flat top shear the cross braces can be extended nearer the top than is possible with the V shear. The leading screw, as it has been remarked before, should not only be independent of the feed, but should be properly supported so as to maintain as nearly as possible, a straight line, as it will be found to make a more perfect thread. There are lathes now built having the screw placed in a trough or cavity directly under the inside edge of the top of the shears. The advantages claimed for this arrangement, in addition to keeping the screw in line, are that it is kept free from dirt, and when cutting a thread the line of strain is brought as nearly in line with the tool post as possible, and near the centre of carriage.

Where the screw is placed down near the bottom of the bed it is inclined to twist the carriage; and to any thoughtful mind this becomes apparent at once. The feed motion should be connected by gears from the spindle to a small shaft running the length of the bed, and by suitable devices to the pinion that works in the rack. The principle is to apply the feed power as near the tool post as possible, thereby avoiding unnecessary friction.

The spindle should be made of steel, with good large bearings, which must each be an exact circle, for they will reproduce their own shape. There must be no end motion, and the lathe must have a proper device for taking it up when it does occur through wear. I am in favor of the extension of the spindle, though the bearing to receive the different change gears for feed and screw-cutting, in this plan does away with the complication of gears under the cone, which are always a source of trouble and accumulation of dirt. The castings can then be made solid under the cone and kept clean. All lathes should have a projection on the casting to prevent the belt from running into the gears, for the writer has seen otherwise good lathes, on which the belt could only be kept out of the gears with the greatest care.

The cone pulleys should be properly proportioned to the back gears, so that the speeds will increase and diminish in exact ratio to each other. The cone should be turned inside and outside, thereby avoiding that thumping sound which exists in some lathes after they had become a little worn, which reminds one of a "country grist mill." The cone should be wide enough to run a good wide belt, large in proportion to the size of the belt, for there is nothing lost by a little excess in this particular. There are very few lathes in which the line centre will run true except in one position, which shows that the proper discretion was not used in boring the hole for the centre. The proper way is to finish the spindle on the outside, then bore and finish the hole for the centre which insures a perfect job. For application of chuck, manner of applying gibs to slide rest, and application of centres, the reader is referred to my previous articles. In the latest improved back head there are eccentric rollers, so placed that when it becomes necessary to raise the head, it may be raised clear of the shears, so that the entire bearing comes up on the rollers: thus it is easily moved, besides avoiding the accustomed wear upon the shears. In place of the ordinary screw for holding the spindle from moving, a split, conical-shaped sleeve is used on the end next to face plate, which is forced into place by a large nut which covers it, and insures a central position for the spindle every time.

I believe in having just enough motion sideways on the back head to allow the alignment of the centres to be rectified, which becomes necessary as the lathe wears, and never drawing the head over in order to turn tapering, for the following reasons, viz., it is impossible to get a perfect bearing on the centres when they are not in line. There are good devices for turning tapering, which are applicable to any lathe at a nominal price, and will soon pay for themselves. This former or taper attachment gives greater capacity to the lathe than the other, as in the cast of very short tapers and irregular forms. The cross-slide of the carriage and slide-rest should fully cover the slides so as to exclude all dirt. All parts should be easily accessible in case of accident or repairs.

ENEMIES OF HUMAN LIFE.—An English paper, *Capital and Labor*, thinks that, while excessive labor, exposure to wet and cold, deprivation of sufficient quantities of necessary and wholesome food, habitual bad lodgings, sloth and intemperance, are all deadly enemies to human life, none of them are so bad as violent and ungoverned passions. Men and women have survived all the former, says the writer, and at last reached an extreme old age, but it may be safely doubted whether a single instance can be found of a man of violent and irascible temper, habitually subject to storms of ungovernable passion, who has arrived at a very advanced period of life. It is, therefore, a matter of the highest importance to every one desirous of preserving "a sound mind in a sound body," to have a special care amid all the vicissitudes and trials of life, to maintain a quiet possession of his own spirit.

CORROSION OF BOILERS BY FATTY MATTERS.

The Chief of the Experimental Railway Company of France, M. A. Mercier, gives, in the *Annales des Mines*, the results of some experiments upon the changes produced by fatty matters in the wrought and cast-iron parts of engines exposed to the action of steam. M. Mercier had occasion to examine in the laboratory some hard balls taken from the cylinders of steam engines, and which were generally attributed to the use of acid lubricating oil. The balls, when crushed and digested in ether, left an insoluble residue of peroxide of iron, while the soluble part was composed of oleic acid, combined with the oxide of iron mixed with a non-decomposed oil.

A series of experiments was made to determine whether the formation of this oleate of iron resulted from the use of oil more or less rancid, having an acid reaction, or whether it was the product of the decomposition of neutral fatty matter in presence of iron, and of steam at a high pressure. According to these experiments the fatty matters have no need of being acid or rancid, nor of being heated above 212° Fahr., to decompose steam in presence of iron and thus produce oleate of iron, glycerine and hydrogen. Observations made upon steam engines which showed corrosion in those parts exposed to oil and steam, suggested the following experiment: An iron bucket containing wrought-iron clippings, thoroughly saturated with oil of colza previously neutralized, was left during eight days in a reservoir supplying steam to several steam hammers. At the expiration of this time there was taken from the bucket about 30½ cubic inches of very thick oil, which flowed with difficulty and emitted an odor similar to that produced by the action of an acid on iron; the iron was strongly corroded, and the oil—colored to a dark brown and entirely soluble in ether—contained 7% of the oxide of iron. This oleate of iron oxidized rapidly on contact with air, and, like all the minimum salts of iron, gave up some peroxide of iron; when again placed in contact with iron it attacked the iron and was thus brought back to its first state of saturation. In this manner can be explained the large proportion of non-combined peroxide of iron contained in the matter found on the valve-face of an engine at Valance, upon which an observation was made.

These facts appear to clearly explain the corrosions of certain boilers receiving fatty matters brought over from the cylinders by the exhaust steam, or used to lubricate the throttle valve of locomotives.

In locomotives the steam is generally taken from the upper part of the boiler by means of an immersed slide throttle valve; the oil used for lubricating the latter becomes saturated with iron, being thus heavier than water sinks to the bottom of the boiler, where it attacks the iron plates, forming in them those excavations which are only found when feed-water is used of such purity as not to deposit the lime-scale that in most cases preserves the boilers.

The use of mineral oil, thickened if necessary with wax of paraffine, for the lubrication of moving parts placed in the steam, would be without doubt a good means of preventing changes in the material of such organs.

SOME HINTS ABOUT THE TREATMENT OF STEEL.

A practical worker in steel, writing to one of our exchanges, gives the following hints in reference to the treatment of tool steel. He says: "Bosses of machine and other shops, where considerable steel is used, would be astonished could they see the amount of loss to them in broken taps, dies, reamers, drills and other tools accumulated in one year. I do not mean to say that tools can be made and hardened that will not break, but I do say fully one-third, especially taps, are broken by being improperly tempered." * * * "Thousands of dollars are lost in waste of steel and loss of time by men who try to do what they never have learned.

"First of all, never heat steel in any fire, except a charcoal fire, or a lead bath, which gives it a uniform heat. (I mean steel tools of any kind). Rain-water is the best water for hardening, as it contains less lime than either well or river-water. Water should never be very cold for hardening tools, as the sudden contraction of the steel will cause it to crack, more especially in cutting dies, where there are sharp corners.

"To insure thorough hardness, salt should be added to the water until the same becomes quite brackish. The salt will cause the water to take hold of the steel and cool it off gradually. I find rock or fish salt to be best, though table salt will answer. The salt is also beneficial to the carbon in steel. For removing scale from steel when put into water, ivory black should be used, putting it on the steel while it is heating, and letting it remain till the steel goes into the water.

"In tempering taps, reamers, twist drills and other like tools, great care should be taken to put them in the water in a perpendicular line, and slowly, not allowing them to remain stationary in the water, as there is danger of there being a water-crack in the water line.

"A good way to draw the temper is to heat a collar or any suitable iron with a hole in the centre, and draw the tool backward and forward through it, until the right temper is obtained, which will be uniform."

STEEL CASTINGS FOR MACHINERY.—Among the engineering exhibits at the International Agricultural Exhibition at Kilburn, England, one of the most interesting, alike to the metalurgist and the machinist, was a collection of steel castings produced, at Newburn-on-Tyne, by Messrs. John Spencer & Sons. As illustrative of the various applications of steel to the purposes of machinery, this extensive collection was most instructive, especially at the present time, when steel is daily asserting its claim to be considered "the metal of the future," and when the demand is increasing for machinery at once light and strong, and capable of resisting a great amount of wear and tear. The articles exhibited by Messrs. Spencer were of the most varied form and application, including spur-wheels, pinions and geared wheels of all kinds, rings of gear and winding drums for traction and for steam plows, wheels and sheaves for collieries, mines, etc., solid-disc, railway wagon wheels, crank-axles, brackets, rollers, clutches, axle-boxes, hydraulic cylinders, together with a great variety of engineering castings, projectiles, etc., the specimens shown varying in weight from 10 lbs. to 30 cwt. each. All the castings displayed remarkable soundness, those made from steel of the milder qualities possessing a very great degree of toughness, some of the test pieces being capable of bearing a tensile strain of 30 tons per square inch, with an elongation of 25 p.c. before fracture. Such a material is well suited for any work having to withstand sudden strains, or where a high degree of ductility is required. The harder qualities which stand a tensile strain of from 40 to 50 tons per square inch, with an elongation varying proportionately from 15 p.c. to 3 p.c., are applicable to various uses, according as greater resistance to abrasion, or more or less ductility is required. It is the remarkable capability that steel possesses of being thus varied in hardness and toughness which constitutes the immense value of that metal for the purposes of the engineer and machinist, and which has already caused it to displace cast-iron in so many constructions. Messrs. Spencers' exhibit served in an admirable manner to demonstrate the capabilities of cast-steel, and promises well for the future development of this important branch of manufacture.

VEGETABLE FIBRE VS. HAIR FOR MORTAR.—Vegetable fibre is now successfully substituted, it is said, for hair in the composition of plaster for building purposes. The advantages claimed for it are as follows: First, being of a woody nature, instead of being destroyed when put in the lime, it is preserved, lime being a preserver of wood; second, it is light and bulky, so that one pound, costing but a small sum, is sufficient for a barrel of browning, and two pounds for a barrel of lime scratch coat; third, it is much stronger than hair, is very light, clean and entirely free from foreign substances; fourth, it mixes more easily and freely with the plaster than is the case with the hair, and also spreads more uniformly through the same. This being the case, the new fiber is greatly superior to the ordinary animal hair, the latter, as is well known, usually containing some 30 p.c. of its weight in impurities—as lime and scrapings of hides—while the hair itself, by the caustic action of the quick-lime used in removing it from the hides, loses much of its original strength.

SOME German and Russian rail mills employ an ingenious method to overcome difficulty in cutting red or nearly white-hot rails, so that they may be all the same length when cold. The rails are looked at through a dark glass; when they have cooled to a certain temperature they cannot be perceived. If a dark blue or an orange-yellow glass is used, the rails may still be at a red glow, but the light radiated from them does not reach the eye. It may be considered that the light from two rails observed through the same glass disappears at the same temperature, and thus a rule is obtained for cutting the rails to the same gauge. Each rail is allowed to cool until it can no longer be seen through the dark glass, and is then cut. The result is said to be satisfactory.

A NEW COMPOUND FOR MAKING CASTS, MOLDS, ETC.

Our exchanges bring us an account of a new cement known as Jannin's cement, from the name of the patentee, a resident of Paris. The cement is simply a mixture, in suitable proportions, of yellow oxide of lead (the quality known as massicot being preferable) with glycerine. Several other metallic oxides and matters may be mixed with the cement, so as to suit the quality or the color of the cement to the nature of the work to be produced, but the two essential compounds are yellow oxide of lead and glycerine, varying according to the consistency of the cement it is desired to produce. The proportion of glycerine is larger for a very soft cement than for a stiff cement. The exact proportion of each of the two essential compounds is not specified. The paper from which we make our extract says that this cement is specially adapted for molding those objects which require an extreme delicacy in the lines of the cast, such as engraved blocks and plates, forms of printing type, photoglyptic plates, etc. Under the influence of gentle heat it sets in a few minutes, and then resists perfectly both pressure and heat. When set it is also a very good substitute for natural lithographic stones, and it can replace them for many practical purposes. It can also be used for artistic reproductions, such as *fac similes* of terra cotta, whose color and sonorous quality it possesses. Though setting to great hardness in a few minutes, it does not shrink. Massicot, it may be observed, is an old name for litharge, but the term is more generally applied to the yellow oxide of lead, prepared from the scum of the molten metal by roasting until the color is fully developed.

A mixture of litharge and glycerine forms a well-known cement, discovered, if we are not mistaken, some 10 or 12 years ago in this country by Dr. P. H. Van der Weyde. As a plastic material, however, it is a novelty. We doubt very much whether as a substitute for lithographic stones it will come into use. It is strong and hard and sets rapidly. Some attention must be given to the quality of the glycerine, which must be nearly pure, at least, to form a good cement, capable of setting quickly; it must be free from water and quite thick. We suppose the thick purified article to be found in the drug stores would answer. It is possible that the quality known as crude would answer just as well except for the presence of water. The discovery of the value of this compound as a cement was rather a matter of accident. Dr. Van der Weyde wished to seal a glass stopper into a bottle, so that it would remain perfectly tight, and yet be easily removed when desired. Not wishing to use wax, the material commonly employed for the purpose, he took some litharge, and, mixing it with glycerine, applied it around the stopper. It answered one portion of the requirements of the case perfectly, and the contents of the bottle were kept from leaking, but the doctor found, when he came to empty the bottle, that bottle and stopper were as firmly united as though they had been made in one piece, so that it became necessary to break the neck of the bottle to get at the contents. It is needless to say that it was not again used for that purpose.—*Iron Age*.

CARE OF STEAM BOILERS.

The Boiler Insurance and Steam Power Company, Limited, of Manchester, England, has recently issued the following instructions to firemen:

Water gauges should be blown out frequently during the day and the glasses and passages to the gauges kept clean. More accidents are due to inattention to water gauges than to all other causes put together.

Safety valves should be tried at least once a day to make sure that they will act freely. Overloading or neglect of these valves tends to the most disastrous results, and cannot be too carefully guarded against.

Pressure gauges, where fitted with cocks, should be tried occasionally by shutting off the steam and letting the pointer run back to zero. For this purpose the cock to the gauge should be arranged to open to the atmosphere when shut off from the boiler.

Blow-off cocks should be taken apart, examined, and greased when the boiler is cleaned. Make certain that no water is escaping from the blow-off when the cock is supposed to be closed.

Check-valves, or self-acting feed valves, should be taken out and examined when the boiler is cleaned. Satisfy yourself frequently that the valve is acting when the feed pump is at work.

Fusible plugs should be examined when the boiler is cleaned, and carefully scraped clean on both the water and fire sides. If this is not done, the plug will not act.

To save coal, keep the boiler clean inside and outside. If there is a plentiful supply of steam, keep a thick fire; but if short of steam, work with a thin fire, keeping the bars evenly covered. Firing a furnace on each side alternately tends to prevent smoke.

To preserve the boiler raise steam slowly. Never light fires till the water shows in the gauge glass. Never empty under pressure, but allow the boiler and brickwork to cool before running the water off. Clean the boiler inside regularly once a month, oftener if the water be bad. Clean all flues once a month, stop any leakages, and get rid of any damp in the seatings or covering. Examine especially plates subject to the direct action of fire, the under side of the boiler, and any parts in contact with the brickwork, or with copper or brass, where water is present. If not required for some time, and it is impracticable to empty and thoroughly dry it, fill the boiler quite full with water and put in a quantity of common washing soda.

Should the water get too low, draw fires at once, as a rule; but if the fire is very heavy, or if the furnace crown appears to be red-hot, it is best to smother the fire with wet ashes, wet slack, or any earth that may be at hand. The dampers may then be closed. If the engine is running, or the feed pumps delivering into the boiler, do not stop them, but if not working, do not start them, and do not attempt to blow off the steam until the fire is out and the over-heated plates have cooled.

IMPROVEMENTS IN PILE-DRIVING MACHINES.

We have received from a correspondent a plan and specification of an improved Pile-Driving Machine, which we have much pleasure in illustrating for the benefit of our readers. Our correspondent has had great experience in the use of these machines, and believes this one possesses merits over any that he has seen and used. He freely invites criticism, and would be glad to hear the opinion of practical pile drivers as to its merits.

SPECIFICATIONS FOR MAKING A PILE DRIVING MACHINE.

Fig. 1 shows a front elevation.
Fig. 2 shows a side elevation.
Fig. 3 shows a plain view.
Fig. 4 and 5 show a section and plain view of trip-block (L).
Fig. 6 shows a section of nipper-block (M).
Fig. 7 shows yoke or buckle (N).

Figs. 1, 2, and 3, are drawn to a scale of ½ inch to 1 foot, and figs. 4, 5, 6 and 7 to a scale of 1 inch to 1 foot.

A shows frontal roller of pine 12″ diam., 16′ long.
B " stern " " " " " "
C C " side rollers " 7″ " 14 "
D D shows sills of oak 6″ x 14″ x 16 long.
E E shows part of leaders of hard maple or oak, 4″ x 6″ x 38 long. All bolts through E and F must be neatly countersunk, so that their heads will be at least half an inch clear of face of E.
F F shows part of leaders of pine 3″ x 6″ x 38′ long.
G G shows side braces of pine 3′ x 12″ at bottom and 3″ x 8″ at top end, 28 feet long.
H may be of pine 3″ x 12″ x 13½′ long.
I I of pine 3″ x 10″ x 12′ long.
J shows *snatchjack* of hardwood 6″ x 6″ x 3′, having a 6″ diam.) pulley to receive fall line *m*, as shown in Fig. 2.
K shows hammer, weight from 1,600 lbs. to 2,100 lbs.
L shows trip-block made of two pieces of boiler-plate, 6″ x 18½″, and two wedge-shaped pieces of hardwood held together by four small bolts; the whole to be suspended from cap of machine by two small chains or ropes.
M shows nipper-block, nippers of iron and block of wood or boiler-plate, see Fig. 6.
N shows yoke or buckle made as shown in Fig. 7 of 1½″ round iron.
R shows hook made of 1½″ square iron.
T " scaffolding of pine 3″ x 8″.
P " braces of pine 3″ x 8″.
V " ladder of pine 4″ x 5″ x 37.

The manner of fastening the line *b* by means of a single pulley-block *a* and a small iron pin *c*, will be found to be a great saving of time over the most general way of making the line fast at top of machine, and then securing the other end to a stake; by this means the line is made fast to the stake, and is tightened or slackened at the pin *c*.

By having two pulleys *g* secured to cap by iron band *d* will allow a foot more drop for hammer than if a regular pulley-block were used.

It will pay to have all the pulleys to revolve on steel pins.

Size of fall line *m* should not exceed ¾″ to 1″ diam. for a hammer of one ton and under.

The arrangements of pulley-blocks, etc,, has been made for horse-power, but this machine can be used equally well with steam power.

It is not necessary here to describe the mode of working this machine, as any practical pile-driver will at once see that the main rollers A B are intended to move the machine forward or back, and the side roller C C to move it sideways, and so on with all the other parts.

NOTE.—Use wooden bars in the main rollers and steel bars in the side rollers.

IMPROVED PILE-DRIVING MACHINE.

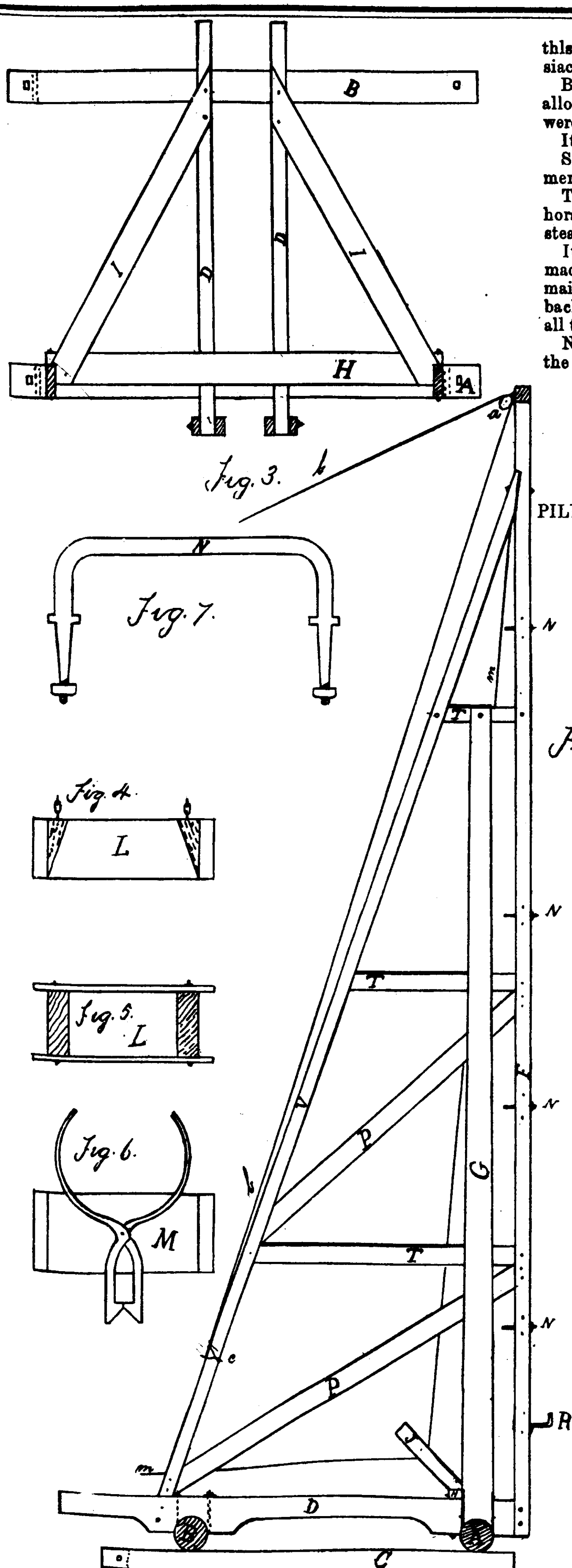


Fig. 3. Fig. 7. Fig. 4. Fig. 5. Fig. 6. Fig. 2.

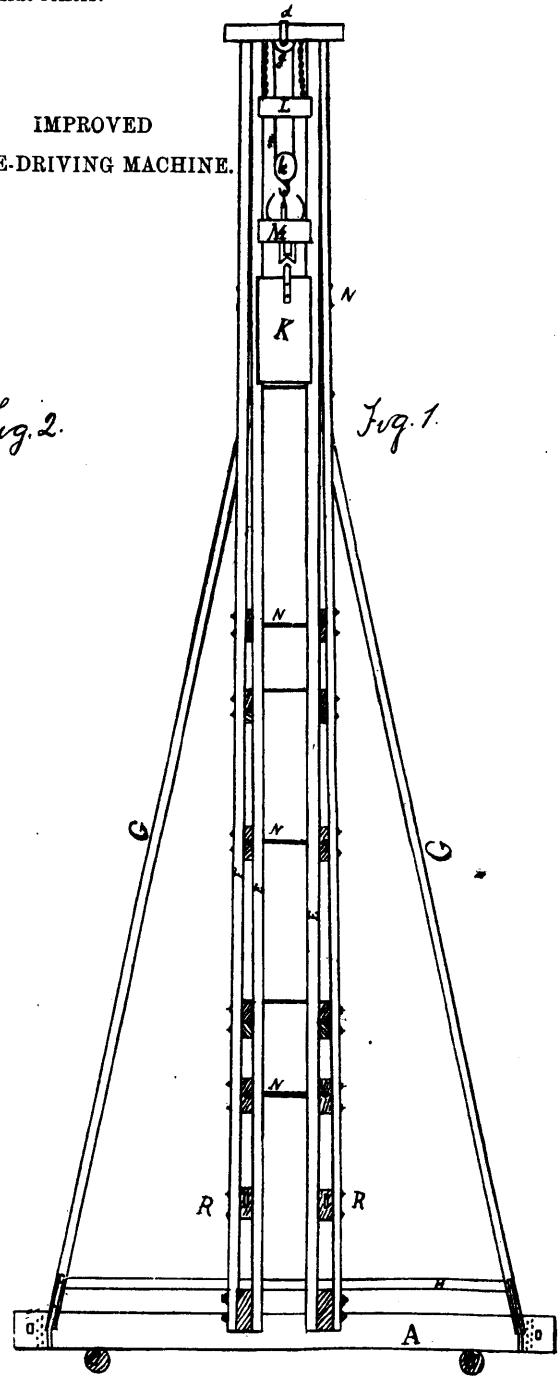


Fig. 1.

Mechanics—(*Continued.*)

Utilization of Steel Scrap.—The rapid development of the use of steel for shipbuilding in Scotland, has brought out an interesting question in regard to the utilization of the large amount of steel scrap which the shipyards now find accumulating on their hands. It appears that the shipbuilders were much dissatisfied with the low rates paid them by the Steel Company of Scotland, the chief producer of steel and only user of scrap who were not willing to take it back at less than scrap iron. The question is now solved, it seems. A Coatbridge ironmaster found that he could work it up into rods almost as easily as scrap iron, but his experience showed him that it required a much higher heat to weld the pieces into a solid billet. In testing the rods it was found that, while the average of the bars made by the Steel Company of Scotland stood a tensile strain of 28.3 tons per square inch, the rods made from the steel scrap only bore a strain of 26.6 tons per square inch, with an equal extension of 20 p.c. The bars made from the steel scrap have not been tested for their shearing strain; but it is thought that they would stand better than the Steel Company's bars. The great advantage in the scrap steel is its price, as it can be produced at about £2 per ton less than steel bars direct from the steel makers. As Lloyd's and the Board of Trade only required steel to stand a tensile strain of from 24 to 26 tons per square inch, welding up and working the scrap steel into bars will, it is thought, prove a decided success.

Refractory Bricks and Furnace Linings.—A new material for basic linings and bricks has been recently made by S. G. Thomas, of Battersea Park, England. He mixes lime with liquid tar, so as to moisten it and render it somewhat plastic. When the silica and alumina are low a little oxide of iron may be mixed with the lime before adding the tar, the oxide of iron acting as a binding material. He uses these mixtures either to ram the interior of converters or other iron and steel furnaces, particularly their bottoms, or to make it into bricks and tuyeres under very great pressure. The bricks he prefers to fire at an intense and prolonged heat. He also uses this mixture when made rather liquid as a cement for calcareous bricks; crude creosote may be substitututed for tar when it is readily obtainable. He also uses a mixture of very highly fired hard shrunk lime made from the silico aluminous magnesian limestones (such as described in a former specification) with crude petroleum or similar cheap oils as a material to use for rammed linings, particularly bottoms and hearths, and also to make bricks of. In all cases when using this mixture of petroleum and highly fired shrunk lime he exposes the linings and bricks (after the linings are in position or the bricks made) to a further very intense and prolonged firing. This mixture also may be used as a cement for basic bricks.

Hints Concerning Saws.—A saw just large enough to cut through a board will require less power than a saw larger, the number of teeth, speed and thickness being equal in each. The more teeth, the more power, provided the thickness, speed and feed are equal. There is, however, a limit, or a point where a few teeth will not answer the place of a large number. The thinner the saw, the more teeth will be required to carry an equal amount of feed to each revolution of the saw, but always at the expense of power. When bench saws are used, and the sawing is done by a gauge, the lumber is often inclined to clatter and raise up the back of the saw, when pushed hard. The reason is that the back half of the saw, having an upward motion, has a tendency to lift and raise the piece being sawn, especially when it springs and pinches on the saw, or crowds between the saw and the gauge, while the cut at the front of the saw has the opposite tendency of holding that part of the piece down. The hook or pitch of a saw-tooth should be on a line from one-quarter to one-fifth the diameter of the saw; a one-quarter pitch is mostly used for hard, and a one-fifth for softer timber. For very fine-toothed saws designed for heavy work, such as sawing shingles, etc., even from soft wood, one-quarter pitch is best.

A School of Mechanical Handiwork.—Following the excellent example of the Worcester Free Institute, and in obedience to a long-felt want for such a school, the managers of the Spring Garden Institute, of Philadelphia, have decided upon the establishment in connection with this institution, of a school where apprentices and amateurs may acquaint themselves practically, with the use of tools for working wood and metal, and, at the same time, acquire a knowledge of mechanical principles. This branch of the Institute is now ready to go into operation, and a circular has been issued announcing that the managers are ready to receive applicants for admission. The pupils, we learn, will be furnished by the Institute with work-benches and the tools and materials required for practice. There will be conversational lectures on the nature of properties and materials, and practice shops, in charge of experienced workmen as instructors, fitted with improved appliances, where the learner will be taught the right mode of holding, using, and caring for tools, etc. The practical instruction will include, in wood-work, carpentry, and joining, wood-turning, and cabinet and pattern-making; and, in iron-work, forging, foundry-work, and machine-tool work. This is the plan of the school, and the managers expect to gradually develop it fully up to this pattern as rapidly as the number and requirements of its pupils demand. The design of the school is most admirable, and it is sincerely to be hoped that it may really become what the managers announce their design to make it.

Slag Boiler Covering.—Mr. Franz Buttgenbach, the well-known metallurgist, gives the following method for the utilization of blast furnace cinder as an insulator for steam pipes, etc.: Mix 150 parts of cinder dust, 35 parts by weight of fine coal dust 250 parts of fire clay, and 300 parts of flue dust, with 10 parts of cow's hair, add 600 parts of water into which 10 to 15 parts of raw sulphuric acid has been poured, and make a stiff dough of the whole. This is thrown in small amounts upon the warmed pipe, hardening rapidly. Upon this rough coat, a second, third, etc., is laid accordingto the thickness which is to be used. By the action of sulphuric acid gypsum is formed, and the silica, rendered free, hardens. The mass becomes as hard as porcelain, and is still porous. It adheres firmly, and never cracks. Mr. Buttgenbach states that he has tested its merits by ten years' use, and has found it to meet all requirements.

The Strength of Wheels.—"I wonder," said a veteran wheelwright, the other day, "how many who see slender wheels flying over the road stones, or a massive wheel slowly drawing a mass of iron or stone along the cobble stones, ever pause to think what a perfect piece of mechanism a wheel must be to stand such continuous wear and tear. Every spoke must have a perfect bearing, both at the hub and on the felloe, lie exactly on the same plane as the others, and be of equally well-seasoned timber. The felloes must be of equally good fit at the joints and upon the spokes. They must form at the circumference a perfect circle, and be strong enough for their duty without being too heavy. I tell you that a ton weight continually thumping at a wheel will soon flatten out the weak spots, and bad-fitting and insufficiently-seasoned timber will soon give a loose tire, boys."

Something New in Boiler Making.—We learn from English journals that a few weeks ago a number of engineers visited the Park View steel works, Owlerton, near Sheffield, for the purpose of seeing Mr. George Whitehead's new process for producing weldless and seamless steel and iron boilers. A ring of steel is cast and heated. Then it is placed upon a large roller, and by the aid of smaller rollers it is enlarged to the requisite dimensions. The ring is run from one end of the roller to the other, and is returned by a reversing of the machinery. The other portions necessary for the completion of the boiler are subsequently put on with bolts. Mr. Whitehead states that boilers constructed on this process will stand twice the pressure of those made of riveted plates.

To Protect Iron from Rust.—Iron can be protected from rust and made very pleasing in color by a method invented by Mr. Dode. He coats the surface with a thin film of borate of lead, in which some oxide of copper has been dissolved, and some scales of platinum held in suspension, by means of a brush or bath. He then heats the composition until it is diffused. The result is a thin, glassy coating, which will withstand the action of sewer gases, dilute acids or alkalies, and the heat of the kitchen fire. If all be true that is said of this "platinized iron," as it is called, it will find numerous applications.—*Rev. of Sci. and Ind.*

A Brilliant Purple for Show Bottles.—Sulphate of copper, two drachms; water, two ounces; French gelatine, one drachm; boiling water, two ounces; solution of potassa, two pints. Dissolve the copper salt in the water, and the gelatine in the boiling water. Mix the two solutions and add the liquor of potassa. Shake the mixture a few times during ten hours; after which decant and dilute with water.

English manufacturers, it is said, have succeeded in producing a new cloth from the hair of the vicuna or South American lama. The cloth is called camelina vicuna. It is made in all the new colors, and also in ivory, but the latter hue is different from all other white goods, in consequence of the introduction of the black hairs that appear in vicuna wool.

IMITATION GROUND GLASS THAT STEAM WILL NOT DESTROY.

Put a piece of putty in muslin, twist the fabric tight, and tie it into the shape of a pad ; well clean the glass first, and then putty it all over. The putty will exude sufficiently through the muslin to render the stain opaque. Let it dry hard, and then varnish. If a pattern is required, cut it out in paper as a stencil ; place it so as not to slip, and proceed as above, removing the stencil when finished. If there should be any objection to the existence of the clear spaces, cover with slightly opaque varnish. In this way very neat and cheap signs may be painted on glass doors.

Sanitary Items.

Anecdotes Connected with Ventilating and Heating Arrangements.—A writer in a recent number of the *Sanitary Engineer* says ; A large public institute near New York was heated with a hot-water apparatus, which proved quite satisfactory until one very wintry day word was sent to the contractor that the inmates were freezing. He came, and after listening to the trustees' complaints at the apparent failure of the apparatus explained that the heat from the boilers was neutralized by the enormous windows on the north side of the building, reaching from the ground to the roof and covering some hundred square feet of surface. The casings of these windows were so loose that the keen wintry blasts were forced into the rooms and then down the registers, so that the hot-air was blown out of the cold-air supply box into the yard, melting the snow, and as an actual fact the inmates gathered around this out-door opening to warm themselves. The contractor said that if the trustees wanted more heating service they could have it, but more fuel would be needed. He thought the simpler mode of remedying the difficulty was to put shutters on the windows. This was finally done, and no trouble has since been experienced. Here is another illustration of popular ignorance. A gentleman while attending church one evening found that his feet were icy cold, so that he had to raise them from off the floor. Calling the attention of the sexton to the fact, the latter said with some perplexity, "Yes, we have a good many complaints of cold feet from others ; but I can't understand the reason why we can't keep the church warm ; we surely have fires enough." So saying, he pointed to a register in the floor directly behind the gentleman in the adjoining pew. Looking around, the latter could see that there was a hot fire in the furnace beneath, and yet no heat came up. When a handkerchief was placed over the register it scarcely stirred. The visitor asked the sexton. "Have you any means of ventilation ?" "No, sir" "Are there no windows open ?" "None whatever" "How, then, can you expect the air to come in here if it can't get out somewhere ?" There was no response ; the man was nonplussed. "Did you ever try to blow into a bottle ?" continued the inquirer. "No sir." "Do you think, if you did, that you could force any more air into a bottle than was in it before ?" He couldn't say ; never had thought of it. "Well," continued the gentleman, "you would soon find, if you tried, that it was impossible ; and neither can you force air into this church through a register if you don't open a window or some other orifice." But, the sexton demurred, "opening a window would let in the cold air, wouldn't it ?" "You just try it," was the response ; "Raise ome of the windows on the leeward side of the church, and see what will happen." It was done, and instantly the handkerchief lying on the register rose half-way to the ceiling with the force of the ascending current. The sexton stood and stared in astonishment. "Now what you want to do," explained the visitor who was a ventilating engineer, "is to keep your windows open, or to put in ventilators." He further offered to plan the latter free of charge to the church, and left his card for the trustees to call on him, but, of course, they never came near him, and I suppose cold feet are still the main attraction to the faithful attendants of this church, in spite of the red-hot theology preached there.

Ransome's Hydraulic Cement.—*Engineering*, in an issue of recent date, speaks highly of Ransome's hydraulie cement, which is shown by actual tests to be superior to good Portland cement. Mr. Ransome's first efforts were directed to overcoming the objections to using Portland cement for decorative purposes, for which it is unfitted on account of its color. He obtained a beautiful white cement, capable of receiving a polish resembling Carrara marble, by burning a mixture of kaolin, chalk, and soluble silica which he obtained from New England. After burning, the mixture was composed of 60 parts of lime, 12 parts of alumina, and 22 parts of silica. This product, though valuable for special purposes was too expensive to compete with ordinary cement, and Mr. Ransome, therefore, began the use of blast-furnace cinder, granulated by Wood's patent apparatus. This slag sand, made at the Tees Iron Works, Middlesborough, was found to contain :—

Silica	38.25
Alumina	22.19
Lime	31.56
Magnesia	4.14
Sulphide of lime	2.95
Oxide of iron	0.91

The use of slag for cement is by no means new, large quantities having been turned out for years by Lurmann, at the Osnabrueck works in Germany ; but it would seem that Mr. Ransome's method is capable of producing exceptional results. He reduces the slag to a fine powder, and after mixing it intimately with one or two parts of powdered chalk or limestone, burns it at a moderate temperature.

Action of Sewer Gas on Lead, Etc.—The sanitary inspector of Dundee, Mr. T. Kinnear, has watched the effects of the gas on portions of the zinc eaves of buildings, where it was striking on the under part, and found in the course of a couple of years or so, pretty large holes eaten completely through, showing that material could not long withstand the effects of the gas. Lead is, of course, more durable than zinc, but the difference is only a question of degree, as shown by the fact in not a few of the water-closets repaired by the officers of the department during the year, small apertures were found in the main vertical lead pipe, and in the cross or horizontal one leading from it to the trap of the closets various perforations were found on the top, indicating clearly the operation of foul air from the drain. Lead traps and soil pipes from water-closets, baths and fixed basins are all subject to wear and tear ; but the traps being hardened with the additional strain of barring the passage of sewer gas, do their work less efficiently, and for a much shorter period than they are generally credited with, hence the necessity for proper ventilation and occasional inspection.

Effect of Sanitary Operations.—The Registrar-General, in the last quarterly report, gives an example of how a district may be improved by the adoption of a proper system of sanitation. He instances the town of Llandudno, which at one time had a high death-rate, and which, of course, necessitated something being done to lower it. A scheme of sewerage was designed by Mr. Baldwin Latham, and carried out, at a cost of £30,000 with great success. The death-rate is now nominal, being only 8.4 per 1.000, and during the three months in question not a single death from zymotic disease took place, In order to value the change which has occurred, we may point to the neighborhood of the town—the rural district outside, which is not sewered, where the mortality was 38.6 per 1.000, with a zymotic death-rate of 4.3 per 1,000. The Registrar gives great praise to the town for its enterprise, and when the new works for a water supply are completed, no doubt the death-rate will be further lowered.—*The London Metropolitan.*

Sanitas.—Russian turpentine and water are placed in huge earthenware jars, surrounded by hot water. Air is driven through the mixture in the jars continually for 300 hours, the result being a decomposition of the turpentine and the formation of the watery solution of the substance, to which Dr. Kingsett, the discoverer, has given the name of "Sanitas." After evaporation the substance, as sold in tin cans, is a light brown powder, of a very pleasant taste and odor, and capable in a very remarkable degree of preventing or arresting putrefactive changes. This new desinfectant has been in use for some time in England, and is highly spoken of. It is said to have a pleasant odor, is not poisonous, and does not injure clothing, furniture, etc. For household uses it would seem well adapted.

Gutta Percha.—M. Vogel states that gutta percha dissolved in sulphuret of carbon in all proportions, and without the aid of heat, when placed on the surface of any object, the carburet of sulphur evaporating with great rapidity, leaves a thin layer of gutta percha, which acts as a preservative against the influence of water and air. From this he is led to infer that the solution offers a great advantage for fixing pencil, chalk or charcoal drawings in the paper in such a manner that it is impossible to injure them by friction. Sorel's patent *substitute for gutta percha* consists of colophony (brown resin), 2 parts ; pitch or bitumen, 2 parts ; resin oil, 8 parts ; hydrated lime 6 parts ; gutta percha, 12 parts ; water, 3 parts ; pipeclay or other argillaceous earth, 10 parts. Well mix and dissolve together.

ELECTRICITY AS A MOTIVE POWER.

The great question which occupies the mechanical world at the present time is the suppression of distances. Steam and electricity have already produced such surprising results that human activity, aided by the incessant progress of science, continues to aim at still greater results. In addition to the tele graphic system, which transmits thoughts to limitless distances; in addition to steam, which has afforded us so many powerful manifestations; and in addition to the telephone, which annihilates distance and brings human speech from widely separated quarters of the globe into close contact—we stand now in the presence of a new problem, the solution of which is faintly presented to our view through the misty clouds which envelop the future. This problem is the distant transmission of power by means of electricity. It is many years since the question was first presented to the world, and that it is capable of solution is easily understood. The immense quantity of wasted forces are sought to be utilized—concentrated at some central locality, in the midst of a flourishing population, there to be brought into subjection, and augment to vast proportions the public wealth.

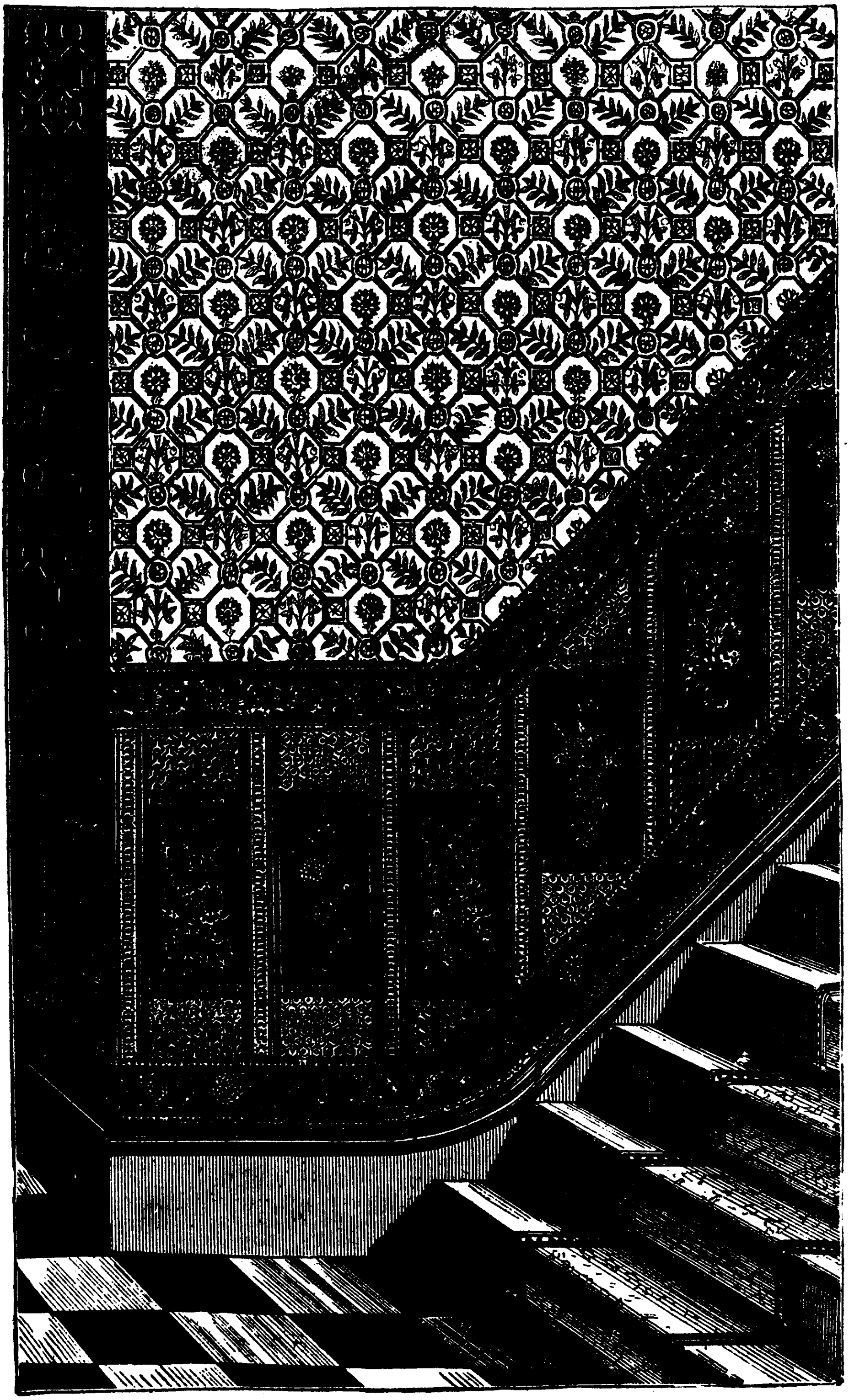
With a view to solve this problem, savants have long been occupied with numerous experiments to convert electricity into mechanical power; but the feeble results of electro-magnetic machines have been, from the commencement, an obstacle, before which science has been compelled to halt, and the logical conclusion has been drawn, from a multitude of experiences, that it is as difficult to convert electricity into mechanical power as to manufacture diamonds from carbon. But latterly great strides have been made in the direction of success, as appears from the experiments at Sermaize, in France, where plowing by means of electricity has suppressed distance and reduced the transmission of power to a practical issue. We have here the most curious as well as the most interesting demonstration of the great principle of the correlation of physical forces.

From a mechanical point of view this question of the electric transmission of power is not clear cut. It still remains in experiment, but will, in a short time, become a certainty. We can, even now, form a very correct estimate of the results which have been obtained. A distinguished engineer, M. E. Hospitalier, in giving a resume of all the experiments with electricity transformed into a mechanical power, says (we translate from *La Correspondence Scientifique*): When a dynamo-electric machine is put in motion by a motive force of a given power, it produces an electric current. This current, conveyed to a second and similar machine, is transformed again into a working or motive power, which can be utilized to the extent of 50% of the initial force required to put the first machine in motion. Numerous experiments upon the Gramme and the Siemens' machines leave this figure indisputable. Suppose, however, that the current is transformed into 20% only of the initial force, and we would produce immense results. Imagine a steam engine of 400-horse power located in a manufacturing centre of Paris, and putting in motion a certain number of Gramme or Siemens' machines, thus producing enormous quantities of electricity, which could be transmitted in every direction by means of wires to a greater distance than one mile, we would have 100 effective horse power, with this great advantage, that the simple placing or displacing of a small wire would regulate the demand for power without special instalments. Every horse power could be subdivided into a greater or less number of parts without diminishing the result, and as easily as can be effected with the electric light. We could, for instance, put in motion 10 sewing machines, 5 lathes, 3 card cutters and 2 saws in 20 different places with the current produced by one single machine, producing a one-horse power, and all the work performed by these 20 different industries, costing but 10 pounds of coal per hour. Would not the expense of rent, engineer, care, etc., be greater in comparison? These electric motors are not ponderous. One invented by Marcel Deprez, which will do the work of one man, weighs less than 37 pounds, while the motor for a sewing machine does not exceed eight ounces. These motors, it will be understood, are the mechanical means of transforming electricity into mechanical power. They produce neither steam nor smoke, and cannot explode. They are easily transported, and are always ready, by simply attaching a wire, to perform faithful and constant labor. We can readily perceive that great advantage would result to industries requiring small powers from a distribution of electricity, which would give motive power under such favorable conditions. It only remains to determine the value of mechanical results. That this will be done, is a question of only a few months, in spite of the predictions of W. E. Ayrton, in his lecture before the scientific meeting at Sheffield, that the realization of this power would not be effected before the next century. We have only to point to the practical results at Sermaize in France.

The Englishmen as a Reader.—The English gentlemen has for more than a century found the time to cultivate athletic sports without sacrificing his professional work, and, to put it in Mr. Ragehot's words, to "spend half of his day in washing the whole of his person"—a by no means unimportant start over the Continent, where such civilisatory habits could only be introduced a very short time ago. But the Englishmen of business has not only time to devote to his body, he has also leisure to cultivate his mind. England is the only country where people read, where they read instructive books, I mean, not only novels. Next to England ranges France, where the species of "general reader" still exists, although it is on the wane, and people begin to put their Thierry and Guisot nicely bound on their bookshelves, convinced that they have in this way sufficiently proved their respect for higher literature. As for the Italian, he seldom masters courage and perseverance enough to read more than a newspaper article of one paragraph; and the German, as everybody knows, reads a book only when he wants to write another book destined to supersede the one he is reading. The English alone find the leisure and the humour to read works of a general but serious character. I do not enter a sitting room without finding some new volumes on the table; if expensive, coming from Mudie's or Smith's library—which always supposes that such a library purchases at once a hundred copies or more of a book—or, if cheap, bought at the next bookseller's shop. No wonder, when on opening one of these by no means "popular" works. you read "seventh thousand" on the back of its title-page. On the Continent such a thing happens only with books destined for amusement or for the flattering of vulgar passions and vulgar curiosity, such as M. Tissot's and Herr Busch's twaddle. The leisure, coexisting with hard work, and the noble use made of leisure, are perhaps the most remarkable results of the enormous wealth which first strikes the eye of the foreigner in England. —*Nineteenth Century.*

Electric Stencil Plates.--MM. Bellet and D'Arros, of Paris, have patented a novel method of producing stencil plates, either of written matter or sketches, by means of electricity. A small Rhumkorff coil is the source, and they proceed as follows: A metal plate is united to one of the poles by a wire, and the other pole is connected to the core of an ordinary black lead pencil or other suitable point by means of a very fine wire. On the said plate is gummed a sheet of very thin paper, or other like material, previously dipped in water containing sea salt, and the induction coil is then set in action, and the design it is reqnired to reproduce is drawn on the paper attached to the plate with the pencil or point aforesaid, by which means the two poles are brought together, and the electric sparks pass continuously from the pencil point, producing on the paper small holes corresponding in outline with the design executed. The plate must be placed on some insulating material. The design in writing is thus furnished, the metal plate is dipped in water and the paper carefully removed. The stencilling thus obtained may be readily transferred to stone by inking a sheet of paper with transfer ink, placing the stencil thereon, covering it with a sheet of white paper, and pressing it sufficiently to cause the ink to pass through the holes in the plate. A lithographic plate is thus obtained which can be transferred in the ordinary way, and can be made of zinc by which a typographical stereotype may be produced. The inventors likewise produce etchings and engravings by covering the plate with a suitable varnish, and using the same electrical agency for tracing the design, after which it is eaten in by the ordinary nitric acid bath.—*Inventors' Record.*

Telegraphing without Wires.—Professor Loomis continues his experiments in the mountains of West Virginia, to demonstrate the theory that at certain elevations there is a natural electric current, by taking advantage of which, telegraphic signals may be sent without the use of wires. It is said that he has telegraphed eleven miles by means of kites flown with copper wires. When the kites reached the same altitude, or got into the same current, communication by means of an instrument similar to that of Morse was easy, but ceased as soon as on of the kites was lowered. He has built towers on two hills about twenty miles apart, and from the tops of them has run up steel rods into the region of the electric current.—*Journal of the Telegraph.*



HOUSE DECORATIONS—DESIGN FOR PAPERING A HALL AND STAIRWAY.

Miscellaneous.

MISNAMED THINGS.

The misapplication of a name in speaking of the common things of life is the source of many errors. Why things are not correctly named is probably due to the deficiency of our language in descriptive words. The *Journal of Applied Science* has this to say upon this subject:

Why should trade not have a Johnson to classify and correct the mass of inconsistencies that go to make up its nomenclature? We not only tax our brains to invent "fantastic" names for every new fabric, varied, perhaps, only by a thread or a shade from what our grandparents wore a century ago, but there are in use positive misnomers for many staple articles of merchandise. The following imperfect list, culled from sources already at hand, will give a faint idea of them:

Acid (sour), applied in chemistry to a class of bodies to which sourness is only accidental, and by no means a universal characteristic. Thus rock crystals, quartz, flint, etc., are chemical acids, though no particle of acidity belongs to them.

Blacklead does not contain a single particle of lead, being composed of carbon and iron.

Brazilian grass does not come from Brazil, or even grow there; nor is it grass at all. It consists of a palm leaf (*Thrinax argentea*), and is imported chiefly from Cuba.

Burgundy pitch is not pitch, nor is it manufactured in or exported from Burgundy. The best is a resinous substance prepared from common frankincense, and brought from Hamburg; but by far the greater quantity is a mixture of resin and palm oil.

China, as a name for porcelain, gives rise to the contradictory expressions—British china, Dutch china, Chelsea china, etc., like wooden milestones, iron milestones, brass shoe horns, iron pens, steel pens.

Cuttle bone is not bone at all, but a structure of pure chalk, once embedded loosely in the substance of certain species of cuttle fish. It is enclosed in a membraneous sac within the body of the fish, and drops out when the sac is opened, but it has no connection whatever with the sac of the cuttle fish.

Galvanized iron is not galvanized. It is simply iron coated with zinc; and this is done by dipping it in a zinc bath containing muriatic acid.

German silver is not silver at all, nor was the metallic alloy called by that name invented by a German, but has been in use in China time out of mind.

Honey soap contains no honey, nor is honey in any way employed in its manufacture. It is a mixture of palm oil soap, and olive oil soap, each one part, with three parts of curd soap, or yellow soap, scented.

Japan lacquer contains no lac at all, but is made from the sap of a tree called *Rhus vernicifera*.

Kid gloves are not usually made from kid skins, but of lamb or sheep skins. At present many of them are made of rat skin.

Meerschaum is not petrified "sea foam," as its name implies, but is a composition of silica, magnesia and water.

Mosaic gold has no connection with Moses or the metal gold. It is an alloy of copper and zinc, used in the ancient musivum or tesselated work.

Mother of pearl is the inner layer of several sorts of shells. It is not the mother of pearl, as its name indicates, but in some cases the matrix of the pearl.

Pen means a feather (Latin, *penna*, a wing). A steel pen is not a very choice expression.

Prussian blue does not come from Prussia, but is the precipitate of the salt of protoxide of iron with prussiate of potassa.

Salad oil is not oil for salad, but oil for cleaning sallades, *i. e.*, helmets.

Salt is not salt at all, and has long been excluded from the class of bodies denominated "salts."

Sealing wax is not wax at all, nor does it contain a single particle of wax. It is made of shellac, Venice turpentine, and cinnabar. Cinnabar gives it a deep red color, and the turpentine renders the shellac soft and less brittle.

Sperm oil properly means "seed oil" (Latin, *sperma*, seed), from the notion that it was *spermaceti*, (the sperm or melt of a whale). The sperm whale is the whale that gives the "seed oil," which is taken chiefly, but not wholly, from the head.

Whalebone is not bone at all, nor does it possess any of the properties of bone. It is a substance attached to the upper jaw of the whale, and serves to strain the water which the creature takes up in large mouthfuls.

Rhinoceros horn is not horn at all, but a kind of matted or compact hair, and is only like a horn from being a protuberance on the animal's head.

GLASS-WORKING.

Glass is usually brought into shape by being moulded or blown. There are a few other operations, however, which are constantly needed by the amateur, and which we will describe.

For cutting flat glass, such as window panes, and for cutting rounds or ovals out of flat glass, the diamond is the best tool; and, if the operator has no diamond it will always pay to carry the job to a glazier rather than waste time and make a poor job by other an inferior means. When, however, it is required to cut off a very little from a circle or oval, the diamond is not available, except in very skilful hands. In this case a pair of pliers softened by heating, or very dull scissors, is the best tool, and the cutting is best performed under water. A little practice will enable the operator to shape a small round or oval with great rapidity, ease and precision. When bottles or flasks are to be cut, the diamond is still the best tool in skilful hands; but ordinary operators will succeed best with pastilles, or a red hot poker with a pointed end. We prefer the latter, as being the most easily obtained and the most efficient; and we have never found any difficulty in cutting off broken flasks so as to make dishes, or to carry a cut spirally round a long bottle so as to cut it into the form of a cork-screw. And, by the way, when so cut, glass exhibits considerable elasticity, end the spiral may be elongated like a ringlet. The line of the cut should be marked by chalk, or by pasting a thin strip of paper alongside of it; then make a file mark to commence the cut; apply the hot iron and a crack will start; and this crack will follow the iron wherever we choose to lead it. In this way jars are easily made out of old bottles, and broken vessels of different kinds may be cut up into new forms. Flat glass may also be cut into the most intricate and elegant forms. The red hot iron is far superior to strings wet with turpentine, friction, etc.

For drilling holes in glass, a common steel drill, well made and well tempered, is the best tool. The steel should be forged at a low temperature, so as to be sure not to burn it, and then tempered as hard as possible in a bath of salt water that has been well boiled. Such a drill will go through glass very rapidly if kept well moistened with turpentine in which some camphor has been dissolved. Dilute sulphuric acid is equally good, if not better. It is stated, that at Berlin, glass cutting for pump barrels, etc., are drilled, planed and bored, like iron ones, and in the same lathes and machines, by the aid of sulphuric acid. A little practice with these different plans will enable the operator to cut and work glass as easily as brass or iron.

Black diamonds are now so easily procured, that they are the test tools for turning planing or boring glass where much work is to be done. With a good diamond a skillful workman can turn a lens out of a piece of flat glass in a few seconds, so that it will be very near the right shape.—*Amateur's Handbook.*

A Pleasant Remedy for Toothache.—Dr. T. C. Osborn, in the *Medical Brief*, states that his cook came to him with a swollen cheek, asking for something to relieve the toothache with which she had been suffering all the night. He was on the point of sending her to a dentist, when it occurred to him that there was in the house a vial of compound tincture of benzoin. "After cleansing the decayed tooth," he says, "I saturated a pledget of cotton lint with the tincture, and packed it well into the cavity, hoping this would suffice for the time, and told her to come back in two or three hours if she was not relieved. I was turning away, when she said it might not be necessary, perhaps, as the pain was already gone. Supposing her faith had a large share in the relief, I would not allow myself to think that the medicine had anything to do with the cure any more than so much hot water would have had. But when I arrived at my office, two other patients were awaiting me with the same affliction, and I determined, by way of experiment, to use the same remedy. To my agreeable surprise both patients declared themselves immediately relieved, and begged a vial of the tincture for future use. During the winter a number of similar cases applied, and were instantly relieved by the same treatment, all expressing much satisfaction with the remedy. In December I told my druggist of the discovery, and recommended him to sell it to any person applying for 'toothache drops.' This, he reports, he has done, and that every one seems delighted with the medicine."

HINTS TO COTTON MANUFACTURERS.—As to the remedies for the evils arising in the course of the cotton manufacture, each hurtful agent can be combated separately. The metallic dust given off by the grinding of the carding machines can easily be rendered harmless by the use of magnetic respirators, a remedy which would have been more generally adopted but for the prejudices of the operatives. The remedy for the cotton "fluff" and unavoidable dust given off in the carding-room is the open air. The necessarily warm rooms in which cotton spinning is carried on might be ventilated and still kept warm by admitting air into them through warmed chambers, an arrangement which exist in many private houses, and which could much more easily be carried out in a mill, where the surplus heat from furnaces and boilers, now so constantly wasted, might thus be utilised. Such a plan would also be compatible with filtration of the air through calico before its admission to the mill, by which means the sooty particles and other filth it contains might be removed, so preventing the soiling of the fine white cotton and the irritation of the breather's lungs Gas effluvia might be carried off, as is done in some of the best mills, by waste flues, the heat from the gas keeping up a constant current through them. In order to reduce the danger of taking cold by the sudden exposure to the open air of the operatives who work in the hot spinning-rooms, I would suggest that they spend ten to fifteen minutes in the carding-room before going out, so as gradually to cool the body, after the fashion followed in the Turkish baths. As to the dust arising from over-sizing and the steam bath necessary to the weaving of warps so treated, I have no suggestion to make but the obvious one of a little more honesty.—*Great Industries of Great Britain.*

THE CAUSE OF LONDON FOGS.—Dr. Frankland has lately concluded an investigation into the cause of the persistency and irritating character of the fogs which afflict the large towns of England, a subject which is rather opportune just now. The fogs are not always a sign of dampness, as they occur in comparatively dry air. Dr. Frankland has ascertained that their persistency in a dry medium is due to a coating of coal oil, derived from coal smoke, upon the surfaces of the minute particles of water which compose fog, the oleaginous coating effectually preventing the evaporation of the water. The oleaginous liquids are discharged into the atmosphere in large quantities during the combustion of bituminous coal in fires. Dr. Frankland, therefore, concludes that by the substitution of smokless coal, coke, and gas, for bituminous coal, town fogs would cease. This would be a consummation devoutly to be wished ; but considering the vested interests which are concerned in the supplying and using of bituminous coal, and the national preference for blazing fires, the reformation is just as likely to come from the adoption of some of the, as yet, undiscovered means of heating. But much might be done if the gas companies were more enterprising. Apart from the inconvenience, it is a waste of money to be using costly illuminating gas for heating, when a gas equally effective for that purpose, but far cheaper, could be obtained. Nor would it be requisite to have a double set of mains, as there are several methods by which gas could be rendered illuminating at a cheap rate.—*The Architect,*

WHITE BRICK.—A process is now being carried out, by Clarke & Pickwell, Hull, England, for the manufacture of white pressed brick, from common red clays. This process consists in mixing or grinding into the common clay a cheap material—chiefly magnesian limestone—which has been reduced to an impalpable and harmless powder by being burned and slaked. This mixture is passed through a series of mixing and grinding mills, and so completely ground that each particle of each ingredient is brought into close contact with each other. This mixture is then acted upon as it leaves the last mill by an apparatus which reduces it to a fine grain almost like running soil; in this state it falls through the feeder into the molds of a powerful steam-pressing machine, is subjected to a heavy pressure and is delivered at the delivery table a complete and almost dry pressed brick, which when burnt in the kiln, produces a white brick of good quality. The ingredients added to the clay at once absorb about forty per cent. of the moisture found in the natural clay, and the grinding is so close and complete that the mixture is thoroughly and evenly amalgamated. The change effected in the color of the red clay on being burnt is due to the presence of the mixture.

IRON AND GLUE IN STREET DUST.—In this country we have assays of street dust yielding gold in some towns, but glue and iron we have not searched for. Signor Parnetti has been engaged in analyzing the dust and *debris* of the streets of Florence and Paris. His investigation of the *debris* of the horse paths proves that the dust contains 35 p.c. of iron, given by the shoes of the horses to the stones. In the dust from the causeways this eminent chemist finds from 30 p.c. to 40 p.c. of good glue. Signor Parnetti selected and treated separately the dust from the causeways of the Boulevard des Italiens over a period of two months, which uniformly gave 30 p.c. of good transparent glue, it is said quite equal to Belfast. This eminent chemist is now engaged in the analysis of the dust and *debris* deposited by the shoe abrasions in Lombard street, Cornhill, Cheapside, and other thoroughfares of London, and has it in contemplation to place his discoveries at the disposal of a limited company, with a view of establishing blast furnaces on the banks of the Thames to recover the iron thus lost, and large glue works, which, it is thought, will produce more glue from the wasted material than will supply all London for every purpose.

TROUBLESOME OCTOPODS.—The Leeds *Mercury* says that a rather amusing incident was witnessed in the Scarborough Aquarium recently. The keeper, while engaged in cleaning out the tank occupied by the octopods, was suddenly seized by the leg (fortunately he had sea boots on) by the largest of the octopods, which fastened four of his tenacles round the leg of the boot, and with the other four held firmly on the rocks forming the back of the tank. A struggle ensued, during which the man found he could not disengage himself without killing the animal, and finally hit upon the expedient of slipping his leg out, leaving the boot in the water, and beating a retreat. The hungry octopus stuck to the boot for twenty minutes, when it relinquished its hold. A much more exciting story is reported in the Tokio (Japan) newspapers about a struggle between octopods and a bull, which would have ended fatally for the bull. if some men had not interfered by cutting the arms and legs of the monsters.

TREATMENT OF GOLD FISH.—Seth Green says this as to the proper care and treatment of gold fish : "Never take the fish in your hand. If the aquarium needs cleaning, make a net of mosquito- netting and take the fish out in it. There are many gold-fish killed by handling. Keep your aquarium clean, so that the water looks as clear as crystal. Watch the fish a little, and you will find out when they are all right. Feed them all they will eat and anything they will eat —worms, meat, fish-wafer or fish-spawn. Take great care that you take all that they do not eat out of the aquarium ; any decayed meat or vegetable in water has the same smell to fish that it has to you in air. If your gold-fish die, it is attributable, as a rule, to one of three causes—handiing, starvation or bad water."

"AN INTEROCEANIC NUISANCE," is what the *Engineering News* epigrammatically dubs the canal with locks that is advocated by the friends of several of the routes, which the late discussions on the subject of interoceanic transit have called out into print. The *News's* terse and vigorous sentence is too good to be forgotten, nor should its concluding paragraph on this subject be permitted to be lost : " In the canal which is to join the Atlantic and Pacific oceans, and be a highway *for all time* for the world's commerce, which are a few extra millions of money in original cost and its future inexpensive maintenance as against the continually-increasing and never-ending maintenance account of any canal with locks and embankments ?"

BLACK JAPAN FOR SEWING MACHINES.—Remove all rust or old varnish by means of emery cloth, then procure, say, 1 lb. of best black japan, one gill of best turps. Pour a little of the japan in a cup, add a little turps until of the consistency of ordinary paint. Then apply carefully to the parts to be japanned, using an ordinary small-sized paint brush. The japanning should be done in a wareroom, free from dust ; the machine should also be quite free from dust or grease. One coat will be sufficient if done carefully, if not a second coat may be applied with advantage.

ALMOST the universal article used on the continent for kindling fires are dry pine cones. A couple of these are usually enough to start a fire of dry wood, and several of them contain enough resinous material to start a coal fire without other kindling. They are readily lighted with a match, and are free from dust and insects. In Paris and other large cities on the continent scarcely any other than pine cones are used for kindling purposes in the hotels.

RAG PACKING FOR VALVES, BEARING SPRINGS, ETC.—This is made principally from the useless cuttings in the manufacture of India-rubber coats, when the gum is run or spread on calico foundations. Proportions as follows : Grind together useless scraps, 35 lbs. ; black lead, 18 lbs. ; Java gum, 16 lbs. ; yellow sulphur, 1 lb.

RIVETING.

BY ROBERT GRIMSHAW.

The rivet is a device employed, in general, to unite two plates of metal quite firmly together. Occasionally, as in a pair of scissors, the rivet acts also as a pivot; but ordinarily it is not a centre of turning. In most cases the strain upon it is a lengthwise pulling or tension, as in boilers, although in some substances, as in lattice bridge work on the English system, there is, instead of a pulling strain, a *shearing* action crosswise of the length of the rivet.

The ordinary rivet is of wrought iron, and has, when made, a first head, which may really be called the *tail*; and a cylindrical shank, body, or stem; and after being placed has a second head given to it, by upsetting the cylindrical stem. In Fig. 1 is shown a rivet uniting two plates, and it has marked on it the proportions which the various parts should have, as compared with the diameter of the stem. It will be seen that an "inch rivet," that is, one having a stem 1 inch in diameter, should have a head 1·8 inch diameter and 0.6 inch high, and that the shank should be long enough to project from 1.3 to 1.7 inch through the two or more plates which are to be united. Fig. 2 shows this rivet headed up by hammer blows delivered obliquely, and thus forming a conical head 2 inches in diameter and 0.8 inch high. These dimensions are larger than those of the first head, as the metal is less perfectly compressed and the shape not so advantageous. If a cup or former, sometimes called a "snap," be used, so as to finish the conical head, the conoid form is given, as in Fig. 3, and which has the advantages of sightliness, regularity, and slightly increased strength. In Fig. 3 the first head is not spherical in shape, but more flattened. Figs. 1 and 2 show plates which have had the holes drilled in them; rather expensive in any case, and unnecessary with iron plates. In Fig. 3 the holes have been punched, and as the die is always larger than the punch, to give "clearance," the holes are tapering. This form is better in those cases where the strain on the rivet is one tending to pull the heads off, as the metal of the shank is forced out (or ought to be) into an hour-glass form. Of course the plates are so put together as to bring the small ends of the holes together. Where a hole is necessarily drilled, as in a steel boiler plate, reaming or counter-sinking, as shown in Fig. 4, gives the same result as is afforded by the taper holes of the punching machine. The second head in Fig. 4 is flatter than in the others, as is sometimes demanded. In fact, there are cases where the head must not project at all, as in iron ship-building; and in this case the sheet is counter-sunk quite deeply, as shown in Fig. 5, and there is very little head left projecting after finishing. It is difficult to assign a length for a shank for this case, as in those shown in the first four cuts.

Good Norway iron will rivet quite well cold, but where it is required that the joint be very staunch, it is best to have the rivet fully red hot, so that one may be more certain that the hole is fully filled by the shank, and that the contraction of the shank in cooling may draw the plates still tighter together and keep the plane faces of the heads in absolute contact with the plates.

For bridge-work it is essential that the proportions of the rivets be very carefully determined and adhered to. Fig. 6, 7 and 8 show round, elliptical, and sunken heads. Hammering the head of the rivet, and the plate in its vicinity, is not calculated to better the resistance of the plates, as these last are really stretched as by *pening*. Steam riveting is largely employed, but hydraulic pressure is much better, and causes the shank to fill the hole absolutely and tightly; besides, the hydraulic machine is more readily controlled.

Where a rivet acts as a *pin*—that is, where it resists shearing strain, its strength may be calculated by mathematical formulæ. Figs. 9 and 10 show two modes of connecting links by rivets; Fig. 10 is chain riveting, and is mostly seen in bridge-work. The proportion between the thickness and strength of the plates and of the rivets should always be closely studied. We may say in general that for bridge-work rivets of great diameter, at comparatively great distances apart, are better than small ones close together.

For boiler-work the necessity of avoiding leakage makes it imperative that the rivets be close together; for thin sheets the diameter and the distance apart of the rivets should be proportionately greater than for thick sheets. Fig. 11 shows a single row of rivets in section and on top view; Fig. 12, double riveting, the rivets being placed "staggering," as they should invariably be. The edges of the sheets should, if possible, be cut with a slight bevel, to facilitate calking; and this calking should invariably be done with a round-nosed tool, so as to ensure perfect contact and to prevent *scoring* of the under plate. The joints of cylindrical boiler shells ought to run spirally around the shell, to give the greatest strength.

In using rivets of *very* long shanks, that is, with stems disproportionately long for the diameter, care should be taken not to heat the stem too hot, or else not to heat it throughout its whole length, as otherwise the contraction in cooling tends to pull the heads off.

While it is best to drill all rivet holes in steel plates, on account of punching altering the temper and causing liability to crack, the holes may be punched somewhat smaller than needed, and then reamed out; or the sheet may be annealed after punching.

Recent experiments in punching iron sheets show that a punched hole is stronger, than a drilled one—that is, leaves the plate stronger; for in punching there is a good deal of metal that is crowded into the sides of the hole instead of being punched out, and the deeper the hole in proportion to its diameter the more of this flow of metal and condensing it in the walls of the hole do we find.

DANGERS OF ELEVATORS.

We have more than once called attention to the dangers of elevators, and to the certainty that as they are now used a great many serious accidents must from time to time happen to them. An efficient contrivance for diminishing the danger of the worst of these accidents seems to be that of Mr. Ellitherpe, who has hit upon the device of putting an air-cushion at the bottom of the well to check the blow in case the car falls. A tight box is provided at the bottom; into this the falling car plunges, and the air, that is compressed beneath, forms the cushion which breaks the fall. The principle is familiar, and indeed has been applied to the same use in Gray's safety attachment for elevators. An experiment was safely tried the other day at the Biddle House in Detroit. An elevator car containing seven persons was dropped sixty feet by cutting the rope from which it hung. The car fell with frightful swiftness, but brought up safely at the bottom. A bench, which seems to have been overloaded, broke, but the passengers were unhurt, and a dozen eggs, with which heroic hardihood had strewn the bottom of the car, escaped unbroken. A previous experiment at the Parker House in Boston had not been so lucky, and showed the danger which is common to inventors of overlooking, while their attention is fixed on the main feature of their invention, the collateral conditions on which its success may depend. The well in the lower story was closed by a door. This with its casement was blown out of the wall by the compressed air, which, escaping, let the car down abruptly enough to shake and bruise the passengers in a way that sent them to their beds, though without permanent injury, we believe. The car and the passengers in this case weighed some four thousand pounds, and fell through a height of about eighty feet. It was certainly a naïve confidence that expected any ordinary door-casing to withstand the shock of this tremendous impact; nor is it quite easy not to smile at the innocence of the passengers, who prepared themselves to meet the worst by seating themselves upon the floor of the car, thus carefully presenting the end of the spinal column to meet the apprehended shock and transmit it directly to the brain. We would remind all our friends who may venture on similar experiments that boys, when they jump from sheds, with a safe and native instinct take pains to light upon their feet with loosened knees, which breaks the jar by a natural spring.—*American Architect and Building News.*

GALVANIC-RELIEF PLATES.—A recent French patent contemplates the embellishment of metallic plates, to be tinned or galvanized, by submitting them, after being suitably polished and grained, and printed upon with the pattern to be shown in a greasy ink, to the action of an acid bath by which the exposed parts of the plate are bitten in or deepened, and the parts protected by the ink are left in more or less relief as may be desired. The necessary relief having been secured, the plates are removed from the acid bath, the ink removed either with the aid of heat or of solvents, and the plates submitted to the galvanizing or tinningbath, or to an electro-plating process, as may be desired.

THE DEEPEST DIVING.—The deepest depth to which the diver has descended in pursuing his dangerous occupation, was that reached in removing the cargo of the ship *Cape Horn*, wrecked off the coast of South America, when a diver by the name of Hopper made seven descents to a depth of 201 feet, and at one time remained down 42 minutes.

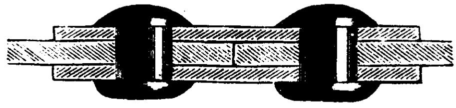


Fig. 10.

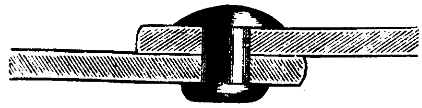


Fig. 9.

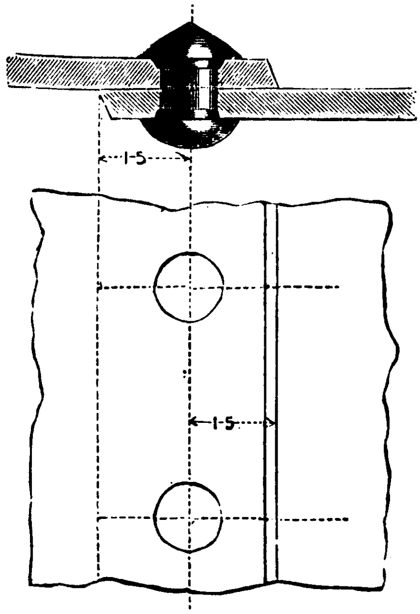


Fig. 11.

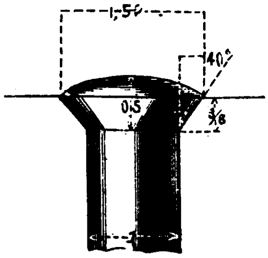


Fig. 8.

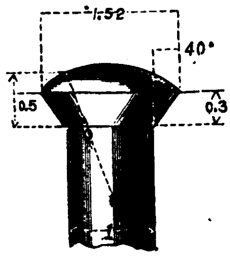


Fig. 7.

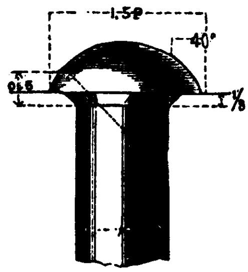


Fig. 6.

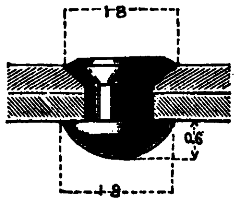


Fig. 5.

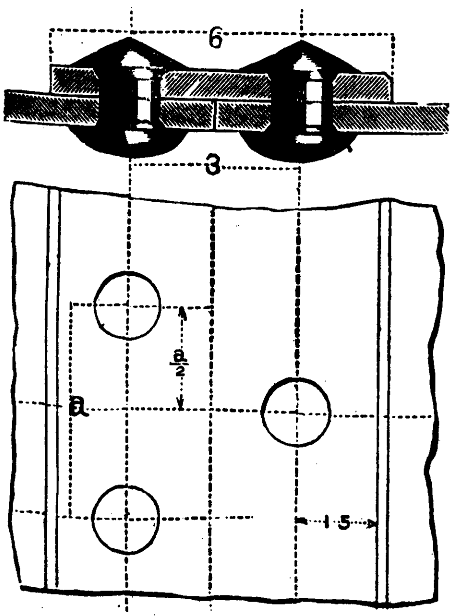


Fig. 12.

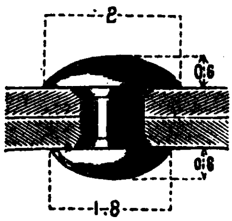


Fig. 4.

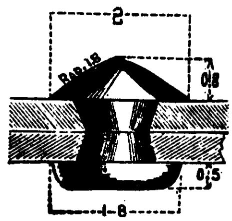


Fig. 3.

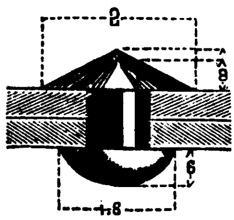


Fig. 2.

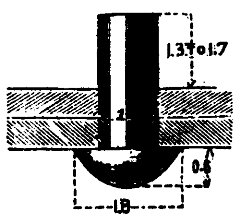


Fig. 1.

RIVETING.

Health and Home.

HOW NOT TO TAKE COLD.

Dr. Beverly Robinson, discoursing upon the subject of "colds and their consequences," gives the following useful advice: If you start to walk home from a down-town office, he says, and carry your coat on your arm because the walking makes you feel warm, you are liable to take cold. Therefore don't do it. If you should take the same walk after eating a hearty dinner, your full stomach would be a protection to you, but even then my advice would be, don't take the risk. A person properly clothed may walk in a strong wind for a long time without taking cold, but if he sits in a room where there is a slight draft, he may take a severe cold in a very few minutes. Therefore don't sit in a room where there is a draft.

Unless you are affected by peculiar nervous conditions, you should take a cold sponge bath in the morning, and not wash yourself in warm water. Plunge baths in cold water are not recommended, neither is it necessary to apply the sponge bath all over the body. Occasional Turkish baths are good, but those who have not taken them should be advised by a physician before trying them. Warm mufflers worn about the neck do not protect you against taking cold, but on the contrary render you extremely liable to take cold as soon as you take them off. They make the throat tender.

Ladies ought to wear warmer flannel underclothing than they now do, if one may judge from the articles one sees hanging in the show-windows of the shops. People take cold from inhaling cold air through their mouth oftener, perhaps, than by any other way. Ladies dress themselves up in heavy furs, go riding in their carriages, and when they get home, wonder where they got that cold. It was by talking in the cold open air, and thus exposing the mucous membranes of the throat. The best protection under such circumstances is to keep the mouth shut. If people must keep their mouths open in a chilly atmosphere, they ought to wear a filter.

Above all, be careful of your feet in cold damp weather. Have thick soles on your shoes, and if caught out in a rain which lasts so long as to wet through your shoes, despite the thick soles, put on dry stockings as soon as you get home. But in cold, wet, slushy weather don't be caught out without overshoes. Rubbers are unhealthy, unless care is taken to remove them as soon as you get under shelter. They arrest all evaporation through the pores of the leather. Cork soles are a good invention.

When you go into the house or your office, after being out in the cold, don't go at once and stick yourself at the register, but take off your coat, walk up and down the room a little, and get warm gradually. Warming yourself up over a register just before going out in the cold is one of the worst things you can do. Never take a hot toddy to warm you up, unless you are at home and don't expect to go out of the house till the following morning. In short, make some use of your common sense, and thus emulate the lower animals.

IS ALUM POISONOUS?

This question has caused a good deal of discussion. Alum is used by many bakers to whiten their bread, enabling them to use an inferior flour. It is more extensively employed as a cheap substitute for cream of tartar, in the manufacture of baking powders. It has not been considered immediately dangerous; although if continued it induces dyspepsia and obstinate constipation. But the fact that many cases of poisoning have occurred from baking powders which contained alum, puts the question in a more serious aspect, and prudent people will exercise caution in selection of baking powders.

Under what conditions, then, does this substance—formerly used only for mechanical or medicinal purposes—become poisonous? They are certainly obscure, and at present we can only surmise what they may be. We suspect that the cause exists in the individual poisoned; some peculiarity of the constitution producing a morbid change in the secretions of the stomach, with which the alum combines and forms an active poison; or the secretions may be healthy, but in unusual proportions, and that these less or greater proportions, in combination with the alum, constitute a poison.

For example: Two parts of mercury and two parts of chlorine form calomel, which is not poisonous; but change the proportions to one part of mercury and two parts of chlorine, and we get corrosive sublimate, which is a deadly poison.

Then, again, we know nothing of the causes of constitutional peculiarities. Why is it that one person can eat all kinds of green fruit and vegetables with impunity, while the same course might cost another individual his life? One person can handle poison ivy and sumac without being in the least affected, another is poisoned if he approaches to within 10 feet of them. Out of a family residing in a malarial district, some of its members will suffer half the year with fever and ague, while the others will enjoy excellent health during the entire year. Foods that are wholesome to some persons are actually poisonous to others. This is especially true of some kinds of fish. There is no safety in taking alum into the stomach, as it is shown to be always injurious, and often dangerous. Baking powders properly compounded, and containing pure cream of tartar instead of alum, are more convenient than yeast; and bread and pastry made with them are just as wholesome, and far more palatable.—*Hall's Journal of Health.*

DIPHTHERIA.

Dr. Benjamin Browning, the Health Officer of Rotherhithe (London), has an interesting paper on this subject in the *Sanitary Record.* He gives a variety of cases, occurring in city and rural districts, which appear to prove beyond a doubt that diphtheria may be caused by polluted water. The disease has been found to prevail in families using the water, while their neighbors who did not use it, but who were otherwise exposed to the same chances of infection, were exempt. In one instance he met with seven cases of diphtheria in the family of a railway station-master. He says: "I could ascertain no previous contagion, but found the existence of the customary polluted shallow well, close to the public latrine, the whole premises being isolated, standing on a lofty chalky embankment. Two casual visitors to the station (not to the dwelling-house) who drank some water in the waiting-room also contracted the disease. There was no more of it before or afterwards in this parish while I knew it."

Dr. Browning seems to have been careful to satisfy himself that the disease could not have had any other origin than the bad water. On this point he says:

"In the country epidemics I have mentioned, at their commencement, no direct personal contagion could be made out, although it was anxiously sought for; aerial infection seemed everywhere contra-indicated, owing to the open and breezy situation of nearly all the implicated dwellings; in all of them the drinking water was organically impure, and received surface filth of every description: and in the town cases there was also clear evidence of water pollution by sewer-gas or fetid emanations, if not by actual deposit of dirt. And I venture to submit that I have therefore supplied some of that 'evidence,' which is by Dr. Parkes and others deemed 'still wanting' to prove the 'production of diphtheria by contaminated water.'"

Not satisfied, however, with this logical evidence, Dr. Browning determined to settle the question by direct experiment upon the lower animals; and he actually succeeded in infecting two kittens with the disease, by feeding one with milk mixed with water in which he had kept diphtheritic false membrane and sputum, and the other with milk adulterated with water taken from the cistern of a house where a fatal case of diphtheria had recently occurred. Microscopic specimens of the diphtheritic membranes from these animals were shown at a meeting of medical gentlemen, none of whom were committed to Dr. Browning's theory, and pronounced by them to be identical with specimens taken from human beings. If this testimony is not accepted as conclusive, it must at least be admitted that it is of sufficient importance to show that further experiments and investigations should be made in order to confirm or refute it.

POISONS AND THEIR ANTIDOTES.

Reliable statistics, running for many years, and extending over large areas, show that accidents from poisons are of much more frequent occurrence now than formerly. This fact is no doubt due to the much more general use of poisons at present than in years past, both in ordinary household matters and in the arts.

While in all cases of poisoning the chief reliance must be placed upon medical aid, yet it often occurs that the need for a remedy is urgent, so that others should know the most ready and available methods of relief. There are some general instructions which, in the absence of direct antidotes, will apply to most poisons, and the New York *Independent* has done a good work in preparing and publishing the following quite full directions of how to act in cases of emergency or while waiting for a physician:

Many poisons do their harm by their immediate action upon the esophagus and the coats of the stomach. Hence, if any liquid or soft solid substance is soon swallowed, it tends to diminish the effect. To this end liquids, such as water or milk, may be freely given. Oils also have a protective agency, and these diminish the virulence, especially of the acrid poisons.

It is also a safe indication to remove from the stomach by means of emetics the substance which has been swallowed. A teaspoonful of mustard in a tea-cup of warm water is generally nearest at hand, and may be given to an adult, or half the quantity to a child, every ten minutes until vomiting is excited. A half teaspoonful of powdered ipecac, given in the same way, will act as well. Tickling the throat with a finger or a feather five minutes after the emetic has been given is likely to hasten its effect. They may well be aided in their action, as well as the stomach protected, by the use of flaxseed, or slippery-elm tea, or eggs, or jelly, or a teaspoonful of melted butter, or lard, or molasses. Whenever the poison is one producing stupor, cold to the head, warmth to the extremities, rubbing the skin with a flesh-brush, and attempts to rouse the person by alternate warm and cold sprinklings may be tried.

Better than all, the chemical antidote should be given, if known. Where an acid has been swallowed, soda, saleratus, lime, magnesia, or prepared chalk should be mixed with water and given in frequent doses. Of these the best is the calcined magnesia, given freely. If an alkali has been swallowed, as a lump of potash or lime, then acids, as vinegar, cider, lemon-juice, and the like, are indicated ; but the use of oily and mucilaginous drinks must not be omitted. In poisoning with copper and its compounds, vinegar must be carefully avoided. The recent cases of pie-poisoning in New York city were probably owing to the action of some acid upon a copper kettle, or on copper in some other form.

Oxalic acid, used for cleaning metal, is sometimes taken for Epsom salts. Chalk, whiting, or other alkali should be freely used before any attempt to excite vomiting.

Prussic acid, although called an acid, is feebly so, and kills by its direct poisonous power over the nerves of organic life. The concentrated juice of peach leaves and kernels, of laurel, etc., may affect in the same way. Hartshorn, alternate cold and warm effusive stimulants to the surface and internally are more important than any other means. Artificial respiration, the same as directed for drowned persons, may be required. Smith's antidote of a half teaspoonful of pear lash, followed by 10 grains of copperas in water, is of service where you are sure as to the acid having been taken.

Sugar of lead and other salts of lead are best neutralized by white of eggs, Epsom salts, and lemonade.

When blue vitriol, or verdigris, has been taken, white of eggs, paste of wheat flour and flaxseed tea, sweetened with sugar, are indicated.

When green or white vitriol, or litharge, or yellow ochre have been swallowed, chalk and flaxseed tea are of service. If lunar caustic has been swallowed, a cupful of salt and water is the antidote.

Phosphorus, as used for poison of vermin and for matches, is sometimes eaten by children. Magnesia or other alkali, with water or mucilaginous drinks, are the readiest means of relief.

Creosote or an overdose of carbolic acid is to be met by white of eggs, milk and wheat-flour paste.

For poisons of the narcotic kind, such as opium, aconite, belladonna, henbane, digitalis and tobacco, there is not at hand any antidote. Stimulating emetics, stimulants to the surface, and, if need be, artificial respiration are indicated. Heavy draughts of strong coffee help to postpone the narcotism of opium. Lemonade or other mild acids are deemed of some service.

Overdoses of camphor or chloroform are an indication for alcoholic stimulants. We are still without certain antidotes for several of the narcotics.

Arsenic, either in its metallic form as gray fly-powder or the white arsenious acid, has an antidote in the hydrated peroxide of iron. Until this can be secured, warm water, milk, plenty of eggs, and lime water must be our reliance. The most frequent mistake of vegetable foods are the substitution of other varieties for the edible mushroom and the use of poke root (*Phytolacca decandra*) for horse-radish. No antidotes are known. But the indication is to use mustard or other stimulating emetics, and prevent further trouble by a few drops of laudanum, frequently repeated, until pain or sickness abates.

These are merely directions for those sudden cases of emergency which may occur in any family, and which, in the country, at least, occur when the physician is not within ready reach. With the use of disinfectants, insect remedies, Paris green (arsenic), and with the increasing familiarity of the people with various chemicals, public health requires great care as to labeling all such articles. The medicines left over the physicians' prescriptions should either be marked or thrown away. Teach those under your control not to eat any vegetable or leaf without knowing what it is. All flowers with the cups turned downward or hooded, and all stalks which exude a milk-white juice when broken, are to be regarded as poisonous. All paints, whether of oil or water colors, should not be held in the mouth. It behooves all householders to have a special place for keeping all extra hazardous or doubtful compounds, and to cast away all unmarked or unneeded bottles and packages.

DISINFECTANTS.—The National Board of Health, in its circular on " Disinfectants and How to Use Them," makes a clear distinction between disinfectants and deodorizers, and disseminates the wholesome truth that "disinfection can not compensate for want of cleanliness or of ventilation." The recommendations of the board as to the disinfectants to be employed are as follows : For fumigation (that is, the purification of an infected atmosphere), roll-sulphur ; for sewers, cess-pools, and the like, sulphate of iron (copperas), dissolved in water in the proportion of 1½ pounds to the gallon ; for clothing, bed-linen, etc., sulphate of zinc and common salt in the proportion of 4 ounces sulphate and 2 ounces salt to the gallon. The interaction of these two compounds doubtless results more or less promptly in the formation of sulphate of sodium and chloride of zinc, which last is recognized as being the most energetic of the mineral disinfectants. The recommendation of the board to employ the zinc compound in the form of sulphate (with salt), instead of applying the chloride of zinc directly, may perhaps be explained on the ground that the sulphate of zinc is a stable salt that remains in solid form, and may be exposed to the atmosphere without change ; whereas the chloride of zinc cannot be preserved in solid form save in hermetically-sealed vessels, having such a powerful avidity for moisture that it rapidly liquifies by abstraction of moisture from the air. This property renders zinc chloride inconvenient to handle. By its indirect production after the recipe of the board, this objection is overcome. The board does not recommend carbolic acid for general use, for the reasons that the quality of the commercial article varies greatly, that it is difficult to determine its quality, that it must be used in comparatively large quantity to be serviceable, and that it is liable, by its strong odor, to give a false sense of security.

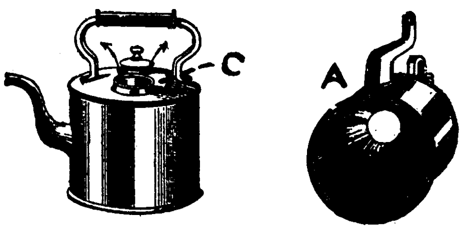
ENGINEERING NOTES.—Of the present state of work at the *St. Gothard tunnel*, it is reported that a serious obstacle has lately been encountered in some soft strata, the enormous pressure of which has, up to the present, resisted all attempts at successful penetration. The most solid beams are bent after a little time, and a resistance-wall of 1 meter thickness was completely crushed. Another of 2 meters thickness is now constructing. In these strata, the boring machine is useless, and only hand-labour can be employed.——The daily press of the past week chronicles the arrival, at the Isthmus of Panama, of M. de Lesseps, with a party of engineers. The first work of the party, it is noted, will be to verify disputed points in the existing surveys of that portion of the Isthmus. Lesseps is reported to have declared his unshaken faith in the practicability of the *sea-level* canal approved by the Paris Conference.——A bill has been introduced into the National House of Representatives for the creation of a permanently deep, wide, and *straight channel through Sandy Hook* bar to the port of New York.——On the 8th of December, preliminary work for the driving of the *Mersey tunnel* was commenced. The engineers will drive trial headings both from the Liverpool and Cheshire sides of the river, to determine the nature of the strata to be encountered before beginning the main railway tunnel.

CONGESTIVE HEADACHE.—The use of the old domestic remedy a tight bandage, during the attack is useful. I make use of a rubber bandage, applied thoroughly from the eyes up, with a thin pad over each temporal artery, if the temporal ridge be sharp enough to keep the bandage from compressing the arteries. Instead of rubber, a well applied muslin bandage may be put on and then wetted, using compresses over the temporal arteries. The comfort thus given is sometimes surprising.—*Sanitarian.*

THE *Chemiker Zeitung* is authority for the announcement that the German Imperial Department of Public Health is about instituting measures for the repression of secret and proprietary remedies ; and that in Switzerland the sale of patent and secret medicines is about to be submitted to very stringent regulations.

REGISTERED TUBULAR TEA KETTLE.

Mr. B. Barren, of Cross Cheaping, Coventry, has invented a new and improved tea-kettle, which it is claimed will boil water with either fire or gas in one-fourth the time occupied by any ordinary kettle of equal capacity, and consequently the invention is likely to be of service where rapid boiling is required. This rapid boiling is effected by an arrangement consisting of a funnel shaped tube, shown in the accompanying engraving A, by means of which the heat is conveyed through the interior of the kettle, entering at B, and leaving at C, where the upper portion is so arranged as not only to secure the funnel but firmly fix the handle and holding it more securely than the old style of riveting. In this way the heat not only embraces the outside of the kettle, but is drawn through the inside of the cone-shaped funnel by a strong draught, exposing a greater area of metal to the action of the fire, and causing the water to boil as if by magic. These kettles, which may be ordered through Messrs. Martineau & Smith, Birmingham, are manufactured of best block tin, of extra strength, and are produced at a price that will place them within the reach of even the most economic of house-keepers.



THE PRESERVATION OF IRON SURFACES.—In a note on this subject Mr. C. Graham Smith says: The paints used for iron-work are of every description, nam eand quality. The usual varieties employed for preserving it against corrosion may be divided into lead, iron oxide, silicate, and tar paints. Differences of opinion exist as to the relative merits of the first three descriptions, but the experience of three foremen painters connected with establishments in England is decidedly in favor of lead paints, when of good quality and mixed with good oil without spirits. Unfortunately, there are no reliable practical tests to insure good materials alone being used. Consequently, both the colors and the oils are often inferior in quality and much adulterated. For these reasons, and on account of cheapness,iron oxide paints are by some preferred. A little white lead mixed with red makes it go further and easier to work into corners. If the first coats are put on with pure red lead, owing to its weight, it is liable to run off; but the last coat should consist of red lead alone. The tar paints are more often used for iron-work which is not to be seen, such as water-pipes, floor-plates for bridges, and girders which are to be built into masonry on brickwork. It is cheap and answers well for such purposes and for sea-work, as it is said not to foul so readily as lead or other paints of a finer description. A good rough paint is made by heating coal tar and mixing with it finely sifted slaked lime, in the proportion of between half a pound and a pound of lime to a gallon of tar, adding sufficient naphtha to render it of a convenient consistency for laying on. This composition should be applied while hot, but not too hot. Do not keep it over the fire too long, or it will lose its essential oils. Some positions admit of the paint being sanded, in which case it should be done, as it adds to its durability. Before painting iron, give it a coat of boiled linseed oil applied hot.—*The Iron Age*

A USEFUL COPPER ALLOY.—A very useful copper alloy which will attach itself to glass, metal or porcelain, may be made as follows:—From 20 to 30 parts finely blended copper (made by reduction of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this add 70 parts of mercury and triturate well, then wash out the acid with boiling water and allow the compound to cool. In ten or twelve hours it becomes sufficiently hard to receive a brilliant polish and scratch the surface of tin or gold. When heated it becomes plastic, but does not contract on cooling.

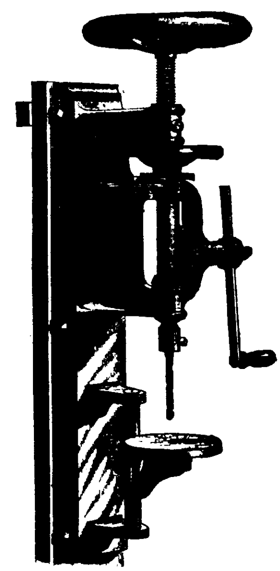
IT is said that if twice the amount of water flows from a given-sized jet against a turbine, it will increase the capacity or power of the turbine eight times.

IMPROVED BLACKSMITH'S DRILS.

The adjoined engraving represents an improved selffeeding drill, intended especially for the use of blacksmiths. It is, however, of course adapted to for various kinds of drilling, and will drill from ⅛ to ¾ inch holes in cast or wrought iron. The frame is of iron, cast in one piece, giving the machine strength and stiffness. The forked arm, accurately machined, holds the finished table upon the lowest spindle at any elevation within its limit of adjustment of 6 to 12 inches from the bottom of the main spindle.

The feed, having a run of 4 inches, has three rates of speed, which may be quickly adjusted by a thumb-screw. The gears, ratchet, and feed cam are cut; the cam roll, pawl and screws are hardened, and the construction throughout is excellent. The crank being rectangular, will not turn in the socket when the thumb-screw is loosened for adjustment. All bearings of the main spindle may be lubricated through an oil-hole in its top. Drilling may be done on wheels and other bulky articles by removing the table, or swinging it aside, and resting the work upon the arm or an independent support.

This machine may be fitted for power by adding a cone pulley, which will not interfere with the hand crank. Its weight is 120 pounds, and is manufactured by the Pratt & Whitney Co., of Hartford, Conn.



HOW TO KEEP VARNISH BRUSHES.

It is but needful to say when speaking of a method for keeping varnish brushes in good order, to first get your brush, and every painter will know what that means.

There seems to be nothing more difficult than to obtain a good brush, and no painter, willingly, will part with it, or even loan it to another. The next thing of importance, after getting the brush, is to keep it in good working order. No doubt there are a great many different opinions as to which is the best way, and though many feel they have the "best," yet there is room for further ventilation of ideas. Having often talked to painters on this subject, we find they will differ, some prefer one thing and some another. This method has been known to give satisfaction, yet it is given for what other minds may see and find in it.

WHAT TO KEEP YOUR BRUSHES IN.

As to the keeper, it matters little, so long as the brushes are suspended by wires and have a good covering so that no dust can penetrate. Sufficient varnish should be in the keeper, so that with the bottom of the brushes at least an inch and a-half or two inches from the bottom of the can, the hair and rim of the brushes are submerged. This prevents the varnish drying on the hair or binding. Never let your varnish get but to the top of the hair, as it will dry, and your brush will become lousy.