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SCIENCE IN OUR PUBLIC SCHOOLS.

WE follow up our article on "Practical Training in Public Schools," by a few more remarks on the same subject; it is one of great importance to the community, and should receive more public attention than has hitherto been given to it. We want more practical men to be on the Boards of Education, and our Public Examiners and School Inspectors should give more attention to what is practical in education and essential to the wants of our people, than to forcing upon them a mere superficial knowledge of subjects of little importance to their requirements in after life. There cannot be a doubt that our schools are burdened with too many studies. All sorts of fantastic theories and notions have crept into the profession of teaching, and many of our teachers are becoming pedagogues, who are not satisfied with confining themselves to teaching growing mankind the essential parts of a practical education, such as reading, writing and arithmetic, but stuff their pupils with a variety of information, which it is impossible for them to digest, in the form of ologies, isms, and crotchets of eccentric and pedantic examiners; so that the most essential part of education for an ordinary citizen, who in youth time can spend but a few years at school, and who does not intend to study any of the learned professions, is neglected, and valuable knowledge lost which might have been gained had his time at school been more profitably employed. Such a state in our educational system demands reform, as it shows an utter want of knowledge in our Education Departments of the value of science and practical training to the mass of the youth of the Dominion.

Something more is required in a country like Canada, whose prosperity depends on agriculture and its manufactures, and which aspires to hold a high place yet in the World's industrial progress, than even the knowledge of mere reading, writing and arithmetic, as taught in the common country schools, and the higher knowledge obtained in High Schools, which is too often of such a superficial character as to be of no after utility, and that want is practical illustration and practical teaching, which should go hand and hand together.

The knowledge of mere reading and writing to the poorer classes in the present day is far in advance of what it was a few years ago, and far be it from our desire to cry down the present system of education in Canada; on the contrary, it is most excellent and highly approved of by all; but it is the application of studies to the wants of life that we desire to deal with. Reading and writing, to be sure, are the keystones to further knowledge, but unless the child has been taught by early application some useful branches of study, and the mind directed into proper channels, by which a taste is developed for more solid information, all the use will ever be made of his knowledge of reading will be to peruse silly stories and trashy novels. The enormous sale of this class of books fully bears out this assertion.

We believe the feeling is growing stronger, day by day, in the minds of parents, that a change in the branches taught is necessary, and more attention should be paid to the introduction of certain branches of knowledge in our public schools that will be of practical utility in after life, and the question is one of choice of the subjects to be taught, as it would be unwise to introduce indiscriminately everything that happens to fall under the attention of those called upon to regulate these matters. And here we may observe that the Boards of Education should contain among their members men of high standing in the professions of civil and mechanical engineering, architecture, and chemistry, as well as those of high classical and mathematical attainments, as the latter are seldom, by the very nature of their education, practical men.

The subject has to be considered from two aspects:—1st. What branches are absolutely necessary? and what others are merely desirable, and which can, without harm, be entirely discontinued in the present state of society, and can be attained at any future period of life by self-study? 2nd. What subjects of study have the best influence in developing practical judgment, and, in general, the minds of the pupils? This is a very important point, for, as stated in our article on "Practical Training" (see page 257, September number,) most branches, so far as taught in our public schools, are merely exercises of the memory—and what is the worst feature of it—a mere mechanical memory for words and names.

The study of Latin and Greek became prevalent in olden times, for the simple reason that the former principally was the only language by which ambassadors, statesmen and churchmen could hold conversation with foreign Courts and with each other, when nations mingled but little together and could not speak each other's language as they now do, and when the principal works handed down to us from posterity were nearly all written in these languages; and also for the reason that so little was known, in those days, of other matters, that it was impossible to keep students busy except by acquiring the classical languages. But times have so changed now, that if a man wishes to become eminent in one particular branch of science or literature, the whole study of a lifetime must be devoted to it. In practical knowledge the ancients were like mere children to the present generation, and we can learn scarcely anything practical from ancient writers; therefore, we are forced to the conclusion that the teaching and the occupation of a youth's time at school, who is destined for a learned profession, and whose parents can afford to give him a collegiate education, should be of such a kind as is suitable to that end; but that the youth destined to be a mechanic, and whose parents can only afford to keep him a few years at school, should not be obliged to follow the same studies in class with the student for a profession, and which he never can complete, but his time should be devoted to the acquisition of those branches of knowledge of practical use to him in the trade he is to follow, and not thrown away in acquiring a mere smattering of classics and mathematics. This is a grave error, even a serious wrong, and needs reform.

Writing, reading and arithmetic, geography and history, have for some time been considered necessary branches to be taught to all pupils in our public schools, and they are doubtless most important for every boy and girl to learn, but at the same time might be taught a general knowledge of the earth on which we live, of the various nationalities which partake of the advantages it offers, and a sufficient knowledge of practical geometry for mechanics. There are other branches which should be also taught, but which could be more readily impressed upon the mind in the form of lectures, accompanied by illustrations and proper diagrams, such branches as astronomy, anatomy of the human frame, geology and botany. The way in which many of these branches are taught in most schools makes the studies distasteful by confining the students to recitations from mere text books, when, if taught by lecture and made both amusing and instructive, would be comprehensive to the mind of the youngest child. We confidently believe that more real knowledge could be acquired by illustrative teaching in one year than by our present system of text books in two. These studies, combined with natural philosophy, would explain those phenomena of nature immediately surrounding us, and are the best basis for religious culture, as they teach all respect and admiration for the wonderful powers which pervade the universe.

In regard to drawing, which in several previous articles we have advocated, it is a branch of tuition of the utmost importance, and which is receiving the greatest consideration in the public schools of the United States and European nations, as evinced by the examples exhibited from schools at the recent international exhibitions; it is a branch which we may say is altogether disregarded in the common public schools, and yet it is one of the most essential studies for a mechanic; moreover, it has a most beneficial influence in the development of the mental faculties. A pupil who has learned to draw has always a better developed mind than those ignorant of the art. Drawing we should recommend to all, and pupils may be put to it quite young, especially when they possess some natural talent and like it. It requires, however, an able instructor to make the pupils reap all the benefits. This is the case with all the branches of study, especially those that are more influential in developing other faculties of the mind than a parrot-like memory, against which we always most earnestly protest, but which unfortunately is the most cultivated, as by it the pupils make the most striking display at public examinations, at the expense, however, of other and much more important mental faculties, which become crushed by the over-straining of the faculty of memory for words and sounds.

The above are only suggestions, the further development of which we leave to the reflecting reader. We have no doubt that many will agree with us that there is a necessity for reformation in the method of teaching and in the branches of education taught in our public schools, and of the unnecessary expenses parents are put to in the purchase of new books, many of which are merely the productions of some political pedant, and are in no way superior to other text books of the kind, and frequently far inferior. The cost of unnecessary books required now in public schools is becoming most vexatious to parents of large families, who can ill afford the expense. In many instances the child has hardly learned a few pages of a newly purchased book when it is thrown aside for another. It is high time that only certain standard books should be used in our public schools, when the change is merely for another work, to obtain the same end in different words, often to the confusion of the pupil.

In conclusion, we may add that we by no means would insist upon following the same course for all pupils; let those who love music and have a natural disposition for it, obtain some preliminary knowledge which will aid them afterwards to devote more time to it, as music is a study which, in order to acquire even the smallest degree of proficiency, requires more time than can be given to it in any public school; but whatever branch of learning is taught in our public schools, let it be so practically taught that it will be thoroughly understood by any child of ordinary intellect, who, if thus practically instructed in early life, would, when his memory grew stronger and his intellect ripened, far excell in general ability the boy with the parrot-like memory, who stands first in public school examinations and is the teacher's prodigy, but often does not come up to even mediocrity in after-life.

EARLY INHABITANTS OF BRITAIN.

At the Thursday evening lecture at the London Institution last week Professor Boyd Dawkins gave an interesting summary of what has been learnt of the early inhabitants of this country from pit and cave explorations. Enough, he said, was now known of them for some of their characteristics to be traced in the present population. The claims of race have lately been urged in the cry of Panslavism, and we ourselves take pride in recognising an Englishman as an Englishman, whether he is born in Britain, Australia, or America. The history of the "English" from their invasion of this country in 449 is fairly well known. It took two centuries from their first landing at the Isle of Thanet for them to drive back, district by district, the inhabitants they found here, whom we should call the Welsh or Iberian people. It was not until 607 the invaders took Chester. His object was to speak of this earlier people turned out by the English. He wished first to mention that the Roman invasion had no more influence, so far as blood was concerned, than has British rule in India at the present time on blood there. The history of our island begins with the age of steel and iron—with that civilisation of which the term "iron age" is accepted as typical. He had to deal with the pre-historic people. Before the iron age there was what is known as the "bronze age" of civilisation, and further back again than that the "polished stone" age. It was this "polished stone" age of which he had to speak. The habitations of the people of this age are now known to us from the examination of such traces of groups of dwellings as are met with at Cisbury. The people lived in huts which had roofs to them. Their animals, most probably domesticated, were sheep, goat, ox, hog, and horse, and there is evidence from the bones that the horse was used for food. The fact that the horse has ceased to be animal for food is due to the "ecclesiastical" superstition that, as it was used sacrificially, it was not to be eaten. It came to be not the "correct thing" to eat horse. The dog, too, was used for food, as well as for herding and other purposes. In all the sites of old dwellings broken and cut bones of dogs are met with. All the bones show they were large dogs, not diminutive pets. Still more can be learnt of the people from their implements. They had pottery made by hand, not turned on a wheel. They struck lights from iron pyrites, not from steel, as steel was not invented. They ground corn. The needles found point to the tailors' and dressmakers' art being in a fashion followed. They spun and wove apparently, for some of the implements found could hardly have been used for other purposes. As now, so then, the ear was adorned, and perhaps, nose rings were worn. The people, too, were warlike, and their spears, bows, battle-axes, and stones for slings show that they liked then as much as "civilised" people do now to try the effect of weapons of destruction. They were evidently not a nomadic people, for their centres of habitations were well fortified, and General Lane Fox is of opinion that the work shows as much engineering skill as any fortification works of our own day. The number of strongly-fortified places seems to indicate many tribes who enjoyed warfare. There is evidence from implements found, that these people were miners. With all this they were a religious and a superstitious people. Avebury might be called their Westminster Abbey. It was an imposingly grand temple, and graves clustered around it as burying-places are now associated with places of divine worship. The tombs contain such things as the departed might want in his future state, and in and around important tombs have been found relics of funeral feasts or "wakes." That there were family vaults is well established, and family peculiarities can be traced in the skulls. Looking at the sum total of what we know of these people, we find in them many of the rudiments of that culture which we now enjoy. Turning to the evidence as to where this people originally came from, the work of archæologists on the Continent has shown that this Iberian, or, as he would call it, Welsh, race was widespread over Europe. The small dark Basque of the Western Pyrenees showed many features identical with what could be made out of the old people. At fairs in some of the Welsh towns, too, the Iberian element could be traced in some of the people who came to them from out-of-the-way places. St. Asaph was remarkable in this respect. In Ireland, too, small dark men are to be seen who, if put side by side with the Basque, could not be distinguished as regards type. The English who invaded the old "Welsh" or Iberians of our islands were, on the contrary, tall, fine people, with light hair and blue eyes, as is known from history. Although these old Welsh were driven to the mountain fastnesses, there can be hardly a doubt that the raven tresses and flashing dark eyes we sometimes come across in modern English people are traceable to them. We, at any rate, can trace that they enjoyed the basis of a civilisation of which ours might be an outcome, except where we can trace other influences.

LIGHT AND LIFE.

The question as to how life is affected by the different colours of the spectrum has at various times engaged attention, and plant life has apparently been more studied in this respect than animal. Two distinct series of researches lately described to the French Academy seem to afford some fresh insight into the matter, and it is interesting to compare them together. One series, by M. Bert, was on plants; the other, by M. Yung, on the eggs of certain animals. M. Bert kept plants within a glass trough enclosure, containing an alcoholic solution of chlorophyll (very frequently renewed) and exposed them thus in a good diffuse light. The solution, which was very weak, and in a very thin layer, intercepted little more than the characteristic region of the red in the spectrum. This excluded part, then, was proved to be the indispensable part of white light, for the plants immediately ceased to grow, and before long died. It is this red region (as M. Timirigzeff has lately shown) that the greatest reduction of carbonic acid takes place. If red rays are kept from the leaf the plant can no longer increase its weight, it is reduced to consuming reserves previously accumulated, exhausts itself and dies. This part of the spectrum, however, though necessary, is not sufficient. Behind red glass plants may no doubt live long, but they get excessively elongated and slender, and their leaves become narrow and little-coloured. This is owing to the absence of the blue violet rays. Thus each region of the spectrum contains parts that play an active *rôle* in the life of plants. Now turn to animals: M. Yung has experimented during three years on the effect of different spectral colours on the development of the eggs of frogs (the common frog and the edible frog), of trout, and of fresh-water snails. It was found that violet light favoured the development very remarkably; blue light comes next in this respect, and is followed by yellow light and white light (which two gave nearly similar effects). On the other hand, red and green appear to be positively injurious, for it was found impossible to get complete development of the eggs in these colours. Darkness does not prevent development, but, contrary to what some have affirmed, retards it. Tadpoles of the same size, and subjected to the same physical condition previous to experiment, died more quickly of inanition when deprived of food in violet and blue rays than in the others.

Queries and Answers.

A CORRESPONDENT enquires for a remedy to prevent new crucibles from cracking when first exposed to fire.

Ans.—We have received the following receipt from a practical mechanic: Coat the inside with albumen (that is, the white of an egg); when well absorbed and dry, apply a second coat. If any of our readers know a better plan, we should like to publish the result of their experience.—EDITOR S. C.

Correspondence.

To the Editor of the SCIENTIFIC CANADIAN:

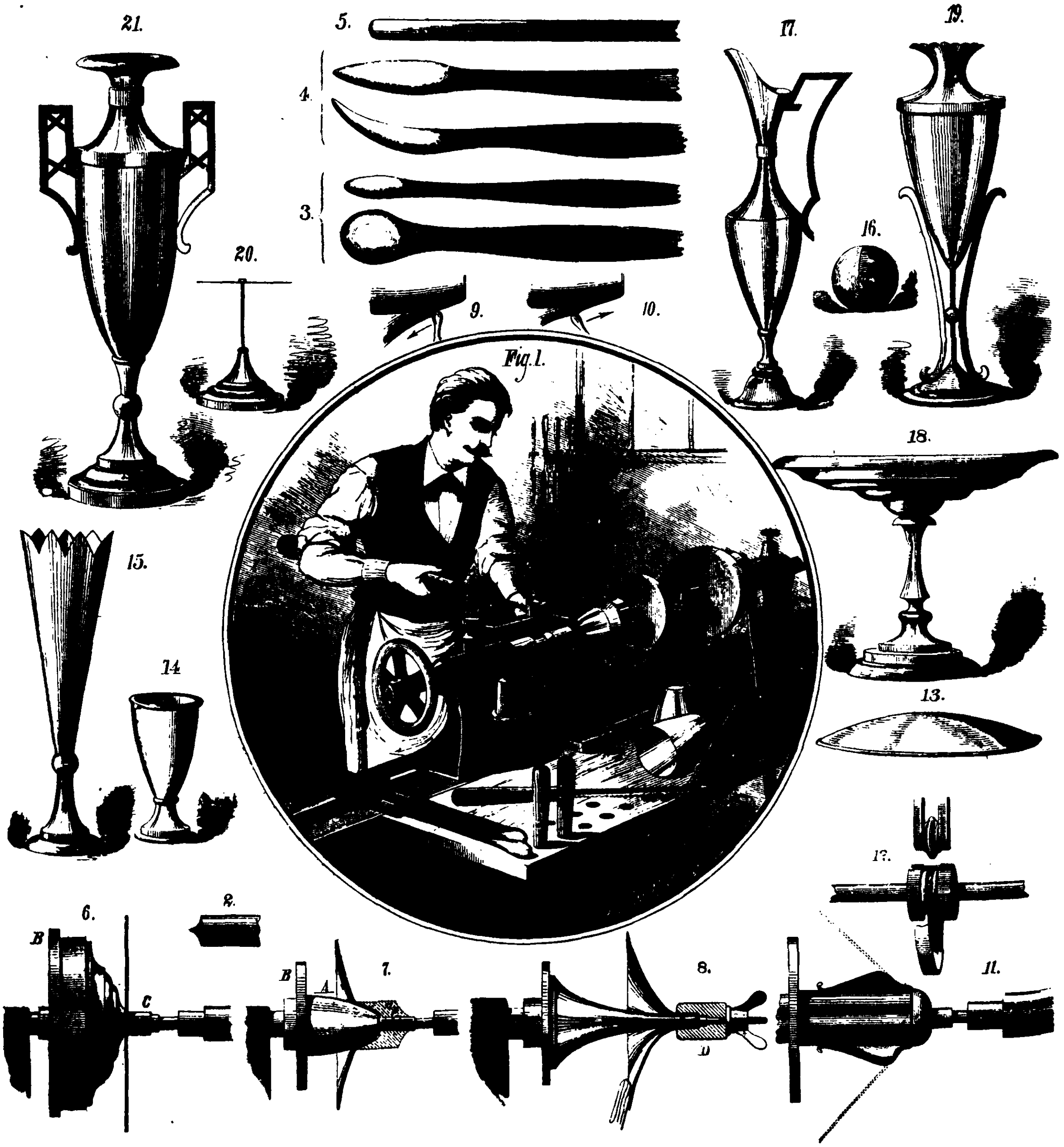
DEAR SIR,—Whilst appreciating the great improvements made in your valuable magazine during the past two years, could you not also improve the *Patent Office Record?* The smallness of the diagrams, and particularly the lettering, render it almost impossible to understand them, and they are utterly useless for comparing with the words of the claim. In the United States there is always a brief given of the specification, sufficient to describe the use and workings of the machine patented, and one can always obtain, for a few cents, a full-sized copy of the drawing from the U. S. Patent Office. I think if you would give this matter consideration and do something to improve the *Patent Record,* you would have many more subscribers.

Respectfully yours,

J. W. BROWN,

Kingston. Carriage Builder.

[This matter rests entirely with the Patent Office Department. The publishers only have the privilege of giving the *Patent Office Record* as a supplement to the subscribers to the SCIENTIFIC CANADIAN. However, as we have already received several complaints on this matter, we shall be happy to draw the attention of the Patent Office to the subject of our correspondent's suggestion.]—ED. S. C.



TOOLS FOR METAL SPINNING, AND EXAMPLES OF SPINNING.

Amateur Mechanics.

METAL SPINNING.

The operation of spinning metals, although exceedingly simple and capable of being practiced to advantage in almost every shop, and also by the amateur mechanic upon the foot lathe, is not generally understood. One reason for this is that the artisans who follow this branch of mechanics as a business usually conduct it under locked doors, and it is with considerable difficulty that the amateur in search of information on this and kindred subjects can obtain entrance to one of these establishments. The reason of this secrecy is plain enough, as the "kink" or "wrinkle," or, in plain English, the knowledge required to do the mechanical part of spinning, is so slight that secrecy is the only protection.

The tools required are few. They consist of a lathe; a form or mould on which to shape the article; a tool rest with a series of holes for receiving, a pin to keep the tool from slipping, and a few spinning tools or burnishers of different sizes and shapes.

The lathe the amateur is supposed to possess; the tool rest he may easily make; and the only other addition to the lathe will be a back centre of the form shown in Fig. 2. This form of center answers as a step to the work holder, and will bear considerable pressure without undue friction.

The tools required are shown in Figs. 3, 4 and 5. These are simply hard steel burnishers of the form shown, and varying in size, with the size and kind of work to be done. The size given in the engraving is about right for amateur work on the foot lathe. Fig. 3 shows in two views a ball tool. Fig. 4 shows both side and edge views of a curved tool. Fig. 5 shows a plain round burnisher. In some instances it may be necessary to make tools of different forms. The operator will be guided in the selection of his tools by the particular work in hand, and practice will bring new suggestions as to tools and the manner of using them.

The materials generally used in spinning are brass, copper, zinc, britannia metal and lead. All of these may be worked on the foot lathe, but perhaps the amateur will derive the most satisfaction at first by using britannia metal, as it works easily and does not require annealing. Articles in this metal also present a handsome appearance when done, whether simply polished or plated. Zinc must be spun quite hot. Articles of brass, if of considerable depth, must be annealed when partly done.

The form on which the metal is spun may be either hard or soft wood or metal. A good close-grained pine answers as well as anything for most purposes, and is very readily turned to the required form. It may be attached to the face plate, B, and the disk to be spun may be held against it at first by a hard wood or metal piece, C, as shown in Figs. 6 and 7, which is forced against the disk by the tail center. After the spinning is a little advanced, a cup-shaped holder is applied, as shown in dotted lines in Fig. 7. Sometimes the holder is secured by a bolt that runs through both it and the form or mould, as shown at D, Fig. 8. In some cases a little rosin is applied to the form to increase the friction, but this is rarely necessary. The motion of the lathe should be quite rapid, and the disk should receive a coating of grease (lard or heavy oil) before applying the burnishes. A very strong solution of soap may be used instead of oil. The position of the workman and the manner of holding the tool may be seen in Fig. 1. It will be noticed that the pin in the tool rest serves as a fulcrum for the tool, which must be brought with considerable pressure against the surface of the disk. This pin is moved forward from time to time as the work advances. The movement of the tool may be seen in Figs. 9 and 10, and the shape taken by the metal in front of the tool will also be seen. In swinging the tool towards the form it is moved in the direction of the arrow as shown in Fig. 9, and it is carried back as shown in Fig. 10. This last operation is very essential to the proper fitting of the mould, and it also thickens the metal. Too much should not be attempted at a time. A succession of quick movements, as indicated in Figs. 9 and 10, under a moderate pressure, is much better than to do a great deal of execution at a single stroke. Should the metal tend to vibrate or buckle, a piece of wood may be applied to the back with the left hand as shown in Fig. 8.

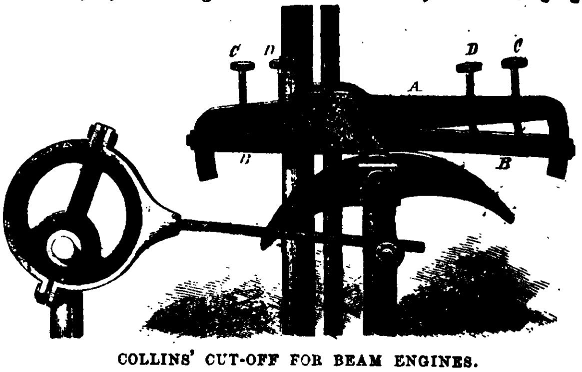
The method of spinning a cup or pot without a form is illustrated in Fig. 11. Here the metal is supported by a plain cylindrical mandrel, and is first spun into the form indicated by the dotted lines, and then bringing the burnisher on the return stroke only to the shoulder which forms the larger part of the vessel. For small work on the foot lathe the handles of the tools need not be as long as represented in Fig. 1. The length commonly employed for wood turning tools will answer.

To spin a ring a mandrel like that shown in Fig. 12 will be required. A plain flat ring placed between the shoulders of the mandrel is pressed upon by the roller seen above the mandrel until the ring assumes the desired form. Napkin rings are made in this way. Fig. 13 shows a concave reflector. Fig. 14 represents a single cup formed of two pieces. Fig. 15 represents a small vase made of three pieces, the smaller end of the upper or conical part and the upper portion of the base piece being soldered in a spherical connecting piece. The two halves of the ball Fig. 16 are made upon the same form. The edges are beveled and soldered together. The pitcher, Fig. 17, is made of five spun pieces, a short cast and turned piece that unites it to its base, and a handle made of square wire. The card receiver, Fig. 18, has a spun top and base, and a cast standard. The vase, Fig. 19, consists of four spun pieces and three legs of square wire, uniting the body with the base. Fig. 20 shows a base for a magnetic needle or other small apparatus. Fig. 21 represents a vase composed of seven spun pieces and two handles of square wire. More complex examples of work done by the process of spinning might be furnished. The ones given are undoubtedly sufficient to enable the amateur to get an idea of the endless variety of articles that may be made by this simple and easily acquired art.—*Scientific American.*

NEW CUT-OFF.

The accompanying engraving represents an improved cut-off for steam engines recently patented by Mr. Thomas E. L. Collins, of Fall River, Mass. The improvement, although especially designed for beam engines, is not confined to this use. The lifters are made in two parts. The fixed portion, A, being attached to the valve rod in the usual way, the adjustable portion, B, is pivoted to the heel of the fixed portion, and is guided and supported by a curved arm that projects downward from the toe to the lifter Two screws, C D, pass through the lifter, the screw, C, being swiveled in the adjustable part of the lifter. The screw, D, merely presses against the back of the adjustable portion, giving an additional bearing.

The ordinary cut-off lifters of beam engines are secured to the valve rods by means of set screws and keys; and they can be adjusted only by loosening the set screws and keys and changing



COLLINS' CUT-OFF FOR BEAM ENGINES.

the position of the lifters. This operation involves a great deal of labor and requires considerable time, and the engine must be at rest.

The advantages of the improvement above described are apparent. The lifters can be adjusted with great accuracy even while the engine is in full operation, by simply turning the screws, C, D, and the application of the improvement to engines already in use involves no change except in the lifters.

THE TELEPHONE AS A LIGHTNING INDICATOR.—Mr. George M. Hopkins, of Brooklyn, N. Y., during a recent thunder storm connected the gas and water pipe of his dwelling with an ordinary Bell telephone, and discovered that the electrical discharges were plainly indicated, either by a sharp crack or by a succession of taps. This occurred when the discharge was so distant that the thunder was inaudible. The sound also seemed to be perceived by the ear before the lightning could be seen. There was a marked difference in the character of the discharges, some that appeared single to the eye were really multiple. Often the discharges would consist of a series, beginning and ending with discharges larger than the rest, thus : ____ - - - - - - ____ sometimes it would be thus : ____ - - - - -, sometimes the reverse, and often a single crack. The gas and water pipes were used, being the most convenient and at the same time the safest conductors for the purpose. Special apparatus might be devised, having a good ground, and a series of points for gathering the electricity from the air, but in using apparatus of this kind there is always more or less danger.—*Scientific American.*

PRESERVATIVE WRAPPING AND PACKING PAPER.—Mr. John F. Rodgers, of Philadelphia, claims to have discovered a preservative wrapping and packing paper for protecting cloths, furs, etc., from mildew and ravages of moths and other insects. The patent bears the date January 9th, 1878. The paper used is made from woolen and cotton rags and manila rope or manila paper. This paper is saturated with a mixture of 70 parts, by measure, of the oil remaining from the distillation of coal tar naptha by live steam with five parts crude carbolic acid, containing at least 50% of phenols, 20 parts of thin coal tar, heated to about 160° Fah., and five parts of refined petroleum. After saturating the paper it is passed through squeezers and over hot rollers for the purpose of drying. When cool it is cut into sheets as desired, and the drying completed in the atmosphere. The paper thus treated is used for packing woolen clothing, cloths, furs, carpets, and all material likely to be injured by moths, mice, or vermin, and will also to a great extent, he states, prevent cotton material from mildew.

FLAX VS. SILK.—Considerable excitement has been caused in Lyons, France, by a discovery which purports to give to flax all the qualities and appearance of silk. It has long been known that silk is soluble, not only in powerful acids, but also in soda and chloride of zinc; and it is said that these qualities are made use of in the new process. A company is being formed, with a capital of $6,000,000, for the manufacture of the new textile.—*Iron Age.*

THE ANTIQUITY OF MAN.

By Sydney B. J. Skertchly, F.G.S.
Of H. M. Geological Survey.
(Continued from page 164.)

The Neolithic and Bronze Age discoveries in England, and elsewhere, have taught us much respecting the manners and customs prevailing in those times. But, as we have already pointed out, it is to the Lake-dwellings of Switzerland that we must look for most of our knowledge respecting the domestic habits of these early peoples.

One of the most striking facts in the study of pre-historic man is the singular uniformity of the stone monuments. Whether we take Great Britain by itself, or include all Europe—nay, even if we examine Asia and great part of Africa—we find similar erections, such as mounds (or *tumuli*), circles of stones (or *cromlechs*), standing stones (or *menhirs*), covered stone chambers (or *dolmens*), and so on. The most perfect type of these erections is a stone chamber, covered with a mound of earth, surmounted by one or more standing-stones, and surrounded with a stone circle, from which one or more double rows of stones lead outwards. This perfection is seldom attained. Most frequently only one or two of the features are present.

It has been wisely said that savage races are children in intellect, and close study has proved how infantile is the savage mind. Now, if we take our own children, and allow them full scope to carry out those architectural proclivities, which seem to be as natural to childhood as mischief, what do we find? Any sea-side resort will afford ample evidence. Armed with little spades, the embryo Wrens build dolmens, cover them with mounds, erect menhirs upon them, surround them with stone circles, and construct long avenues of stones. I have often been much struck with the exactitude with which little hands and minds have performed on a small scale what stronger hands and lesser minds had accomplished ages ago on a grander plan. Here, then, we see a simple explanation of the uniformity of stone erections in differents parts of the globe.

These old stone structures were confidently ascribed to the Druids before prehistoric archæology became a science; just as, in country districts at present, the demolition of castles, church sculpture, and so forth, are, by the bucolic mind, ascribed to Oliver Cromwell—or, what seems much the same thing, to the Devil.

But we now know that ages before the Druids worshipped here, these structures stood as hoary monuments of the zeal of long-forgotten races; and we know that most of them were burial or holy places of the Stone and Bronze Ages.

It must not, however, be concluded that, even in Britain, all the tumuli and heaps of stones (*cairns*) belong to remote antiquity. Tumuli were occasionally built in England as late as the third century, and cairns are still erected in the Hebrides and other parts of Scotland.

An objection has sometimes been urged against the antiquity of these structures, that they are often too massive to have been erected by people ignorant of the use of metal. But this objection is at once removed by historical facts. The Tahitians, who, when first visited by Europeans, were quite ignorant of the use of metal, erected huge stone structures for the reception of the distinguished dead. One of these, described by Captain Cook, was no less than 267 feet long, 87 feet wide, and 44 feet high. The stones were four feet deep, and were neatly squared and polished. Similar instances might be cited from other places.

Respecting the dwellings of the Bronze Age, but little is known. In Germany and Italy there have been found rude earthenware urns of this age, representing huts. Some of these are round, with a door at the sides, and with tall, conical, thatched roofs. The lake-dwellings of this age have been already alluded to.

Of the dress of these people naturally but few examples remain. In the lake-dwellings linen cloth of rude texture has been found. The most interesting discovery, however, was made in Jutland, where singularly well-preserved bodies were found in certain tumuli. One of these had the head covered with a round, thick, close fitting woollen cap, covered with threads terminating in knots. The body was clothed with a woollen shirt, a woollen cloak, and woollen leggings. The head and feet were covered with woollen shawls, fringed at the bottom.

Their weapons and tools were of bronze, stone, wood, bone, and such like materials. The bronze implements were all cast, and they do not seem to have been able to cut or inscribe the metal; even the ornamentation (which is always free-hand) being cast.

Celts, used as axes and chisels, are plentiful; and the earliest, which are seldom ornamented, are of well-known Stone Age types. These, of course, are solid. Others are grooved for the readier attachment of the handle, to which they were further secured by cords passed through a loop in the celt. A third kind was hollow and looped, but none have as yet been found with socket-holes like hammer-heads.

The swords were all small, like large daggers, leaf-shaped, double edged, and more adapted for thrusting and stabbing than for cutting. The handles were small, without guards, and often ornamented.

Javelins and spear-heads are common. Bronze arrow-heads are rare, probably because flint was less expensive, more readily fabricated, and quite as effective. Indeed, at close quarters, a bow with stone-tipped arrows is almost as deadly as a rifle. Some of the North American Indians of the present day will discharge twenty arrows in a minute, with great precision, and with sufficient force to pass right through the body of a buffalo.

Fish hooks of bronze are pretty abundant in Switzerland, but very rare in Britain. Sickles are common, and so too are knives, of which, one peculiar type, shaped like a razor-blade, and often highly ornamented, is characteristic of the period. Personal ornaments are abundant, and consist chiefly of bracelets and ornamental headed hair-pins, some of which are over two feet in length. The bracelets are generally simple spiral bands, or rings open at the side.

With one exception, no inscriptions have been found on bronze implements, though they are by no means rare in the succeeding Iron Age. The one exception is a bronze celt, found in Rome, years ago, upon which is a well-fashioned inscription, in unknown characters.

The prevailing ornamentations are series of circles, and spirals, no authentic case being known of the representation of animals or plants, which were a feature in the Iron Age.

The use of the potter's wheel was unknown until the Iron Age. The pottery is often finer than that of the Stone Age, and though similar rude ornamentations adorn it, they are supplemented by circles and spirals, which were unknown in the earlier age.

Gold was known, but not silver, lead, or zinc. Glass beads were in use, but no vessels of this material have been found belonging to the Bronze Age.

Leaving the question of the habits and state of civilisation of the people of the Bronze Age for the present, we will now describe some of the features of the Neolithic and Newer Stone period.

We have already seen that in their mode of burial, so far as the structure of their tombs goes, they were very like their successors, but, on the other hand, they seldom if ever practised cremation.

Respecting their dwellings we know but little, save with regard to the lake-dwellings. It is, however, highly probable that, in inland localities, they erected rude structures, partly underground, and not very unlike some of the chambered Tumuli. We know that at the present time some savage races, such as the Kamschatdales, possess winter dwellings very much like some tumuli; and a tomb is often looked upon as a dwelling for the dead, hence we may infer that their houses were not unlike their tombs.

The dress of the Neoliths was chiefly of skin, but they manufactured rude textile fabrics of flax, straw, and probably of wool.

Their cutting tools were all of stone, and often of great beauty. Many of the celts are polished or ground smooth, and this, amongst other features, at once distinguishes this age from the Palæolithic. The arrow-heads are often exquisitely fashioned, and the marvellous delicacy of their workmanship can only be fully appreciated by those who have spent years in the practical study of stone weapons. Bone and wood, of course, were largely used.

The staple commodity for cutting-tools was flint, and they carefully sought out the localities where the best material existed. One of these is Brandon, in Suffolk, where the same bed of flint which was used by these old people is still worked for the manufacture of gun-flints. The remains of the old flint-pits are still extant, and they afford a striking example of the attainment of great ends by simple means. Many of them are forty feet deep, and their diameter at the top is not less than ten yards. From the bottom of these pits galleries were driven. These huge works were carried out by the aid of no better weapons than stone celts, and picks of deer horn.

Their pottery was very coarse, the clay being ill-worked, badly baked, and full of large grains of sand. They were rudely embellished with lines, thumb or finger-marks, impressions of a twisted cord, and sometimes by rows of ill-shaped knobs. The vessels were not strong enough to stand fire; but there is ample evidence to show that they boiled water in them by dropping red-hot stones into the vessels, just as the Assiniboins and other savages do to this day.

The manners and customs of the Neolithic and Bronze Age people are best illustrated by the study of their food, and it is here that the lake-dwellings afford us such valuable testimony, as in them alone have vegetable remains been found.

Firstly, with regard to the animals used as food, we find that they all belong to species which either now live, or have lived within historic times, in Europe.

The earliest of the lake-dwellings show us a people passing from the hunting into the pastoral stage. The ox and the stag are the most abundant, the former a domesticated, the latter a wild species. In the earliest settlements the remains of the stag are more common than those of the ox; but as we trace the history of these people onwards we find them depending less and less upon the products of the chase, and trusting to a greater extent to their herds. Similar signs of progress are also seen in the gradual increase of the number of species domesticated, for whereas in the early stone settlements two races of oxen were kept, another was added later on, and yet another in the Bronze Age. The lake-dwellings thus afford us proof of four races of oxen having been domesticated.

A like story is told by the remains of the hogs. At first they were all wild, then a wild variety was domesticated, and in the Bronze Age the present race first makes its appearance. The horse, too, very rare during the Stone Age, was common in that of Bronze. Space will not permit us to go further into this interesting question, but a few words may now be said respecting the cultivated plants.

Wheat and barley were cultivated in the earliest of the lake-dwelling eras, but the ears were invariably smaller than at present. This is true of all the cultivated plants, and when we ponder upon the length of time required to modify species, we begin to realise the antiquity of Neolithic times. The variety known as Egyptian wheat is common. Six-rowed barley, like that used by the ancient Egyptians, but smaller, was largely grown. It appears, indeed, that the cereals were introduced from the south, for seeds of weeds native to the south of Europe are also found, evidently having been accidentally introduced with the corn. Wheat and millet alone seem to have been used for bread, and fragments of round, flat, unleavened loaves have been found. Oats were first cultivated in the Bronze Age. Peas were known in Neolithic times, beans not till the Bronze Age. Dried apples are plentiful in places, but are of wild varieties.

From this meagre sketch we can draw a moderately accurate picture of the people of the Neolithic and Bronze Ages. We see them at first emerging from the hunting state, and gradually progressing through the pastoral, well into the agricultural stage. They lived in large communities, apparently in tolerable amity, for battle grounds are very rare, and they enjoyed a certain amount of foreign intercourse, as is shown by their cereals, and by the introduction of certain domestic animals not native to their own country.

In fine, we can compare the people even of Neolithic times, in point of culture, to many modern races. The two most important points arrived at are, *Firstly:* that even in the earliest of these Neolithic settlements, we have indications of cultivation and the domestication of animals, in which they were in advance of some races now living; *Secondly,* we have incontestible proof of gradual, continuous, steady progress.

We will next see what attempts have been made to assign time-limits to these prehistoric epochs.

(To be continued.)

LIGHTNING RODS NOT INSULATED.—Insulators should not be used in putting up lightning rods on buildings for protection against the electric current. The rod should be fastened directly against the building. But the most important precaution is to make sure that the bottom end of the rod has a large conducting surface in contact with the earth. Better have no rod than simply to stick the end a few feet down into dry earth; the proper way is to solder the bottom end of the rod to a metal water pipe or gas pipe in the ground. If there are no pipes, then make a long trench and put in some good conducting material, such as fine charcoal, or hard coal dust, iron ore, or old iron, making a good connection between the bottom end of the rod and this conducting material.

FORECASTING STORMS—THE LOSS OF THE "EURYDICE."

We copy the following from the *English Mechanic*:

At the inquest held over the bodies recovered from the *Eurydice*, and in the daily Press of the period, it was said, no means were known to science by which the squall which caused the loss of that unfortunate vessel, with its 300 lives, could have been foreseen. I hope, with your assistance, to show that there is a means, "within the grasp of ordinary minds," of guarding, to a very great extent, against all such catastrophes.

For an illustration, I will refer to the action of a pendulum suspended before a strip of paper which is stationary (diagram 1). If we pull it to the right at B it will, as we know, when released, rebound nearly as far to the left as C, oscillating about its position of rest at A, and we can easily imagine that to arrest and reverse its action would indicate considerable violence in the disturbing force; if we now cause the strip of paper to move perpendicularly at a uniform rate, and attach a pencil to the end of the pendulum, we should find its path traced upon the paper as a symmetrical curve, and any interference with, and reversal of, the motion of the pendulum, as at D, would, of course, destroy the symmetry.

The Astronomer Royal, writing to the *Times* on the day after the *Eurydice* was lost, referring to the atmospheric circumstances about the time, said:—"The fluctuations of the barometer were very inconsiderable," leaving us to infer that no warning could have been gained from that instrument. The diagram No. 2 *shows the barometric pressure for March, 1878*, and premising and asserting that there is ample evidence that atmospheric pressure has a *primary* tendency to vary also by symmetrical curves, it will be seen that the indication given by the barometer at the time was really very significant, inasmuch as its action was being violently reversed—equivalent in effect to the reversal of the action of the pendulum; and Sir G. Airy's letter shows that ample warning was given of the change of direction, for he says:—"At 2h. 30m. the barometer stood at 29·35, at 3h. 56m. it was 29·28 (the lowest point), and at 5h. 30m. it was again 29·33." The squall was at 3h. 56m., "nearly" in corroboration of the adage, "First rise after low foretells stronger blow."

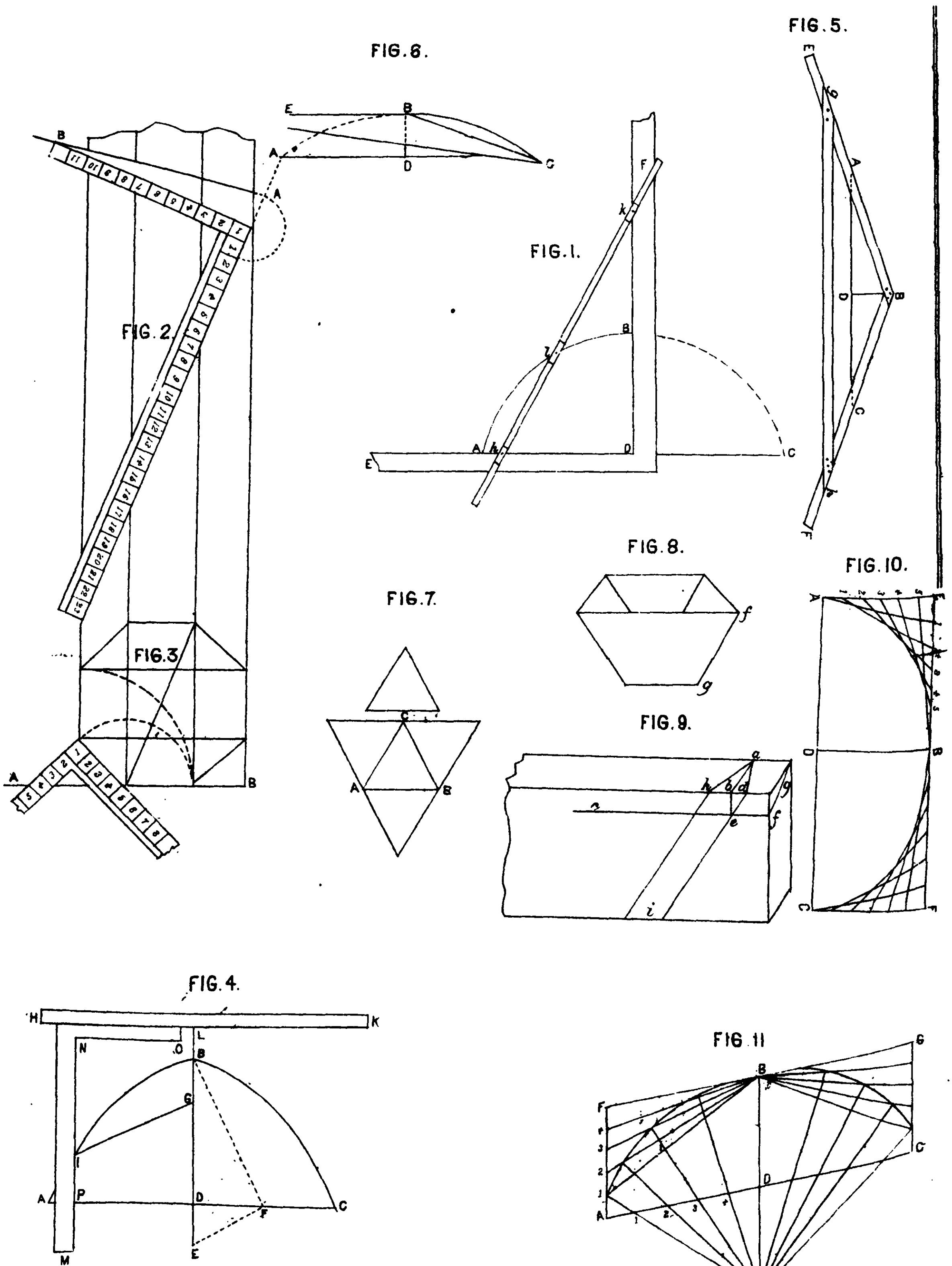
The variation of barometric pressure, as of the pendulum, is by this idea referable to gravitation; difference of opinions may, and doubtless will, exist as to the origin of the disturbing force, the fact of the disturbance being probable, and the part of the barometric curve where it is likely to be most dangerous—viz., when the pressure has been for some days largely in excess (as from the 1st to the 21st March), and the fall having for some time set in, a reversal of the action takes places—is all that is necessary for the seaman to know.

Air is a much heavier substance in the aggregate than is popularly supposed. Dr. Mann, the late president of the Meteorological Society, has lately stated that the air contained within the walls of Westminster Hall weighs 50 tons; if such a substance is forced above its true level it will, like any other fluid, try to regain such level by an equal and contrary reaction.

It will be seen the really hazardous days to a seaman are by this theory reduced to a very few in number; all that would have been necessary in the case of the *Eurydice* would have been to have closed the lee ports when it was seen the true line of fluid-motion was being departed from; this one simple precaution would have saved the ship. A very cautious seaman might, with such a barometric curve before him, have passed 2 miles instead of 1 from such a coast as that of the Isle of Wight, and might have also lowered a studding sail which was "the biggest sail in the ship," until he had turned the barometric corner and the squall had passed.

Collateral evidence of the probability of the shift of wind from about S. W. to N. W. might also have been gained by reference to the temperature: the barometer had been steadily falling for four days. When it does so the thermometer ought *cœteris paribus* to rise, and *vice versâ*. Sir G. Airy states the temperature "about 2h. 0m. had been 49°, diminishing to 45° just before the squall. With the squall it sank most rapidly to 38°, and continued to fall till at 5h. 0m. it was about 32°."

With letter 13862 (January, 1878) a diagram was given with the average height of the barometer for the years 1873 to 1877 inclusive; during 1878 pressure recovered to 29·85, so that upon the large scale a "reversal of the pendulum" has occurred, and it is suggested that the great influx of cold air necessary to produce such a reversal will account for the extraordinary low temperature of the past few months.



EXAMPLES OF THE PRACTICAL USE OF THE STEEL SQUARE.

By F. T. Hodgson, Acht., Ed. "American Builder," (late of Collingwood, Ont.)

THE CARPENTER'S STEEL SQUARE AND ITS USES.

By F. T. Hodgson, Editor *American Builder*.

(Continued from page 187, June number.)

In the present paper we have introduced a few examples that will be interesting, as well as instructive, to the young student.

In Fig. 1 we show how the square can be used, in lieu of the trammel, for the production of ellipses. Here the square, E D F, is used to form the elliptical quadrant, A B, instead of the cross of the trammel; *h l k* may be simply pins, which can be pressed against the sides of the square while the tracer is moved. In this case the adjustment is obtained by making the distance, *h l*, equal to the semi-axis minor, and the distance, *l k*, equal to the semi-axis major.

Figs. 2 and 3 are taken from *Gould's Wood Worker's Guide*.

Fig. 2 exhibits a method of finding the lines for eight squaring a piece of timber with the square, by placing the block on the piece, and making the points seven inches from the ends of the square, from which to draw the lines for the sides of the octagonal piece required.

At the heel of the square is shown a method of cutting a board to fit any angle with the square and compass, by placing the square in the angle, and taking the distance from the heel of the square to the angle A, in the compass; then lay the square on the piece to be fitted, with the distance taken, and from the point A, draw the line A B, which will give the angle to cut the piece required.

Fig. 3 exhibits a method of constructing a polygonal figure of eight sides; by placing the square on the line A B, with equal distances on the blade and tongue, as shown; the curved lines show the method of transferring the distances; the diagonal gives the intersection at the angles.

Fig. 4 shows a method of describing a parabola by means of a straight rule and a square, its double ordinate and abscissa being given. Let A C be the double ordinate, and D B the abscissa. Bisect D C in F; join B F, and draw F E perpendicular to B F, cutting the axis B D produced in E. From B set off B G equal to D E, and G will be the focus of the parabola. Make B L equal to B G, and lay the rule on straight-edge H K on L, and parallel to A C. Take a string, M *r* G, equal in length to L E; attach one of its ends to a pin, or other fastening, at G, and its other end to the end M, of the square M N O. If now the square be slid along the straight-edge, and the string be pressed against its edge M N, a pencil placed in the bight at *r* will describe the curve.

Fig. 5 shows a method of describing a segment of a circle by means of two laths, the height and base being given. Let E B, B F be the two laths, each of which must be at least equal in length to the whole base A C; join them together at B, and expand them so that their edges shall pass through the extremities of the base, and the angle where they join shall be on the extremity B of the height D B. Fix the lath in that position by the cross-piece *g h*, then by guiding the edges against pins in the extremities of the base line A C, the curve A B C will be described by the point B.

Fig. 6 shows a method by which large curves can be struck at twice, with laths or triangular moulds, the base and height being given. Let A C be the length of the base, and D B the height; join C B, and draw B E parallel to A C, and make it equal to B C. Fix a pin in C, and another in B, and with the triangle E B C describe the arc C B. Then remove the pin C to A, and by guiding the sides of the triangle against A and B, describe the other half of the curve A B.

Fig. 7 shows the development of a pyramid with an equilateral base; it is found by drawing the triangular base A B C and then drawing round it the triangles forming the inclined sides. If the diagram is made on stiff paper, and the triangles folded on the lines A B, B C, C A, the solid figure will be constructed.

Figures 8 and 9 show the method of finding the joints for splayed work, such as hoppers, trays, etc.

Take a separate piece of stuff to find the joints for the hopper, Fig. 8. Strike the bevel *f g*, the bevel of the hopper, on the end of the piece (Fig. 9); run the gauge mark *c* from *f*; then square on the edge from *a*, or where you want the outside joint, to *b*; then square them from *b* to the gauge mark *c*; strike the bevel of the work *f g*, from *i* to *d*, through the point at *e*. From *e* to *d* will be the joint, the inside corner the longest. If a mitre joint is required, set the thickness of the stuff, measuring on *f g*, from *d* to *h*; the line *d h* will be the mitre joint.

Fig. 10 shows a method of describing an ellipse, the major and minor axis being given. Let A C be the major and D B the semi-axis minor. On the major axis construct the parallelogram A E F C, and make its height equal to the semi-axis minor. Divide A E and E B each into the same number of equal parts, and number the subdivisions from A and E respectively; then join A I, 1 2, 2 3, etc., and their intersections will give points through which the curve may be drawn.

Fig. 11 shows another method by which an ellipse may be described. This figure shows the curve on a rake, and is placed in that position to show the student that the curve can be produced on a rake without much difficulty. This method of describing an ellipse is so simple that it requires no explanation. D is the centre of both major and minor axes.

(To be continued.)

Electro Engraving Machine.—It has baffled the skill of inventive genius for ages, to produce a machine that would compete with the skilful hand engraver. Guertant, after much study in trying to perfect such a machine, has, by the aid of electricity, succeeded in producing a practical machine, which it is claimed has no rival. The construction of the machine is not complicated, but simple and durable. It is easily operated—any person of ordinary mechanical skill can learn to work it in a short time. There is nothing to do but turn a crank forward and back, after the work is fixed in the machine. The variety of work that may be accomplished by it is said to be unlimited. It copies from the regular press type of *any* style of letter or design that is made of type; from the plainest to the finest German text letter, or fancy design; and at the same time, it will reduce the letter or design from the original size to ten different sizes, or so small that it cannot be seen by the natural eye. It will shorten the letters or elongate them; also, will lean them forward or backward; will either make a raised or sunken letter; will engrave on any surface, either plain, concave or convex—for instance, such things as watch-cases, either in or outside, finger rings, either in or outside, bracelets, napkin rings, goblets, pitchers, mugs, waiters, spoons, forks, and all kinds of jewelry; or, in fact, any article susceptible of being engraved or ornamented with scroll-work and fancy designs, etc., either on gold, silver, copper, brass, iron, hardened steel, glass, stone, pearl, ivory, bone, gutta-percha, etc. The machine is capable of doing the most difficult kinds of engraving, and on the most difficult metals and substances to be engraved.

Bridge Guards.—The New York, Lake Erie & Western Company is putting up guards at all its overhead bridges, to warn brakesmen of their approach. The guards are made by putting up, some 300 feet from the bridge, posts on each side of the track, to which cross-pieces are attached, from which hang a number of pieces of rope so that, no matter which way a brakesman is looking, if he is standing so that his head will strike the bridge, the harmless contact with the dangling rope ends will warn him of his danger in time to avoid it. The New York Central, we believe, uses a similar device. The Pennsylvania and some other companies use a slender rod hinged to a post at the side of the track, with a spring to keep it up to its places. This will strike a brakesman a sharp rap, and swing back to its place when he is past.

A Feat in Engineering.—Owing to the immense weight that they sustain, the iron shoes in which rest two of the spans of the railroad bridge at Easton, Pa., lately sunk about an inch, throwing the bridge out of grade. As it was certain that the depression would continue, from the fact that the inside masonry of the pier is less solid than the outside, an iron casting, weighing 7,000 pounds, was recently successfully placed under the spans, in order to elevate them. The spans weigh 180 tons each. Hydraulic jacks were used. The spans were raised, the masonry redressed, the castings placed in position, and the spans lowered *without the stoppage of a single train.*

Carbon Photo Printing.—Mr. F. Gutekunst, 712 Arch street, Philadelphia, has organized a complete establishment for the printing of photographs by the carbon process, that is, in printer's ink that never fades. We have received some specimens of the work done, which are unsurpassed for excellence, and reflect credit on the printer. For book illustration and portraiture this method of printing yields the finest results.

THE MYSTERIOUS IN BOILER EXPLOSIONS.

There is beyond question an element of mystery attending certain boiler explosions. At one time all explosions of boilers, save those which obviously resulted from shortness of water or extensive corrosion of plates, were regarded as mysterious and remarkable. Theories have been formed almost without number to account for their occurrence—in a word, to solve the mystery. The spheroidal theory of Boutigny d'Evreux may be cited as an example. When water is dropped on a hot plate it assumes the spheroidal condition, runs about in drops, and evaporates slowly. The drops are really not in contact with the plate at the time, each drop being enveloped in an atmosphere of its own vapor. When the plate cools the water touches it and flashes into steam. It was supposed that under certain circumstances water assumed the spheroidal condition in normal steam generators, and that a great development of steam ensued when the furnace plates cooled a little ; so much steam being made thus in a few seconds that the boiler burst. This idea is now well known to be fallacious.

Another theory was that if a boiler was heated red hot and cold water pumped in it would infallibly explode ; this is obviously the tail end of the spheroidal theory. Inasmuch as the specific heat of iron is but one-ninth that of water, in round numbers it follows that nine pounds of iron heated to about 1,500° must give up their heat to make one pound of steam ; and it has never yet been shown how enough red hot iron could be present in a boiler to cause a development of steam with which the safety valve could not deal. Many experiments have been carried out to test the point, with negative results as far as explosions are concerned

The electrical theory was broached. What this meant we never understood, nor did we ever meet any one who did. One gentleman promised to prevent all explosions from this cause by incasing every boiler in thin sheet copper. Another proposed to fit conducting wires to put boilers in communication with the earth. The notion that water was decomposed into oxygen and hydrogen, and subsequently recomposed with a terrible explosion, kept its ground for a long time. We believe we may say that no engineer possessing a moderate knowledge of chemistry holds such a theory now. The inspecting engineers of the various boiler insurance and assurance companies were the first to place the whole subject on a sound footing. They showed as a result of their experience that boilers burst because they were too weak to withstand the strains brought on them by the internal pressure. They proved that in the vast majority of cases furrowing, and grooving, and corrosion in all their multifarious forms, were the agents operating to bring about boiler explosions, and they carried back such catastrophes from the regions of romance to those of every-day life. There is some reason, however, to fear that these gentlemen have gone a little too far ; and that by assigning all boiler explosions to one cause they are doing harm and stopping inquiry into certain secrets of nature about which we do not know quite so much as is desirable.

That by far the larger number of explosions which occur every year in England are due to weakness of the boilers which give way, either congenital or acquired, we should be the last to dispute. But it is equally indisputable that events take place now and then which quite upset all conclusions based on the idea that explosions always take place because a boiler is too weak to withstand normal strains, and these said events apparently contradict much that sound scientific authorities teach. Thus, for example, although the entrance of cold water into a red hot boiler ought not to cause an explosion, yet there is one case at least on record in which, on a pail of cold water being poured suddenly into a red hot kitchen boiler, a most violent and disastrous explosion took place. The weight of metal engaged here was, however, very great as compared with that of the water. It is also shown that explosions have ensued when water was pumped into plain cylindrical externally fired boilers, which had been allowed to run short.

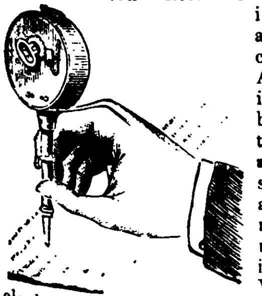
On the other hand, boilers patched and re-patched, and seemingly worthless, have by the hundred done their duty for years without a catastrophe, while boilers as well made as possible, and in excellent condition—nearly new, in fact—have exploded with disastrous results. So long as furrowing and corrosion are present it is easy to account for the failure of a boiler. It is when explosions of strong boilers occur that inspectors are at fault, differences of opinion arise, and we become enveloped in an atmosphere of mystery out of which it is difficult to find the path which leads to certainty. Two notable examples of this have been recently recorded in our columns ; one is the Coltness explosion, when six boilers out of ten flew away at once like a covey of birds ; the other is the Kersley explosion, when one boiler out of eight burst, leaving the rest intact.

As regards the Coltness explosion, that, as is well known, has been explained by Mr. Fletcher on the theory that one boiler which exploded first had the steam pipe plugged up, and consequently gave way from a sheer accumulation of pressure. We cannot find that one tittle of definite evidence was adduced to show that any such plugging took place. Mr. Fletcher is, no doubt, satisfied on this point, but we are not. In fact his theory is based on pure assumption. But, granting that he was right, how are we to account for the explosion of the remaining five boilers ? One explanation is that the boilers were bedded so close that they rested against each other, and that each boiler as it gave way staved in the side of the next one to it. To make this an intelligible cause of explosion, it must be assumed that the sudden reduction of pressure on the outrush of steam through the side of the broken boiler caused so large a portion of the contained water to flash into steam that the boiler flew into pieces before the steam so produced could escape. But it is well known that the Coltness boilers were strong enough to stand a pressure of 300 pounds on the square inch, and it is difficult, if not impossible, to see how steam of any pressure like this could be produced. Only as much water would be converted into steam as would suffice to restore the pressure in the boiler to something less than what it was before the rent took place. To assume anything else is also to assume that once the process of flashing is established it will go on regardless of the pressure set up. This is a very important assumption ; nay, more, it is a complete begging of the question. If it can be shown conclusively that the stored-up energy in a boiler can all be expended in flashing water into steam, if flashing is once fairly set up, without any consideration for the accumulation of that pressure which is inimical to the operation of the flashing function, then we are face to face with a new physical law which would clear away much mystery, and set boiler explosions, like that at Coltness, in a totally new light. It is a notorious fact that a great many explosions take place just when an engine is started. If we may assume that the sudden reduction of pressure sets up flashing, and that the process is continued by, if we may use the words, its own *vis viva*, then it is easy to understand why a sudden reduction in pressure may cause an explosion ; but until some definite statement of facts is available, we must hold this idea to be pure, little supported, theory, and nothing else. If we are asked, how, if we reject the theories of Mr. Fletcher and others, we explain the Coltness explosion, we reply that we cannot explain it, because there is not sufficient evidence available on which to base an opinion.

In the Kersley explosion we have a boiler, insured, carefully looked after, and apparently sound, going to pieces without having given warning in the way of leakage. Here again we find boiler inspectors dealing largely in pure assumption. Mr. Hiller, the engineer of the National Insurance Company, took it for granted that an elbow pipe was broken off and let the water run out. But there is not a scrap of evidence that a cast-iron pipe was broken as supposed. Mr. Baldwin, another boiler inspecting engineer, holds that Mr. Hiller is quite wrong, and that the boiler burst because the plates had become weakened by age ; that they had "lost their nature," to use a word well known among iron makers. But even Mr. Baldwin finds all the plates he tested so strong that the boiler should have withstood on the lowest calculation double the pressure at which it was worked. It is to be presumed that the inspecting engineers of boiler insurance companies are the greatest authorities in existence on all that pertains to the life and death of steam generators. When we find any one of these gentlemen unable to form any opinion concerning certain catastrophes, which is not flatly contradicted by a professional brother, it would be folly to deny that there are mysterious boiler explosions—that is to say, explosions which occur from some cause or causes unascertainable. That we shall always remain in our present ignorance is very improbable. But we venture to think that the solution of our difficulties will come, not from the boilermaker or the engineer, but from an elaborate process of physical research into the laws which govern the generation and evolution from heated liquids of their steams or vapors. Many suggestive phenomena have been recorded which might serve to direct an inquirer. For example, the behavior of water heated under oil is, as shown by Dr. Frost many years ago, very curious and suggestive. Again, water may have its boiling point altered by various conditions other than those of pressure. It is not too much to say that although the more prominent aspects of evaporation and ebullition have been carefully studied, a great deal remains to be learned concerning the real nature of processes about which men speak all the more glibly the less they really know.—*The Engineer.*

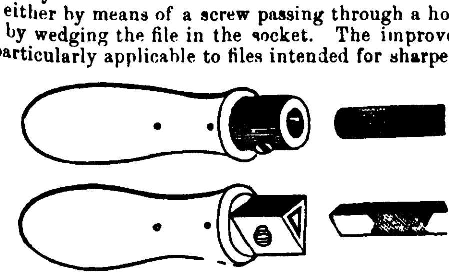
THE "HOROGRAPH."

Among the thousand-and-one interesting items, not strictly agricultural, shown at the Royal Agricultural Society's International Exhibition at Kilburn, we noticed on the stand of Messrs. Newton Wilson & Co., of High Holborn, a little portable instrument for producing rapidly and cheaply any desired number of circulars, notes, or other writings. As its name –The "Horograph"—implies, it may be said to be writing by clock-work, the mechanism and the moving power, clock-work, being all contained in the head of the instrument. This consists of a holder about 4 in. long, and of the thickness of a pencil-case, upon which is mounted a metallic casing about 2½ in. in diameter, and ¾ in. thick. Within this casing is a train of clock-work, which actuates a needle carried in the tube, and to which a rapid reciprocating motion is imparted. As the point of the needle is thus alternately thrust beyond the lower end of the tube, and withdrawn again, it follows that if traversed over the surface of a sheet of paper, a line composed of a series of small punctures will be produced. This is in fact the principle of "Horographic" writing, the punctures being produced at an estimated rate of nearly 10,000 per minute, and the instrument being held vertically in the hand during the process of writing. On commencing to use the instrument, the clock-work is first wound up by means of a small key projecting from the cylindrical casing. On pressing a small spring lever near the needle point the mechanism is started, and continues running, so long as the lever is kept down by the thumb which covers the lever when the instrument is held in the ordinary position of writing. On releasing the lever the mechanism stops. The letter having been written, or, in other words, the stencil having been completed, it is placed in a frame over a sheet of ordinary paper. The passage of an ink roller over the stencil produces a *fac simile* of the subject of the stencil on the paper. In this way a large number of copies may be taken in a very short time.



HANDLES FOR FILES.

Will you allow me to call the attention of your readers to a patent recently taken out by Mr. Gray, of Sheffield, for improvements in files and in hafts for the same? The patentee says that files made on his plan are reduced in cost and are rendered more convenient for carrying about by the workmen employed in using them. The improvement consists in constructing the files without tangs, and in the employment of hafts or holders, each having a socket or recess corresponding in shape to the section of the file to be used, into which the end of the file is inserted. The file may be secured in the socket or recess in the haft or holder either by means of a screw passing through a hole in the file, or by wedging the file in the socket. The improvement is more particularly applicable to files intended for sharpening the



knives of reaping machines—why, I cannot pretend to guess; but it is obvious that the arrangement of the holder and the file-end will facilitate changing when files have been used up on brass, and if the ferrules are made of different metals, it will be easy to keep the files sorted for the work to which they are suited. The illustration explains itself. The file is constructed without a tang, and is of similar section throughout; the haft or holder having a socket corresponding in shape to the section of the file to be used into which the end of the file is inserted. The extremity of the file is perforated, and a tapped hole is provided in the haft or handle for the reception of a screw-pin which passes through the haft and the hole in the file, thus securing the file in the socket.

VICEMAN.

[Some of our hardware merchants should introduce them.—Ed. S. C.]

DESCRIPTION OF A PAPER DOME FOR AN ASTRONOMICAL OBSERVATORY.

BY PROF. GREENE, IN THE "AMERICAN JOURNAL OF SCIENCE AND ART."

An astronomical observatory has recently been erected for the Rensselaer Polytechnic Institute, through the liberality of Mr. E. Proudfit, of this city. In maturing the plans and supervising the erection of the building, I have introduced an improved method of constructing revolving domes, a brief account of which may not be without interest. While making the preliminary inquiries, I ascertained that a dome of the dimensions required, constructed in any of the methods in common use, would weigh from five to ten tons, and require the aid of cumbersome machinery to revolve it. It therefore occurred to me to obviate this objection by making the framework of wood, of the greatest lightness consistent with the requisite strength, and covering it with paper of a quality similar to that used in the manufacture of paper boats; the principal advantages in the use of these materials being that they admit of great perfection of form and finish, and give extreme lightness, strength, and stiffness in the structure,—prime qualities in a movable dome.

The dome is a hemisphere with an outside diameter of twenty-nine feet. The framework consists primarily of a circular sill which forms the base, and two semi-circular arch girders set parallel to each other, four feet apart in the clear, and spanning the entire dome. These are firmly attached to the sill, and kept in a vertical position by means of knee-braces. The sill and girders are of seasoned pine, the former being 8¼ inches by 3½ t ick, and the latter each 4½ by 3 inches. The paper covering of the dome is made in sixteen equal sections, such that when set up side by side, their bases on the sill, and their extremities meeting at the top, they form a complete hemispherical surface. The framework of each section consists of three vertical ribs of pine each 3¾ inches in width, and ¾ of an inch thick, one at each side, and one midway between and meeting at the apex. The paper was stretched over this framework as follows:—

A wooden model of full size being made of that portion of the dome included within one of the sections, with a surface truly spherical, the framework of a section was placed in its proper position on the model, so that its outer edges formed part of the same spherical surface, and covered with shellac where it was to be in contact with the paper. The sheet of paper cut in the proper form was then laid on the model while moist, the edges turned down over the side ribs, and the whole placed in a hot chamber, and left until thoroughly dry. In this way the several sections were dried in succession over the same model. The paper used is of a very superior quality, manufactured expressly for the purpose. Its thickness, after drying, one-sixth of an inch, and it has a structure as compact as that of the hardest wood, which it greatly excels in strength, toughness, and freedom from any liability to fracture. After being thoroughly painted, the several sections were ready to be set up side by side on the sill, and connected together by bolting through the adjacent ribs. The space between the arch girders being left uncovered on one side from the sill to a distance of two feet beyond the zenith, the upper ends of the sections required to be cut off and accurately fitted to the girders. The joints between sections were made weather-proof by inserting a double thickness of heavy cotton cloth saturated with white-lead paint. The adjacent side ribs were then bolted firmly together through the paper and cloth, the lower ends attached to the sill by angle irons, the upper ends bolted to the girders, and the lower edge of the paper turned under the sill and securely nailed. The joints were afterwards painted over on the outside. As the entire surface exposed is free from nail-holes or other abrasions in the paper, the structure promises, with an occasional coat of paint, to last for many years, and to form an effective and serviceable roof. The four-foot opening between the arch girders is covered by a shutter, which is also of paper stretched over a wooden frame. With the exception of about two feet at the lower extremity, this shutter is in a single piece. Attached to its sides are a series of iron rollers which run on a railway track of band iron laid down on the girders, by which means the shutter can be moved over to the opposite side of the dome. The wooden sides of the shutter have iron flanges attached to their lower edges, which project under the railway tracks, making the whole weather-proof. The shutter is opened and closed by means of a windlass and wire rope. The weight of the dome and its appurtenances is about 4,000 pounds. It is supported on six eight-inch balls which roll between grooved iron tracks, and can be easily revolved by a moderate pressure applied directly, without the aid of machinery.

Scientific.

IRON INTO FINE STEEL WITHOUT FUSION.

Various processes are at present known for converting cast-iron into steel ; those most in use being the Bessemer process, which consists in refining by contact with the oxygen of the air, and that known as Reaumur's process, which acts by means of reaction, and which has been greatly improved by Siemens, Pierre, Martin and others. Ingenious as all these processes are, none of them have yet yielded—nor can they ever yield—anything but imperfect results ; the products in all cases consisting of compounds which are intermediate between true pig-iron, cast-iron and steel. For the purpose of getting rid of these defects, and of improving the quality of the metals, they are maintained for some hours at a red heat, in the middle of a mass of charcoal, over which is slowly passed a current of nitrogen, carbonic oxide, and various gaseous hydrocarburets. Wood, charcoal, peat, coke or any kind of vegetable matter, well dried and heated to a temperature of about 122° Fahr., is plunged into some hydrocarbon, such, for instance, as schist oil, which has been heated to the same temperature. Under these conditions, the liquid is absorbed by the carbonaceous substance in the proportion of from 12% to 15%. A pile is then formed of alternate layers of bars of Bessemer metal, Martin iron or other product resulting from the refining of pig-iron, according to one or other of the processes above referred to ; the whole is placed in the receiving apparatus, which consists of a kind of retort of any shape, heat being applied gradually until the iron reaches a red heat. By these means, the excess of oxygen contained in the vegetable substances forms an oxide of carbon, by combining with the vaporized hydrocarbon, and the nitrogen assists in the formation of ammonia, so that the metals are surrounded by the gaseous compound which is recognized as being the best for their conversion into finished steel or cementation steel.

Playing Balls.—India-rubber has been very largely employed of late in the manufacture of playing balls. These are made either solid, inflated, or self-inflating, and are used for a variety of games. The majority of the solid india-rubber balls, until very recently, were manufactured in Germany, but an English firm having acquired the secret of their success, a very large portion of the trade has reverted to this country. All description of india-rubber balls, with the exception of foot-balls, are vulcanized in strong iron molds, cast in two sections, and turned perfectly true on the inside ; a number of these molds, when the rubber has been inserted, are usually secured together by one pair of clamps. The secret of the German method of manufacturing solid india-rubber balls consists in rendering the interior of the rubber porous, while the outside is perfectly uniform and smooth. The object of this is not only to make the ball much lighter, but to make it appear more elastic, and thus impress the uninitiated with an idea that they are manufactured from a better quality of india-rubber than they actually are. To produce this effect, the following ingredients are mixed together : 20 lbs. of African ball rubber ; 11½ lbs. red lead ; 46 lbs. vulcanized (best rubber) crumbs ; 46 lbs. vulcanized dark compound crumbs ; 6 lbs. salt, wet saw-dust, or other substances capable of rendering the material porous by expansion when subjected to a high temperature. Total, 129½ lbs. The mixture is placed in crumbs in the molds, a solid wooden ball being used as a sort of kernel or center for each ball.

Utilization of Exhaust Steam.—According to the invention of Mr. N. W. Ericson, of Stockholm, he lets steam of higher pressure, or higher temperature, or both higher pressure and temperature than the pressure or temperature, or both, of the steam which is to be used in a steam-engine or for any other purpose, pass into an apparatus for the suction and compression of elastic fluids, in order that the said higher or stronger steam may in such apparatus act as the suction fluid to the said spent steam ; this suction and compression apparatus is further connected with the apparatus wherein steam is to be used in order that the spent steam may to a great or less extent be drawn into the suction and compression apparatus when the acting or higher steam passes through it. The mixture of the acting or drawing steam and the spent steam passes through the delivery pipe of the suction and compression apparatus (and its continuation, as required) either to the place where the thus compressed steam is to be used, or else first through an apparatus containing saturated steam, or water, or in so near connection with water that the steam if in a superheated state becomes more or less saturated or lowered in temperature, or else into an apparatus wherein the steam, by cooling, is rendered liquid, and the heat thereby given out is used for generation of fresh steam. This latter apparatus may be the steam boiler in which the acting superheated steam is generated, or another steam boiler or vessel. The suction and compression apparatus may be any suitable section and compression apparatus, such as an annular or other jet apparatus.

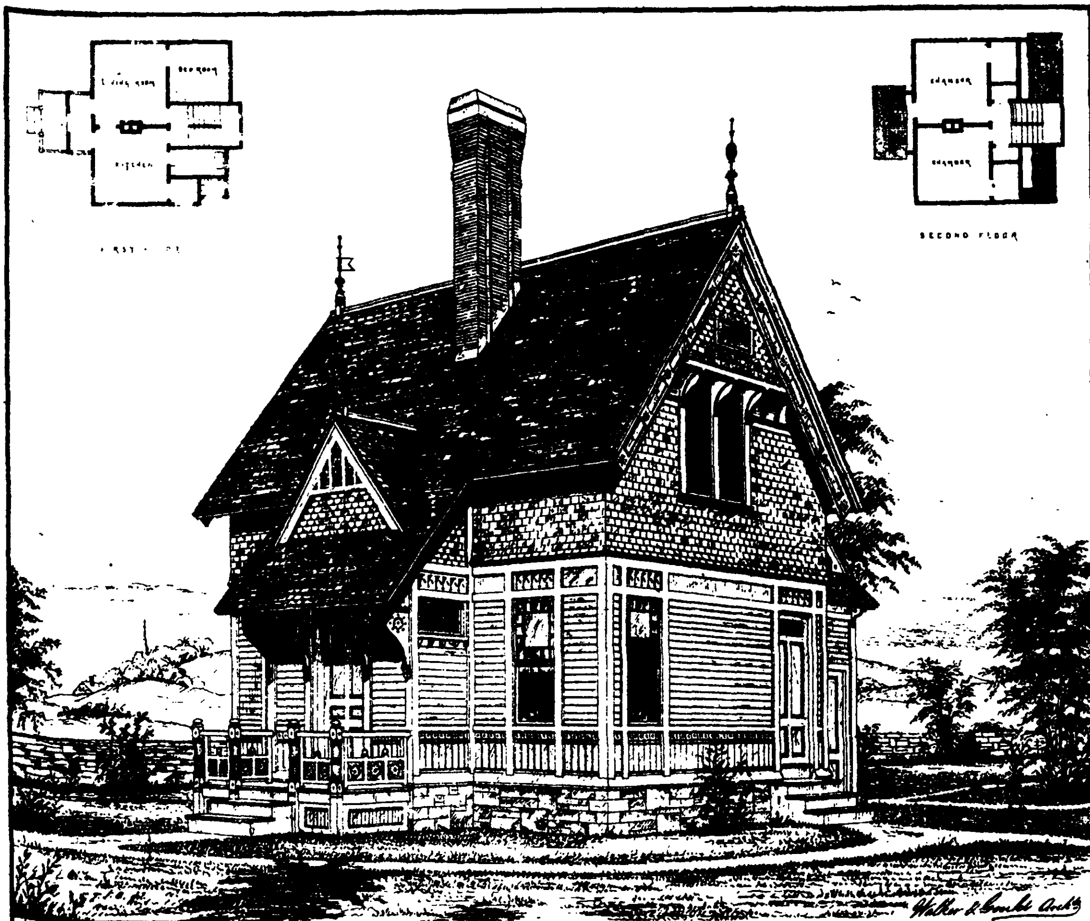
Spontaneous Generation.—Another contribution to the spontaneous generation controversy, favoring the germ theory, has just been published by Prof. Tyndall, in a paper to the Royal Society. He reports that he took with him to the Alps during the past summer one hundred flasks of infusions, 50 of turnip and 50 of cucumber, that had been prepared in the laboratory of the Royal Institution, and carefully sealed. Of these 20 were broken in transportation, and were found to be swarming organisms. Another lot was opened in an atmosphere in which saw-dust had been shaken up, and was soon turbid with organisms ; others were found to be infected by the proximity of a cascade of water derived from melting snow ; while others that were opened in the pure air of the mountains were found to remain clear and uninfected. These results of Prof. Tyndall are entirely confirmatory of his previous experiments and announcements, in which he has always taken strong ground against the hypothesis of spontaneous generation advocated by Bastian and others, and has maintained the view that the origin of the swarms of organisms that make their appearance in decomposable animal or vegetable matter must be explained upon the supposition of infection from without, through the direct instrumentality of the air bearing the germ of these organisms in contact with the medium suited for their development. Tyndall, in the paper above referred to, places himself again on record as an opponent of spontaneous or non-parental generation.

Siliciuret of Iron.—The London *Engineer* reports that the French *Société d'Encouragement* has undertaken to examine into the uses that can be made of the new compound, "siliciuret of iron." An ingot, weighing about 3 kilogs. (6.6 pounds) was sent to the Society by Prof. J. Lawrence Smith, having the following properties : Color, like platinum ; specific gravity, 6.5 ; easily broken with the hammer ; does not rust in the air ; is not corroded by concentrated nitric acid, and is scarcely attacked by any reagents except fluohydric acid and by fusion with alkalies at a red heat. As a substitute for the rough-and-ready mode of testing iron and steel with the hammer, Mr. Hering proposes an electro-magnetic test. The pieces to be tested (wire, rods, bars, etc.) are passed through a magnetizing helix, when, if any break in the continuity of the fiber exists, the same may be detected by means of a magnetic needle suitably mounted on a block above the helix through which the test pieces are drawn.

Drawing in Schools.—The report of the judges on the school drawings lately exhibited at Boston, from various towns of the State, says that there is no feature of the exhibition this year so pronounced as the "systematic educational treatment of drawing in public schools, to make it useful as a preparation for the practical duties of life, as well as to employ it as an implement of education whereby knowledge of other studies may be acquired, rather than to consider it as an ornamental study only, of little practical importance. It is a triumph for drawing as an elementary branch of education, that all mere picture-making has been abolished, and a thing of work having industrial aims and means substituted for the thing of play that drawing used to be."

A New Process of Glazing.—A new process of glazing has been introduced by which putty may be altogether dispensed with. Vulcanite is the substance that is to take the place of the old material. The window sashes under the new system are to be so arranged that the glass may be fixed into the grooves prepared for it, and, coming into contact with a strip of vulcanite attached to the frame, the glazing is complete. Any unskilled workman can fix the glass, and, when fixed, there is no putty to perish under the action of the atmosphere.

The electrical resistance of pure water, according to the experiments of Messrs. Exner and Goldschmidt, decreases uniformly as the temperature rises. At 99° C. (= 210.2° Fahr.) it is only one-third of what it is at 2° C. (= 68° Fahr.). A similar result is observed with water acidulated with sulphuric acid.



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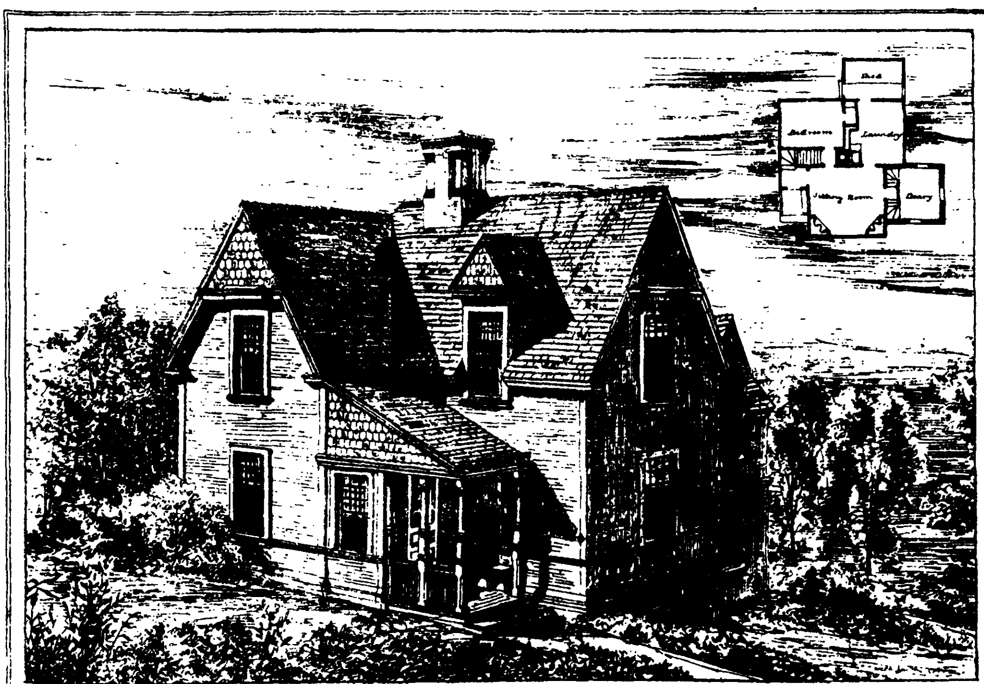


FARM HOUSE.

ARCHITECTURAL DESIGNS FROM THE "AMERICAN ARCHITECT AND BUILDING NEWS."

FURNITURE AND DECORATION.

A drawing-room, in the usual acceptation of the term, is substantially a lady's room. It is there she presides and reigns supreme as mistress of the mansion and queen of her company. As a rule, she fills it with articles of bijouterie and knick-knacks —articles which ladies of taste are sure to admire. Rare cabinets, beautiful and exquisite receptacles for everything and for nothing; shells, mounted in gold and ormolu, etc.; easy chairs, couches, ottomans, and every appliance for elegant comfort and cosy chat. The style of its decorations should be in accordance with its general aspect when in use—light, cheerful and rich.

The ceiling, if it is a moderately sized room and not enriched with ornament in relief, may be tinted cream color. A stile may be added next to the cornice, five, six or eight inches wide, according to the size of the room, which may be tinted of a warm grey; an ornament may be stencilled at each corner, and a smaller one in the centre of each side, between corner and corner, and connected by lines either broken and stencilled, or run continuous with a fitch or flat hog-hair brush.

It is necessary to use caution in the choice and size of the ornaments used. Many gross mistakes are made in this respect. We often see ornaments on ceilings which are only fitted to adorn furniture, and which are utterly lost on a ceiling, and in other cases we may see ornaments put upon a ceiling ten or twelve feet high large enough for one twenty-five feet high, and of proportionate dimensions.

In the designing and connection of the corners and centre ornaments, care should be taken to cause the lines to flow out of the corners and form a part of them. A broad line and a fine line look better than a single line, or than two of the same width, either fine or broad. They may be either broken lines with stripes or dots, or interlace one with the other. Their color, or the tints named above, may be, for the broad line, a dull warm gold or golden brown; the fine line may be either a tint made from vermilion and white, or a reddish mauve. The broad line should not be more than three-quarters of an inch broad on a ceiling of ordinary height, and the fine line about one-eighth. The ornaments may be done in two or three tints, as may be desirable. The larger portion, when the ornament will admit, such as a conventional leaf, may be stencilled from the top to the base with two, three, or four colors blending one into the other, or, in stencilling, the half of the leaf lengthways may be covered with a straight-edged slip of paper while one-half is colored, then the stencilled half may be covered in the same manner, and the other half colored, and so two shades of color, forming light and shade, may be got on the same leaf or ornament. Many good effects may be thus got by very simple means. The cornice, whether plain moldings or enriched, should be colored with tints of cream color and white on the projecting members, and tints of warm grey of different degrees of tone in the coves, quirks, and backgrounds, with suitable tints of red or pink on the under sides or fillets against the darkest grey tints. This causes the grey to look warm, and if the whole is properly balanced, the one color will blend with the other, and the effect will be a sort of bloom of color, equalized and toned to perfect harmony. The enrichments may be etched and gilt. A beautiful effect may be got by the judicious use of three colors of gold in conjunction with color, namely, regular deep gold, middle shade, and lemon gold.

The walls may be done in several ways: when the room is large enough, a good style is to divide each wall into proportional panels, with stiles and pilasters, and gold moldings. The centre panel on each wall may be filled with a mirror of the same dimension, and finished in the same manner as the other panels. The ornaments of a dining-room should have some reference to the purpose for which it is used—fruit, game, implements of the chase, more especially of those animals which are used for food, etc. In the drawing-room, we may have the seasons represented by the aid of flowers, birds, butterflies, etc. The wild flowers of the months are a very suitable decoration, unpretentious, and well adapted for arrangement. Large masses of flowers are objectionable. Colored ornament, enclosing medallions, either of the seasons or classic heads, is also a good style. A less pretentious style of treatment is to put each wall or side of the room into one panel, with gold moldings, as before, but in this case each panel should have a centre ornament of a proportionate size, placed exactly in the middle of the top lines of moldings, in order to give elevation, and break the long straight line, which is always objectionable. The form of these and of the corner ornaments must be determined by the style of the room. The centre of panel may, in this case, be either tinted or filled in with a suitable diaper pattern paper. If paper is used we prefer that there should not be any of the so-called gold in the pattern, but when the gold patterns are used for this purpose they should be chosen of as quiet and undemonstrative a pattern as possible. A simple and inexpensive manner of treating a drawing-room is to color the walls of some light pleasing tint in distemper, then decorate with a floral border round the top part of the wall about 6in. wide, enclosed in simple gold beads, and forming a frieze; a narrow ornamental border in one color may also be put round the bottom of the wall about 6in. from the skirting. Many suitable arrangements of borders are manufactured by the paper stainer, and if good taste is exercised in the choice of color, an excellent effect may be obtained at a slight cost.

White and gold is a favorite style for drawing-rooms, and is considered to be in the purest taste. Large rooms of unrelieved white with heavy deep gold moldings do not appear to us to be in good taste. Where pure taste is exercised, gold leaf will be used sparingly, for there is no stronger evidence of a vulgar taste than a too profuse use of gilding in decoration Any one may produce a gorgeous effect by a prodigal use of gold and color, but the true test of the decorator's art is to produce a rich and harmonious effect without the aid of gold leaf. Instead of white and gold the doors and all other wood-work in the drawing-room may be painted in tints; or the panels, moldings, and quirks tinted, and the stiles white; by adopting this course we retain its purity, but add warmth and harmony. The panels may be painted either with floral arabesques, or simple lines and ornaments, in quiet, pure tones of color. It does not follow that because the work is well executed it is necessarily in good taste; this is not so. Mere manipulative skill, although indispensable in the execution of all good work, is the result of practice. Taste and judgment are much higher qualities, and very rare, and may be possessed in a high degree without the possessor having any manipulative skill whatever, but when all these qualities are combined in the same person, successful works must result.

The imitation of woods we think to be out of place in a drawing-room, except elaborately inlaid work; but in a large drawing-room, in which pilasters or columns form a part of its constructive features, imitations of light-colored marbles may be used with propriety, if well done—not otherwise. The morning room or breakfast room should be treated in a cheerful style, warm and comfortable. The wood-work may be grained any light, clean-looking wood, or a well executed imitation of inlaid woods, all good and serviceable of its kind; above all things it is necessary to avoid a depressing dullness in such a room. When we enter it in the morning, all should look bright and cheerful, and in accordance with the good things spread out for our use. Such a room judiciously colored gives zest and relish to our food, and soothes our tempers. With regard to the decoration of the hall and staircase, much depends upon its size, style of architecture and general character. The Greek, Italian, and Roman styles admit of marbles being used as a lining for staircases. On the walls of a grand hall and staircase, we know of no style of decoration so much in accordance with its grandeur as marble, veneered with the real marble if possible, but if that is unattainable, a good imitation may be used with taste and propriety. In painting imitations of marbles on staircase walls, it is always advisable to make choice of a medium tint of the marble to be imitated, that is to say, there are certain blocks and slabs of (we will say) Sienna marble which are less strongly marked than others, both in vein and color. These are better adapted for painting than the darker parts, inasmuch as they allow of a more uniform tone of color being kept throughout. Nothing looks worse than to see one block or slab strong and dark, and the next light and faintly marked. Yellow or yellowish drab is the prevailing color certainly, but this is mixed and blended with such a variety of tints of pinks, greys, browns, blacks, blues, and purples, that the yellow is sobered down, and made into a perfectly harmonious whole.

The marbles suitable for walls are so well known that we need not describe them here. Vestibules or entrance halls are often done in imitation of inlaid marbles, which, when well executed, is an admirable style of decoration for this purpose. Much care and judgment is required in the selection of the marbles, and the choice of a suitable design. Designs for the inlaying of marbles should be very different to those which are used for inlaying of woods. This is necessary from the difference of material, and should always be kept in view in getting out designs for either. It will be evident to the plainest comprehension that almost any pattern, however intricate, may be cut out of thin veneers of wood with the greatest ease, when the same patterns, cut out of marbles, would entail an immensity of labor and an enormous cost; and many patterns could be cut out of wood which could not be cut out of marble. Therefore, in marble, breadth and simplicity should be aimed at, and only such designs adopted as might be used by the marble mason, which are principally geometrical patterns, formed of strap work, circles, octagons, pentagons, hexagons, etc. There is, of course, an endless variety of patterns which may be used for this purpose, always keeping in mind the caution before given as to simplicity and suitableness. Much of the prejudice against the use of imitation marbles has arisen from the use of marbled paper-hangings, the majority of them being such gross caricatures of the marbles they profess to represent; and even the best of them are so utterly inferior to really first-class painted marble, that no comparison can be instituted between them. A wall covered with paper never can have that evenness of surface and smoothness of finish that a painted wall properly prepared has. Consequently we see at once that it is paper, which fact destroys all illusions at once. If we can see at once how an effect is produced, that effect will not be near so pleasing as if the manner of its doing is effectually concealed; the greater and more complete the deception, and the more pleasure and wonder it excites, the greater the pleasure we receive from its beauty.

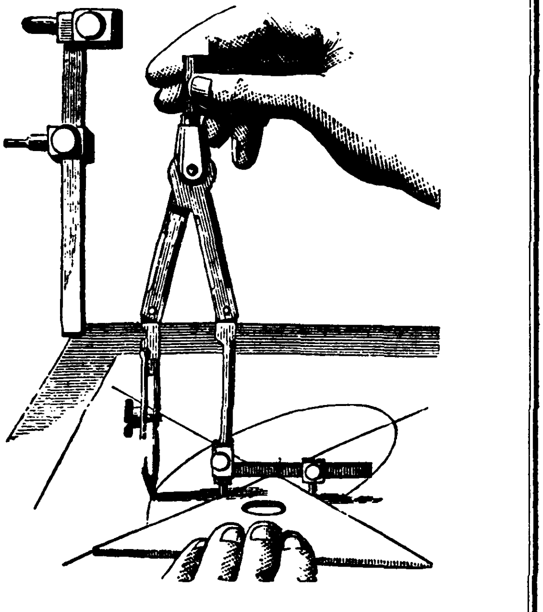
Another good style of treatment is to panel vestibule walls with lines and flat ornaments, and borders stencilled in quiet neutral tints, in accordance with the style of the architecture. The staircase may be treated in the same manner, or it may be painted dado high, with two shades of the same color, the darkest tint about three or four feet above the skirting, and a suitable border stencilled upon the line of division; or the stencil may be divided; a black or dark-colored border may be stencilled upon the lower or dark color, and a line and stops, or small repeating ornament, upon the upper or lighter tint, in any properly contrasting color, or it may be done with the same color as the dado is painted with. A good effect may be got by stencilling a diaper upon the dado of a darker or lighter shade of the same color, with a border of course, but we object altogether to the upper part being treated in the same manner, thus making too busy what ought, in reality, to be a relief and contrast to the rest of the house. Nothing can be in worse taste than to cover every part of our houses with busy ornament, creating a feeling of unrest and oppression utterly opposed to the true principles of decorative art.

Fossil Footprints in Coal.—At the last meeting of the New York Academy of Natural Sciences, Dr. Joseph Leidy read a letter from Mr. W. Lorenz, chief engineer of the Philadelphia and Reading Railroad Company, referring to a fossil specimen presented to the academy by Mr. William D. H. Masson, of Williamstown, Pa. The specimen is a mass of coal shale with footprints, and was discovered by the donor at the Ellengowan colliery, in the Mahanoy coal field. Mr. Lorenz remarks that it is of special interest as having been the first specimen of the kind found in the anthracite coal field. The specimen is an irregular slab, upwards of a foot long, and less than half the breadth. The upper surface is obscurely ripple marked longitudinally, and is crossed in a slant by seven tracks, which are in pairs, except one, in advance on the right. The four tracks on the right occupy a line of six inches, and are about an inch and a half apart from those on the left. The more perfect impressions exhibit four widely divergent toes, successively increasing in length from within outwardly, excepting that the fourth toe is slightly shorter than the third. The expanse of the tracks is about one inch. The impressions probably pertain to some salamandroid animal; and as it had been found useful to refer to fossil foot tracks as the representatives of the animal by which they were made under distinct names, he would in accordance with a suggestion from Mr. Lorenz, name the form represented by the Ellengowan anthracis.

Carbolic Acid Inhalation.—The inhalation of carbolic acid spray (two per cent. solution) in phthisis has been tried in the Mount Sinai Hospital, New York. The first case had fetid expectoration, with an average temperature of 102½°. The first effect of the inhalation was to increase to a marked extent the sputa, but at the same time to check the fetor. The most important effect of the inhalations was to decrease the temperature from 102° to 101°, 100°, and 99°. In some of the cases carbolic acid acted as an irritant, giving rise to considerable spasmodic effects, and in these cases salicylic acid was substituted. The latter agent did not produce such a decided effect on the temperature, but its action on the fetor was equally marked.—*Medical Times.*

A SIMPLE ELLIPSOGRAPH.

The accompanying illustrations represent a simple attachment for compasses for drawing ellipses. It consists in adding an extra point to the compass and then employing it in a manner similar to the way the trammel is used for the same purpose. From the consideration that the draughtsman does not have many ellipses to draw, the crossbars have been dispensed with for the sake of simplicity and the triangle made to take their place. It will be observed that the point inserted in the com-



pass leg, and also the one on the sliding piece, are blunt at the end, so as not to catch on the paper in sliding along the edge of the triangle.

This instrument has the disadvantage of only drawing a quarter of the ellipse at a time, and of requiring a little practice in its manipulation on the part of the draughtsman. On the other hand, it possesses the advantages over the trammel of a greater range of work, of not requiring an additional pen and pencil to keep in order, of compactness, of simplicity, and cheapness.

DISTINGUISHING BUTTER FROM LARD, BEEF FATS, ETC.

Mr. William Gustavus Crook, public analyst for Norwich, England, describes a method which will in a few minutes distinguish butter from the fat of beef, mutton, or pork, or mixtures of them.

The sample to be examined (if in the form of butter) must be first melted and rendered pretty free from water and salt, by filtration if necessary; 10 grains are then to be put into a test tube and liquified by placing the tube in hot water at about 150° Fah.; remove the tube when ready, and add 30 minims of carbonic acid (Calvert's No. 2 acid, in crystals, one pound; distilled water, two fluid ounces). Shake the mixture, and again place it in the water bath until it is transparent. Set the tube aside for a time. If the sample thus treated be pure butter, a perfect solution will be the result; if beef, mutton, or pork fat, the mixture will resolve itself into two solutions of different densities, with a clear line of demarkation; the denser of the two solutions, if beef fat, will occupy about 49.7 °/o; lard, 49.6 °/o; mutton, 44 °/o of the entire volume; when sufficiently cooled, more or less deposit will be observed in the uppermost solution. If olive oil be thus tested, the substratum will occupy about 50 °/o; with castor oil, there is no separation. With some solid fats (not likely to be used fraudulently) no separation whatever takes place; the addition of a minute portion of alkanet root will render the reading of the scale extremely distinct by artificial light. The author states that the above method (although not intended to surpass other processes) is capable of wide application, the saving of a large amount of time, and the reliability of its results will at once recommend it as a "first step" in butter analysis.

FAIENCE JARS AND TAZZA IN PORCELAIN AND ENAMEL.

FAIENCE.

We present herewith an engraving of a group of faience jars and tazza in porcelain and enamel work, designed from Chinese and Japanese originals, by E. Collenot, of Paris.

CHINA WARE IN NEW JERSEY.

Last year, at the suggestion of Governor McClellan, of New Jersey, a commissioner was sent to Paris to study the exhibition of ceramics there and purchase a library of works relating to that industry. Mr. W. C. Prime is reported as pronouncing the library thus selected the best of its kind in this country. A slight controversy, which has arisen among the Trenton potters, owing to a fear that the returning commissioner may bring to the company he is connected with more than their share of the knowledge gained by him abroad, has called out the following facts, which are printed in the *Sun* :

There are sixteen great pottery establishments in Trenton. In them are invested between a million and a half and two millions of dollars, and their annual sales amount to nearly the same figures. Their buildings cover large tracts of ground, and give employment to about 3,000 persons. Their grimy, stained buildings seem to be as old as Trenton, but the industry is, in reality, a new one. It is only about twenty-five years ago that the first pottery was established. It is there yet. It made only yellow or Rockingham ware. Other potteries started out to make only yellow ware, but the grades of goods made in Trenton improve every year, and there is now only one yellow ware pottery there. East Liverpool, Ohio, is the great center of yellow ware manufacture. It is nearly as great a pottery centre as Trenton. Trenton owes its good fortune, in this respect, to its situation. It has no clay, except some black dirt that is used for the manufacture of the boxes that the crockery is laid in to be "fired." The clay used in Trenton comes from Pennsylvania, New Jersey and Delaware. The clay near the Amboys, in New Jersey, is the best in the market. A poor man, in South Amboy, borrowed a little money, a few years ago, purchased a lot of ground, and began selling the clay that lies under its surface. He has dug great shafts and tunnels, and is said to have earned a fortune of $300,000. Trenton's handiness to New York and Philadelphia, and its railroads, canal, and river, are its attraction to the potters. Among the workmen in the potteries are many Englishmen and Irishmen, but Americans are learning to do good work. There are designers and decorators from Minton's great English tile works, and from Tiffany's in New York, employed to decorate the better grades of toilet and table ware.

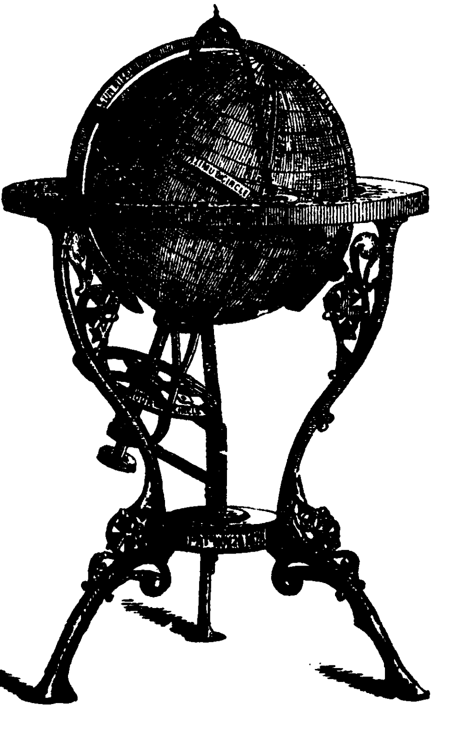
A little while ago nothing better than cream-colored stone china, and blue stone, and stone procelain ware was made in Trenton. Now there are establishments that make real china, and others that manufacture a grade of stone china that they claim looks as well and wears better than French china, and is the same in everything except that it is not translucent. This translucent quality is obtained by an intense "firing," and those who do not make "real" china say that this "firing" spoils a large proportion of the goods. Those who deal in this fine work claim that by "firing" the china just as earthenware is fired—that is, by putting many pieces together where the French put only one piece—there is a tremendous profit at lower prices than the French obtain. The trouble is, however, that the French goods, in standing alone in the firing boxes, receive no blemish, while the American ware, which is stacked up on pegs, in the boxes, bears the mark of the pegs.

Mr. Fisk, of the American Crockery Company, estimates that the growth of the Trenton trade has reduced the importation of foreign ware from 35 to 40 per cent during the past three years. It is said that in one year a great stride has been taken. A market has grown up for fancy goods. People were educated a great deal by the Centennial Exhibition, and, more than all, Americans had ceased to copy from the English, and are relying upon their own originality. Other potters are less cheerful. One young man spent much time and money on a pair of plaques. The principal ornamentation was a wreath containing every garden flower of especial beauty. The potter estimated the cost of the plaques at $125. He took them to Tiffany and to some one else in New York and asked what they were worth. At one place he was offered $50; at another $35. He says that if they had been imported he would have been offered at least $250 for them. He gave them to a bride, and found her a more appreciative connoisseur than the New Yorkers.

TWOMBULL AND FOSTER'S ASTRONOMICALLY MOUNTED TERRESTRIAL GLOBE.

The following design is intended among its other geographical properties, to teach by modern astronomy the correct mechanical relations which the earth has in the system, and for that purpose there are at least eight original appendages, viz.:

1st. A terrestrial globe, with a zone or ring around it 18° broad, representing, the earth's twilight. The edge of this ring which is marked sunrise and sunset, forms the great terminator, astronomically, of sunlight and darkness on the earth's surface, and is always situate 90° from the sun's centre. It moves with the sun's plane around the inclined globe once a year, and is known in astronomy as the "*Solar Horizon*," or Circle of illumination.



2nd. A Terrestrial globe, with a great circle around it representing the ecliptic, or sun's path in the heavens. The ecliptic circle consists of two parts, an outer circle of wood and an inner circle of brass. The outer circle is fixed to the tipod and represents the twelve constellations of the zodiac, divided into 30° each. It is also divided into the days of the calendar, every degree being opposite to the day of the month where the sun's centre is situate at the time. The inner brass circle revolves round the globe upon friction rollers and carries the sun's centre or place, with the other details to be mentioned.

3rd. A Terrestrial globe with a brass semi-circle, graduated to degrees and fixed from pole to pole, to read the parallels of latitude on the earth. The semi-circle is carried round close to the globe by the sun's centre, hence it represents the true solar meridian for giving the longitude east or west, and the right apparent time of the day. This semi-circle has also another useful motion as it is carried round the globe by the sun, from the obliquity of the earth's axis to the ecliptic (23° 28½') it will be observed that it causes the degrees of the meridian to traverse north or south (as the case may be) over the sun's centre in the ecliptic plane, thereby receding off on the earth his daily delineations north or south of the equator.

4th. A Terrestrial globe, with a graduated semi-circle placed between the ecliptic plane and the globe, with a motion round the sun's centre. In practical geography the two quadrants will give approximately the distance in degrees of any place from sunrise or sunset upon any parallel of latitude in the illuminated disc of the earth.

5th. A Terrestrial globe, with a large hour circle placed round the south polar axis of the earth, divided into 360°, and also into hours of civil time. Twelve o'clock or noon on this circle is always in the plane of the solar meridian as it follows the sun's centre, hence it becomes the principal zero for finding the longitude on the earth and the hour of the day.

6th. A Terrestrial globe having a vernier or hour hand placed upon the axis above the hour circle, for reading hours of time or degrees of arc. It can be shifted to suit any meridian and fixed by a screw to the axis of the globe.

7th. A Terrestrial globe, where the sun's place is indicated by the wire through the centre of the circular brass ring which moves over the surface of the ecliptic plane; this appendage gives the sun's position in the zodiac for the day of the month required in the calendar.

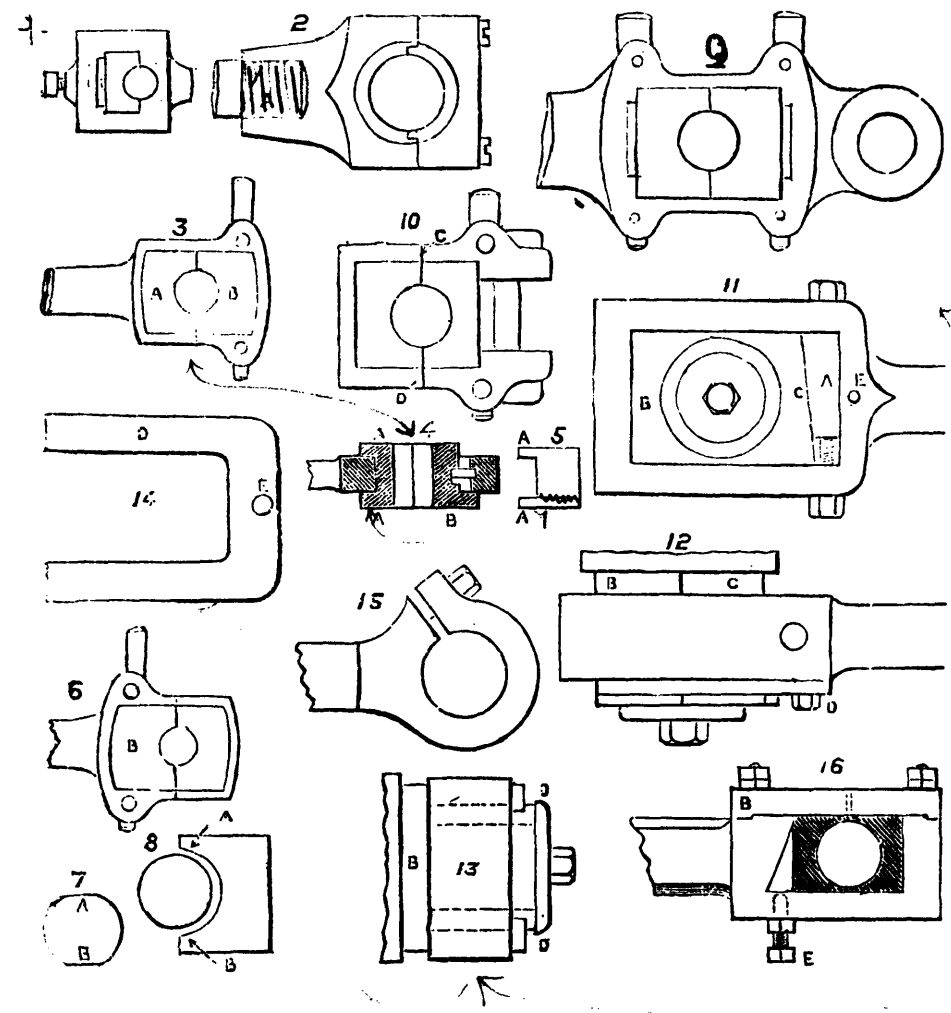
8th. A Terrestrial globe with a round pointed vaze on the top edge of the twilight zone, indicating the axis of the ecliptic around which it revolves.

In concluding this circular the patentees may add that, with those who have written and lectured upon the subject, very great defects have been seen about the old plan of mounting the Terrestrial globe; for example,—Sir David Brewster, a prominent physicist of the last half century, at the end of his lecture on the uses of this educational appliance, observes: "To exhibit in a pleasant and correct way the physical conditions of the earth in the solar system, relative to light and heat, you require to unship the globe from its old mounting, viz.—take it out of the brazen meridian and the wooden horizon, and place it upon a pedestal in sunshine in such a way that its axis shall be pointed to the poles of the heavens, then the sunlight on the little globe will show where it is day and the shade will show where it is night, giving the true physical aspect of the earth in space." Now, in so far as the exhibition of this phase is useful in an educational point of view, this desideratum is correctly accomplished by this new astronomical plan of construction, as the true positions upon the earth's surface are given where the boundary line of the two great hemispheres of sunlight and darkness is situate for every day in the year, thereby giving the true scientific causes of the variation and distribution of light and heat to the northern and southern hemispheres of the globe.

In fine it may be mentioned that it is chiefly in the uses made of the above astronomical principles where the superior claims of this invention are lodged, as it is solely by the use of the "*Solar Horizon*," combined with the sun's motion. In the ecliptic hour the appliance can be made to exhibit truthfully, in miniature, terrestrial phenomena, with all the annual vicissitudes of the seasons which we enjoy.

TO HARDEN THE SKIN.—Through constant use, the fingers in practicing the violin, piano and guitar, or kindred instruments, frequently become very tender and sore. The skin may be hardened by applying a strong solution of alum in water, or the tincture of white oak bark. A still better lotion would be a solution of tannic acid. Any drug store can furnish the acid, which should be dissolved in water.

INSOLUBLE CEMENT FOR BOTTLES.—Soften glue in cold water and melt it in the water bath to form a very thick paste. To this add good glycerine in quantity equal to the dry glue taken, and continue the heating to expel as much of the water as possible. This may be cast on a marble slab to cool, and melted for use as required. This is not soluble in alcoholic liquids.



SOLID ENDED CONNECTING RODS.

By Joshua Rose, M.E.

In Fig. 1 is shown the simplest form of solid-ended connecting-rod. It has but one brass, and the adjustment is made by the set-screw shown, to which there is sometimes added a check-nut to prevent the screw from slacking back. During the pulling stroke of the rod the whole of the strain is concentrated on the end area of the set-screw, and this causes it to imbed in the brass, giving play to the brass unless frequent adjustment is made. It is difficult to readily obtain a very accurate adjustment with a simple set-screw of this kind, and furthermore the rod gets, as it were, shorter from centre to centre of the bore of the brasses. In Fig. 2 is shown a form of end not unfrequently used upon very small rods. The rod-end screws into the brass A, so that when it wears shorter to the amount of half the pitch of the thread upon the rod-end, the brass may be unscrewed half a turn, and the original length will be restored. The cap is held on by two screws, which may be slotted heads as shown, or screws with check nuts to prevent the screws from slackening back, as all screws are apt to do that receive sudden strains in reverse directions.

In Fig. 3 is shown a very substantial form of solid-ended rod, a plan view being shown in Fig. 4. The back brass A has a flange, as shown in Figs. 4 and 5 at A, which secures it to the rod end at the back. The front brass B, Figs. 3, 4, and 6, has the key-way partly sunk in it, and the key binds against one side as well as on the bottom of the key-way, and this draws that brass close down to the face of the rod, as shown in Fig. 4. In order to cause the rod to maintain its original length, the key at one end is placed outside the crank-pin, while at the other end it is placed inside or between the crank-pin and the stem of the rod, as shown in Figs. 3 and 6. In this, as in many solid-ended rods, the flange or collar of the crank-pin requires to pass through the brass opening of the rod. This may be accomplished by making the brass opening large, or wide enough to pass over the crank-pin collar (which will increase the width of the brasses, and hence that of the rod-end); or else the crank-pin collar may have two flat places filed on it, as in the end view shown in Fig. 7. The objection to this plan is that the rod can only be taken on and off in one position of the engine—that is, when the two flat places A and B, Fig. 7, stand parallel with the length of the rod.

It will be noticed in Fig. 4 that the brass B does not fill the space in the rod. This is because that brass has to pass in over the crank-pin collar and push up into the journal after it is in the rod. To make this space as small as possible, and to enable giving the crank-pin as large a collar as possible, the key brass (B) is sometimes bevelled off, as shown in Fig. 8 at A B. Another form of this rod-end is shown in Fig. 9, in which there are two keys to the brasses, the object being to adjust the keys to maintain the rod of its proper length. In order to facilitate making this adjustment, there should always be upon the face of the rod-end centre punch marks, as shown in Fig. 11 at F G, or else two deep marks, as shown at C D in Fig. 10. Then, in lining up the brasses to set the key back, the rod may be restored to its original length by putting behind the back brass a piece of metal of such thicknesses as will bring the centre of the bore of the back brass B even with the centre-punch or other marks. This being the case, it does not matter about the exact thickness of the piece of metal put behind the other brass, since a variation in that will only act to let the key come more or less through the rod-end without affecting the length of the rod. (This remark does not, however, apply to rods in which there is a strap which moves as the key is set up.) In Fig. 10 is shown a form of rod-end sometimes used. The end being open, the brasses pass through it. In this case the whole strain of the pull of the rod falls upon the edge of the jib at top and bottom of the strap, causing the jib to wear out very fast; furthermore, the back brass condenses the metal at the back of the brass opening, acting to pene it and throw the points of the rod-end open, which it always does, the jaws of the jib embedding in the jaws of the rod. This opening of the rod-jaws makes the brasses loose in their places; hence this is a weak and undesirable form of rod-end, though very convenient to take on and off. In Figs. 11, 12, 13 and 14 are shown a form of solid-ended rod of more modern construction. In this case a wedge (A) is used instead of a key being adjusted by screws passing through the rod at the top and bottom, it being obvious that the set-screws may have check-nuts added. B is the back brass, and C the key brass. In this case the flange of the brass goes next to the crank-pin, and a plate, D, is provided to serve as a flange on the front face of the brass. In Fig. 11 this plate is removed to show the wedge, A; but it is shown in the Plan View 12 and the End View 13, and by itself in Fig. 14. A groove is cut on each side of the two brasses and the plate spans, the brasses passing up the groove, being held in position by a screw at E. The opening for the brass (in the rod-end) is here shown wide enough for the rod-end to pass over the crank-pin, but in many cases, with this as well as with other forms of solid-ended rods, the crank-pin may be made plain, that is without a flange, and have a washer secured by a screw (as shown in Figs. 11, 12 and 13), so that by removing the washer the rod may be put on with the brasses already in place, and made no thicker (at the joint face) than is necessary for strength. In Fig. 15 is shown what may be termed a clip-end connecting-rod, the screw closing the rod-end (to take up the wear) against the spring of the metal. It is obvious that in this case the hole may receive a brass brush split as is the rod-end and secured from turning by a pin. Fig. 16 presents another form of solid end-rod, which admits of the use of a brass having a flange on both sides of the strap, and will take on and off by removing the cap, B. If the crank-pin collar is solid, the brasses must be placed on the crank-pin, and the rod, with the wedge in place, lifted or lowered to the brasses; but if the crank-pin has a washer and screw, the rod may be put together and slipped on its place.

HOW TYPHOID FEVER MAY BE PROPAGATED.

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

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

WHITE AFRICANS.

Major Pinto, the Portuguese explorer, who has just crossed Africa, from Benguella southwestward to Natal, describes a race of white men found by him near the headquarters of the Zamberi. He says:

"I one day noticed that one of the carriers was a white man. He belonged to a race entirely unknown up to the present day. A great white people exist in South Africa. Their name is Cassequer; they are whiter than the Caucasians, and in place of hair have their heads covered with small tufts of very short wool. Their cheek bones are prominent, their eyes like those of the Chinese. The men are extremely robust. When they discharge an arrow at an elephant the shaft is completely buried in the animal's body. They live on roots and the chase, and it is only when these supplies fail them that they hold any relations with the neighboring race, the Ambuelas, from whom they obtain food in exchange for ivory. The Cassequeres are an entirely nomadic race, and never sleep two nights in the same encampment. They are the only people in Africa that do not cook their food in pots. They wander about, in groups of from four to six families, over all the territory lying between the Cuchi and the Cubango. It would seem that from a crossing of the Cassequeres with the negroes of other races sprang those mulattoes of the south, whom the English call Bushmen. The latter are, however, better off than the Cassequeres, and use pots in cooking their food, while their dispositions are good, though quite opposed to civilization."

Unfortunately Major Pinto does not say whether he saw more than one of the white Africans he describes, or whether the account he gives of them is based on observation or on hearsay. His promised book may clear up the matter.

INCOMBUSTIBLE WOOD

The following chemical compound is said to produce the result claimed by M. M. P. Folbarri for rendering wood incombustible, petrifying it, as it were, without producing any change in appearance. Intense heat chars the surface, slowly and without flame, but does not penetrate to any extent, and leaves the fiber intact:

Sulphate of zinc, 55 lb.; American potash, 22 lb.; American alum, 44 lb.; oxide of manganese, 22 lb.; sulphuric acid of 60°, 22 lb.; water, 55 lb.; all of the solids are to be poured into an iron boiler containing the water at a temperature of 46° C., or 113° Fah. As soon as the substances are dissolved the sulphuric acid to be poured in little by little, until all the substances are completely saturated. For the preparation of the wood it should be placed in a suitable apparatus, and arranged in various sizes (according to the purposes for which it is intended) on iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for uses of all kinds.

BROWNING'S STONE VARNISH.

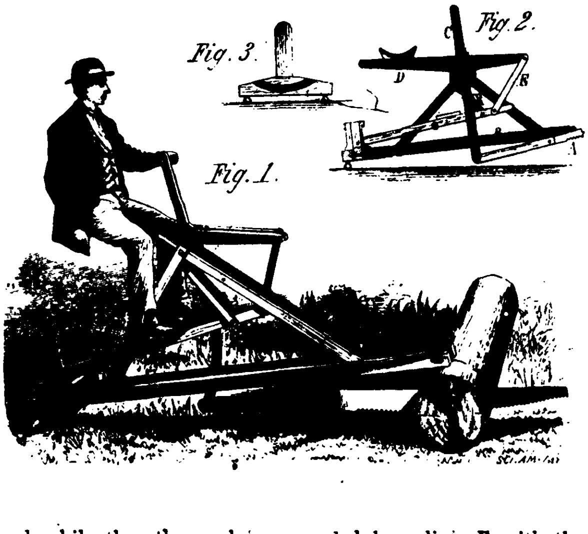
Respecting the colorless preservative solution by which Cleopatra's Needle has been covered, a correspondent recently wrote to the *Times*: "In operating upon the granite, Mr. Browning first gave it a thorough cleansing, removing all the sooty and greasy matters from the surface, and then indurated it with his invisible preservative solution. The effect has been to give a freshness to the granite as if only just chiseled from the rock, retaining the original color, disclosing the several veins, the white spar shining in the sun's rays like crystals, and exhibiting the polished portions as they formerly existed. The solution soaks well into the pores of the granite, and the best authorities consider that it will have the effect of thoroughly preserving the monolith. Mr. Henry Browning has personally superintended the operations."

NEW DRAG SAWING MACHINE.

The engraving on this page represents, in Fig. 1, Messrs. Alters & Brasington's improved drag saw in actual operation, and in Figs. 2 and 3 the details of its construction are shown. The saw is capable of being operated by one man, as the weight of the operator, the pressure of his feet, and the power exerted by the hands are all utilized in giving a reciprocating motion to the saw.

The saw, A, runs between two parallel bars, B, which are connected with an upright pivoted to the standard, shown in detail in Fig. 3. This standard rises from a cross-piece which gives a broad base to the machine, and in which is set a perforated curved plate for receiving the latch or detent carried by the pivoted saw guide. By means of this device the saw may be adapted to inclined or uneven surfaces, as the saw frame may always be adjusted to a vertical position and secured by the detent or latch.

The saw head is pivoted at its rear end to the lower end of the lever, C, which reaches upward and is fulcrumed in the timbers rising from the bars, B, and is provided above the fulcrum with a T handle. In the lever, E, forward of its fulcrum, a rock lever, D, is pivoted. This lever is composed of two parallel bars united at the ends, and supports a saddle for the operator at one



end, while the other end is connected by a link, E, with the treadle lever, which is fulcrumed at the rear of the machine just above the bars, B. The treadle lever is connected by a link, F, with the lever, C, at a point just back of its fulcrum. At the forward end of the bars, B, there are a guide for starting the saw, and two spurs which enter the log and hold the machine in place.

The method of operating the machine will be clearly understood from Fig. 1. The operator sits upon the saddle, as indicated, and his weight being disposed forward of the fulcrum of the lever C, tends to throw the lever back, as does also the power exerted by the hands pushing forward on the handle, while the pressure of the feet of the operator on the treadle lever being expended on the lever C, through the connecting bar back of the fulcrum, and the power exerted in drawing the lever back by the hands, throw the saw forward. Thus, by the weight of the operator, the pressure of the feet on the treadle lever, and the power exerted through the handle of the lever C, a reciprocating motion is communicated to the saw, by which it is rapidly and easily operated.

Further information may be obtained by addressing the Editor of the *Scientific Canadian.*

NEW USE FOR OLD CLOTHES.—A manufactory in Germany turns out 1,000 pounds of grape sugar a day, made from old linen. The old linen, which is pure vegetable fibrine, is treated with sulphuric acid, and converted into dextrine. This is washed with lime water, and then treated with more acid, and almost immediately changes and crystallizes into glucose or grape sugar—which is highly valued in the making of rich preserves and jellies.

DAMPNESS IN FOUNDATION AND CELLAR WALLS.

From "Foundation and Foundation Walls," by George T. Powell, just published by Bicknell & Comstock, New York, we make the following extract on this important subject:

In dwellings that are isolated, to avoid dampness from penetrating the basement or cellar walls that are below the line of earth, architects sometimes specify that the outside of the walls be cemented from the footings to the base-board of framework, and in some instances stop the cement 4 to 6 inches below line of earth. Then excavate the earth around the structure to the distance of 2 feet from wall, and to a depth of 16 to 20 inches, and at an angle of 10 degrees lay one course of brick flat up to wall line, and cover with a coat of cement, as shown in Fig. 1.

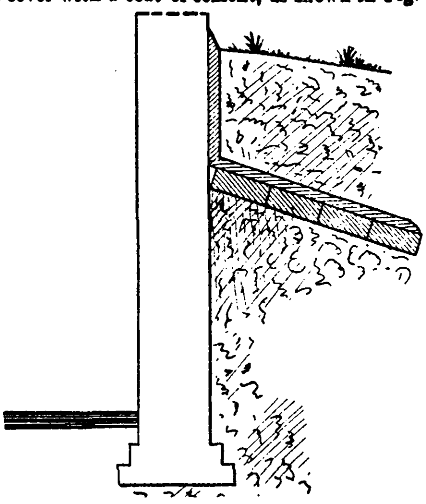


FIG. 1.

Before this is done, it is necessary to fill in earth and settle it around the walls. After this is done, allow it to set perfect before covering with earth. As the foregoing method interferes with flowers and grasses up to line of wall, here is another method (see Fig. 2.)

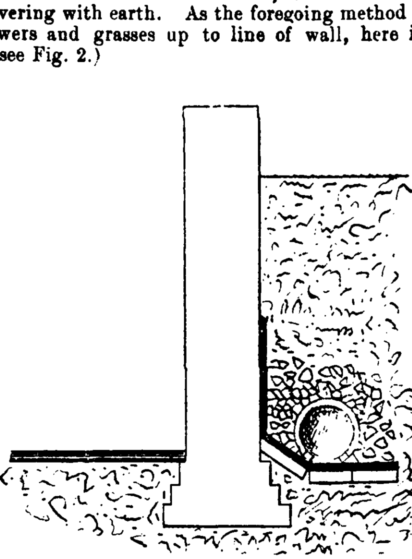


FIG. 2.

After the wall has been built and cemented on the outside (Resendale cement is good enough), excavate the earth on the outside to line of footings, and grade the excavation to a proper descent to carry the water to sewer in a drain pipe, laid on top of a course of bricks cemented, and on top of this put loosely broken stone, and cover the whole over with earth when it is dry. Where there is a clay bottom and much moisture, even this will not prevent dampness from arising in the cellar. To overcome this, use the method shown in Fig. 2 on the outside, and that of Fig. 3 on the inside.

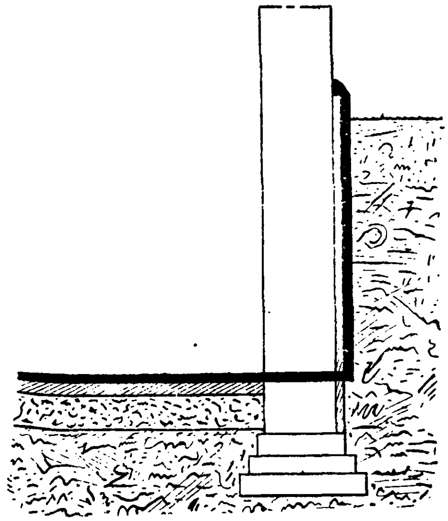


FIG. 3.

Prepare the cellar bottom, and lay, say 3 to 4 inches of sand, rolled down firm and even. On top of this put a coat of cement, 1½ inches thick, over the whole surface of the cellar, and lay off around the cellar walls in the cement flat gutters of slight descent to the sewer or waste pipe.

There are clay soils sufficiently solid for walls of dwelling houses. But the clay in wet seasons retains so much moisture that it does not seem to be carried away into the earth, but rises and penetrates through the cellar bottom, and keeps the cellar damp nearly all the time. This is a serious difficulty to overcome, but I have known the following method to be carried out with success:

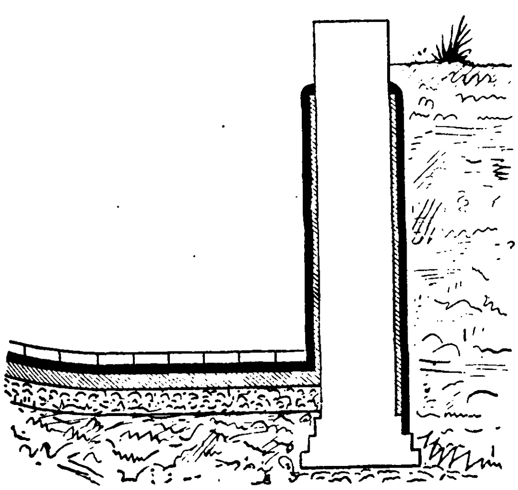


FIG. 4.

Excavate the foundations to the depth required to put in the footings, and in the cellar bottom 4 to 5 inches of sand rolled hard, on top of which lay a coat of cement, not less than 1 inch thick; and when this is as dry as possible, put a coat of asphaltum over the whole surface up to the lines of the inside walls, and through one course of brickwork around the whole structure, care being taken to cement the outside wall, and coat it with asphaltum, same as the cellar floor. This is the best course to pursue where there is no chance for a drain.

Another method to secure a dry cellar is as follows: Perform such levelling to the cellar bottom as may be required; spread over this sand to the depth of three to five inches, and roll or pack firm on top of this; cover the whole surface with 1-inch thickness of cement mortar, Rosendale or American brands; carry it well against the inside of the outer walls. Coat the outside walls with cement one-half to three-quarters of an inch thick in the same manner up to the dry line. Then on top of this lay a coating of asphaltum, tar and sand, applied hot; carry the asphaltum through the wall (this should be provided for when foundation walls are being built), and coat the outside wall to dry line with hot asphalt. When the asphalt is sufficiently dry to walk on, dip heated brick into asphalt and tar, and lay closely the whole surface with brickwork. When it is not possible to carry the asphalt through the wall to the outside, carry it up on the cement on inside.

The best mixture of asphalt is to mix with the asphalt 10 per cent. of coal tar and 25 per cent. of sand and use while hot, to form a cement for bedding brick for damp cellar bottoms.

A damp cellar sends up through the walls of a house a great deal of moisture by capillary attraction; it is, therefore, too often the unsuspected cause of rheumatism and colds.

NEW DISEASES.—Prof. Winckel, the director of the Royal Lying-in Institution at Dresden, has reported to the Congress of Children's Doctors, lately held in Berlin, observations upon a mysterious children's disease, which he had an opportunity of clinically studying in his own institution. An epidemic broke out toward the end of March. Of 23 children attacked, 19, or 82°/₀ died, and the average duration of illness in the fatal cases was 32 hours. The illness began with a sort of sudden stupefaction of the children. The respiration became hoarse, accompanied with groaning and occasional foaming at the mouth. The change in the blood was remarkable. Dr. Winckel made incisions in some cases, but it was only by using pressure that he was able to squeeze out any blood. It was a thick, brown-black fluid, of the consistency of syrup. The body became flacid, the liver much swollen; presently convulsions supervened, during one of which the child expired. The President of the Congress, Privy Councillor Dr. Gerhardt, of Wurzburg, suggested that this new disorder should be designated "Winckel's disease." Another disease has become apparent in the heart of a very crowded portion of London. It is a new form of Cyprus fever, and a diagnosis of a recent malignant case shows the patient to be suffering from hallucinations and lowered vitality. The faculty ascribe the disease to impure water, and have given it the name of detephobia, and, though it is seldom fatal, the sufferer remains but a shadow of his former self.

GEOGRAPHICAL PROBLEMS SOLVED.—Within the present generation, and mainly during the present decade, nearly all the great geographical problems left us by our adventurous ancestors have been solved; all the great lines of exploration have been taken up and worked out with a success that leaves to the future only the details to fill in. The northwest passage was completed more than a quarter of a century ago; the Australian interior has been crossed and recrossed within the past few years; several bright lines now break up the once mysterious darkness of the "Dark Continent;" the sources of the Nile have been traced, and the course of the Congo all but laid down; the Russians have filled up many important blanks in Central Asia; there is now no mystery to speak of for geographers on the North American Continent, and none of any magnitude on the South; even the great outlines of the ocean-bed have been chartered, and now at last, after a struggle begun more than 300 years since, the northeast passage has been made with an ease that makes one wonder why it was not done long ago. A matter-of-fact Swedish professor has shown that with a suitable ship at the proper season this long sought-for passage to the "Far Cathay" is a question of only a few weeks. Of Artic feats there now remains only the "dash at the Pole," and that the North Pole will be reached sooner or later there can be no doubt.

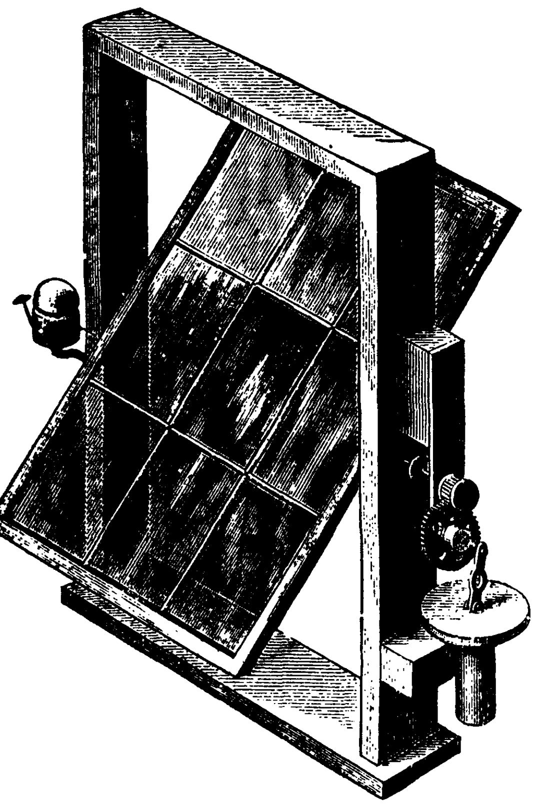
EXPLOSIVE FORCE OF DYNAMITE.—We learn from the *Scientific American* that there is a misconception about dynamite exciting a greater force downward and gunpowder upward when exploded. Nitro-glycerine (the explosive agent in dynamite) yields on exploding about 800 times its volume of gas; gunpowder about 300. This gas, suddenly liberated, must displace a portion of the atmosphere, which presses with a weight of about nine tons upon each square yard of surface. To lift such a weight in the exceedingly short space of time occupied in the explosion of a charge of nitro-glycerine (in the form of dynamite or otherwise) would require a force greater than to split a rock, and the rock yields. Gunpowder yields but one-third as much gas on exploding, and the complete combustion of its grains requires an appreciable amount of time. Nitro-glycerine explodes all but instantaneously.

AN INGENIOUS AUTOMATIC VENTILATOR.

We illustrate herewith an ingeniously devised and curious automatic ventilator, recently patented through the Mining and Scientific Press Patent Agency by Frank J. Crouch, of Eugene City, Oregon. Mr. Crouch is a young man of great ingenuity, and has invented a number of useful appliances of different kinds. This ventilator is his latest device. It is intended as an attachment to windows, transoms, etc., by means of which the opening or closing of the window or transom is automatically accomplished, in accordance with the temperature of the room.

The sash or transom is hinged or swiveled to the frame, so as to swing in a circle on a central axis, and thus be opened or closed. This shaft or axis is continued through the window frame on one side. On its outer end is a pinion, which unites with a small spur wheel, as shown.

On the lower part of the frame is secured a pipe-cylinder or chamber, on top of which is a thin metallic plate. On top of this plate is another of the same size and shape, the two plates being secured together at their edges, and the space between them being filled with sulphuric ether, turpentine, alcohol or similar sensitive substance. The tube or cylinders opens into the chamber formed by these two plates through the lower plate, and also contains the ether or other substance. To the top plate of the disk is secured an arm, the upper end of which is fastened to the crank on the spur wheel.



Now, when the liquid in the cylinder and between the plates or disks expands, the plates are expanded as they admit of a sensible spring apart at the centers. As they are expanded or forced apart by the expanding substance, the arm attached to the upper plate operates the crank and gear wheel, thus rotating the pinion on the shaft or trunnion carrying the sash or transom, and the sash or transom is thus swung open. As the liquid cools, the reverse is the case and the sash is closed.

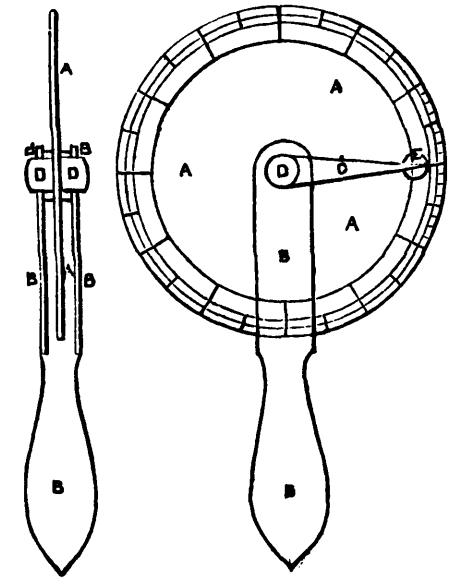
The plates and cylinders are made preferably of glass, as it absorbs heat readily, and none of the chemicals used will corrode it. No dangerous effects are produced should leakage occur.

The plate and cylinder are placed inside the room so as to be affected only by the temperature inside. When the room is heated the resultant expansion of the plates acting on the gearing will open the transom, and as the liquid cools, the plates come together, and close the transom, thus regulating the size of the opening through the transom or window in proportion to the temperature of the air. This durable and self-ventilator is adapted to hotels, theaters, halls and private dwellings, where good ventilation is desirable. On one side of the window frame may be attached a gong, so arranged that in case of fire or when there is any unusual heat, the movement of the sash will ring the bell to attract attention.

CIRCULAR GAUGE.

The inclosed diagram shows a plan and elevation of a circular gauge, which might be found very useful by many of our readers.

It is designed for the measurement of large drums, cylinders, and pistons, and to give more accurate measurements than callipers and ordinary gauges.



The diagram (plan) is 1 foot in circumference, marked like an ordinary rule, viz., inches, half-inches, and eighths.

A A A shows the "gauge."
B B the handle and fork.
C shows the indicator.
D shows the centre-pin.
E the starting point.

In the elevation—

A A shows the gauge.
B B B shows the fork and handle.
D D shows the centre-pin.

In addition to the above uses, this gauge may be used for any description of work.

IMITATION GOLD AND SIVLVER.

There have been a great number of alloys resembling gold and silver patented. The last which has come to our knowledge is a patent recently granted in England to one Thomas Meiffrer, of Marseilles, France, for the following ingredients:

Gold Alloy.—800 parts of copper, 28 of platinum, and 20 of tungstic acid are melted in a crucible under a flux, and the melted mass poured out into alkaline water, so as to granulate it. It is then melted together with 170 parts of gold.

Silver Alloy.—65 parts of iron and 4 parts of tungsten are melted together and granulated; also 23 parts nickel, 5 of aluminum, and 5 of copper, in a separate crucible, to which is added a piece of sodium, in order to prevent oxidation. The two granulated alloys are then melted together. Both alloys resist the action of sulphureted hydrogen.

Expansion of Wrought Iron and Cast Steel.—It is important in workshop manipulation to remember that if a piece of cast steel be made red hot and quenched in cold water it will become longer, but if the same operation be performed upon a piece of wrought iron it will become shorter.

Mechanics.

Steel in the Boiler of the Future.—Steel can now be produced by either the "Bessemer" or the "Siemens" process, surpassing in tensile strength and in the power of bending and twisting, for flanging, any best brand iron known, the metal produced by either of these two processes being of a purer and more homogeneous nature that can be made by any of the older methods. The best American boiler plate is said to have a rupturing strain of 70,000 pounds, or 31 tons per square inch of section. The ordinary plate for locomotive boilers is stated to be capable of bearing a strain of 60,000 pounds, or 27 tons per square inch. Steel boiler plates, having very great cohesive properties, have been made in England and in South Wales. It is stated to have a tensile strength of 45 tons per square inch, and to be capable of producing the highest class of steam boilers. As a rule, England boiler plates are of two classes—Yorkshire and Staffordshire; these, however, include the make of other districts. The maximum strengths for locomotive boiler plates are as follow: Best Yorkshire iron plates, 25 tons per square inch; best Staffordshire iron plates, 20 tons per square inch; best American iron plates, 31 tons per square inch; ordinary American iron plates, 27 tons per square inch; English steel plates, 40 to 45 tons per square inch.—*Universal Engineer.*

Barrel Cleaning Machine.—A brewery at Mouchain, in France, has been using for some time a patented machine for cleaning barrels. Four barrels are washed at once inside and outside. In the center of the machine is a shaft on which is a piece of metal so arranged that four iron hoops about three feet in diameter can be bolted on. These four hoops have each two sheet-iron plates mounted on pivots, and between these plates an attachment screw catches the barrels. Brushes fixed on springs are placed on a hoop outside the machine, and so arranged as to touch the four barrels at the same time. The circle of brushes is eccentric to the shaft. A reservoir under the machine has hot water for washing the outside of the barrels. A chain brush is placed in the interior of the barrel. The machine is worked by an ordinary pulley fixed on the main shaft. This latter carries the four barrels round, like the sails of windmill. The exterior brushes being stationary, produce a friction on the barrels which causes them to rotate on their pivots, so that two circular movements are obtained at the same time. The tables of the screws throw water on the barrels when they come to the upper part, so that they are continually kept wet.

Brass-Founding.—If you want fine castings, dry the surface of your moulds well, dust them with bean flour tied up in a muslin bag, put them upright, and with a pair of common house-bellows, blow out all the surplus flour; use a little care; screw your molds together well, mix your metal with a piece of red-hot iron, skim and pour as quickly as possible. I have heard casters say that the art of casting is in pouring in the metal—that is, the crucible should be held as high as possible over the gateway of the moulding box, and poured in with a firm hand, so that the metal may go down to the bottom at once. Practice will enable you to do this without letting the metal touch the sides of the gateway. When the gateway is full, give the box a few light taps with anything light, and on no account let the metal overflow the box, and you will have good and clean casting. If you want to cast very fine, such as a leaf, to show the veins, you must well powder the facing sand with a pestle and mortar; this must be dusted on the pattern through a fine piece of muslin, then fill up with fine sifted sand.

Preparing Metal Sheets and Wire for Coating.—A special improved process of treating metal previously to its being coated with tin, lead or zinc, has been invented by Mr. Conway, of Pontnewydd, near Newport, England. The present method is to subject the iron, steel, or other metal, to a bath of sulphuric acid, but Mr. Conway's invention does away with the use of acid, and substitutes carbon or hydrocarbon, either in the form of vegetable or mineral tar or hydrocarbons, which may be applied mechanically or by manual labor, but he finds it advantageous to employ a machine by which plates by means of rollers are passed through a bath containing the carbon to be used, thus doing away with what is technically known as "black pickling" in the manufacture of tin and terne plates. After passing through the bath the plates or metal of other forms go through the usual process of annealing, cold rolling, white pickling and tinning, as is well understood.

Automatic Speed Regulator.—A contrivance has been invented by Messrs. Dufilhot & Duprat, of Bordeaux, for regulating the speed of machinery. It consists of a spindle to which rotary motion is imparted by the machine to which it is attached; on the spindle is fitted a sliding cone, and under the latter is a cross-head, bearing bent and counterpoised arms jointed thereon. When the spindle is revolved by the machine, the arms are thrown outwards at their lover extremities, but impinge upon the cone with their upper extremities, and by means of their varying friction on the cone, which increases with the velocity of the motion of the spindle, the speed of the latter is controlled, and its means and that of the machinery, with which it is connected by gearing-wheels.—*Universal Engineer.*

Blackening Zinc.—A process for chemically blackening zinc has been devised by M. Fuscher, of Frankfort. The inventor first scours the zinc to be operated on with fine sand and very dilute hydrochloric acid, and then plunges it into a solution of equal parts of chlorate of potash and sulphate of copper in thirty-six parts of water. When withdrawn, after a short interval, it is found to have taken up a fine coating of velvetry black, which, however, at this stage, very readily comes off. To ensure its permanency, the zinc thus coated is quickly washed with water, allowed to dry, and then plunged into a weak solution of asphalte in benzole. The excess of this fluid is allowed to drain off, and the colour can then be fixed by rubbing the sheet with a cotton plug. Zinc thus blacked is found to be particularly suitable for covering in roofing.

Petroleum Fuel for Steamboats.—On July 15th, the first known attempt to use petroleum as fuel on board a steamer was tried at Pittsburg, and the result was very satisfactory. The *Telegraph* says: "The little steamer *Billy Collins* lay in the Alleghany river this morning with 80 pounds of steam in her boilers, and not a bit of smoke in her stacks, ashes in her pans or clinkers in her fire-box. A few gallons of 63 cent crude oil had run out of a barrel on her guards, and was converted into a waving flame 10 feet long under her boiler, by a little device recently patented." The trip was made a few days ago, and everything passed off satisfactorily. The patent is the invention of a Pittsburg man.

The Use of Files.—A new file should always be used with a light pressure until the very thin sharp edges of the teeth are worn off, after which a heavier pressure may be used with less danger of the teeth crumbling at the top or breaking off at the base. Every filer should keep a partially worn file to use first on the chilled or gritty skin of castings, or on a weld where borax or similar fluxes have been employed, or on the glazed surface of saws after gumming. In filing high tempered steel it will generally be found more profitable to use the finer grades of files, called 2d cut, and particularly where anything like a fine finish is required.

Sailing on the Rails.—The Sioux City (Iowa) *Journal* says: Mr. John McMillan, the enterprising roadmaster of the Sioux City and St. Paul railroad, came here a short time since with his hand-car rigged with canvas, sloop style. The experiment of sailing cars on railroads seems to be a new departure, and the success attending the trial was well marked. The car has been in use about two months, and gives perfect satisfaction, having made, with moderate breezes, upwards of 18 miles per hour, and with its "leg of mutton" sail can sail close up to the wind.

Gilding on Steel.—An old process,—which, however, is by no means universally known,—is as follows:—By shaking a solution of gold leaf in aqua regia with ether, or naptha, the gold will leave the acids to combine with the other liquids. Polished steel surfaces, such as knives, scissors, &c., on being plunged in this solution, when dry become covered with a coat of gold, which is an excellent preservative from rust. Letters, designs, &c., may be traced by means of a pen, pointed stick, or brush, and as the ether evaporates, the gold will remain fixed.

Restoring Steel.—A German magazine gives a simple method of restoring burned steel to a workable condition. This consists in immersing it in a preparation made by melting three parts of pure rosin in a crucible, and after it has become perfectly fluid, adding, with continued stirring, two parts of boiled linseed oil—care being taken to prevent the mixture taking fire, of which there is danger should the temperature be too high.

English Agricultural Implements.

NEW PATENT "ALBION" SELF-RAKING REAPING MACHINE.

Having said so much about the general merits of Messrs. Harrison, McGregor & Co.'s machines, I purpose describing, for the information of your readers, some of the mechanical features which they possess, and supplying, from my notes of a recent visit to the Albion Iron Works at Leigh, a few observations on the economy of manufacture and amplitude of resources possessed by the firm for carrying on their vast business as iron-founders and mechanical engineers. To begin with their New Patent "Albion" Reaping Machine, with controllable rakes, of which an engraving is given in the preceding page, I regard it as near perfection as anything mechanical can be, and at any rate equal

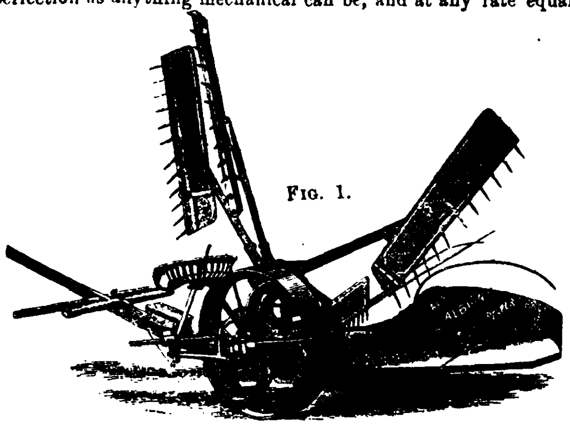


Fig. 1.

The Patent Albion and Self-Raking Reaping Machine.

to any self-raking reaper in the market. This machine is sent out with four (or five) controllable rakes, complete, with knives, box of tools, &c. It will be seen that the platform and cutter bar are constructed so as to be easily folded up for transport, and to pass through a narrow gateway; and that the driver's seat is placed in a convenient position, so as to give the attendant entire control over the machine, whilst the man's own weight balances it, and takes all weight from the necks of the horses. By a new patented arrangement the lever for throwing the working parts into or out of gear is placed outside the main wheel, and close to the driver's hand, an obvious advantage in working the machine. Another lever is placed within easy reach, to enable him to tip

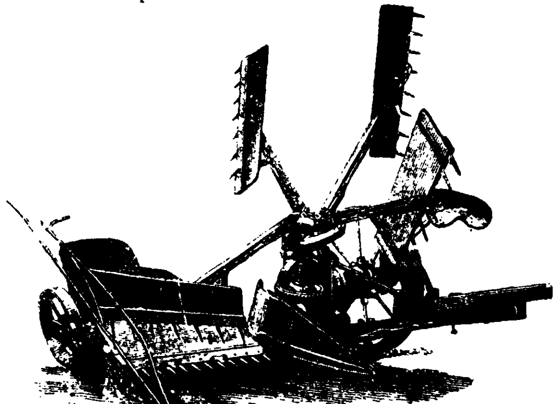


Fig. 2.—The Albion One-Horse Self-Raking Machine.

the points of the fingers up or down whilst the machine is in motion, as the nature of the crop may render necessary. A noteworthy feature of this two-horse reaper is, the gearing is well protected from dirt, and is so constructed that the machine when in operation is comparatively noiseless. By a simple arrangement of the rakes any of them may be made to deliver the sheaf, or pass over the platform leaving it untouched, as may be desired. The New Patent "Albion" One-Horse Self-Raking Reaping Machine is a very complete and handy implement for the use of small farmers. It contains every improvement for light, easy, and rapid corn-cutting, and is similar in every respect to the machine above described, except that it is adapted for one horse,

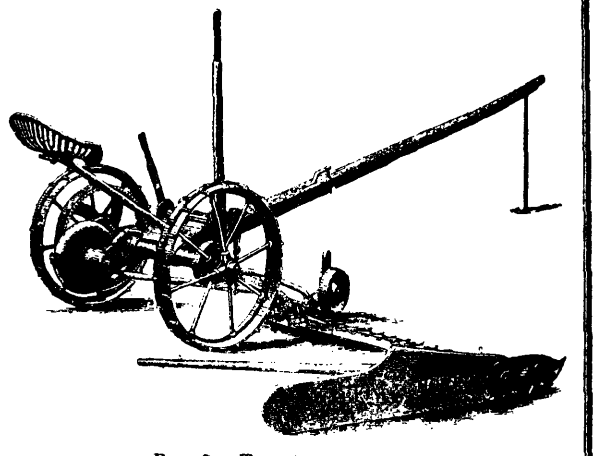


Fig. 3.—The Albion Mower.

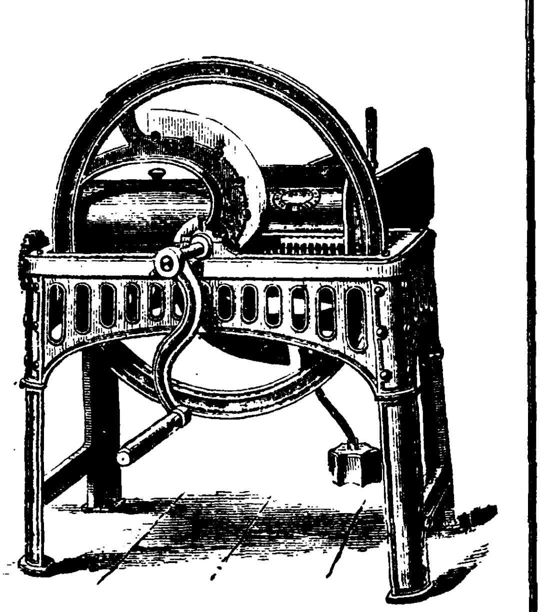


Fig. 4.—The Albion Chaff Cutter.

and cuts 3 ft. 6 in. wide only. This reaper is fitted with the improved controllable arrangement, whereby every rake, every second rake, every third rake, or every fourth rake may be made to deliver the sheaf; by a simple pedal movement the driver can cause all the rakes to act as dummies until it becomes necessary to sweep off the sheaf. These are the main features of Harrison, McGregor & Co.'s reapers, which, up to the present time, have fully sustained, in actual field work, the reputation originally earned by them.

[We simply give these illustrations, which are copied from an English contemporary, in the expectation that our manufacturers may probably see in them some new and useful improvement.—Ed. S. C.]

Taking Casts in Plaster of Paris.—In a previous number we gave the process for this art; the following is considered a preferable method: Put the required quantity of water into a basin. Lift your plaster with your two hands and put it into the water as gently as possible, till it rises an inch above the water in the centre of the basin. When saturated, blend well before casting. Do not use oil for your pattern; it burns the mold and makes it soft. Lacquer for pattern: a piece of black soap the size of an egg, a piece of tallow half ditto, and two gills of water. Put them on a slow fire, and keep stirring till the mixture comes to a boil. Then take off the fire, and let it simmer at the side for 15 minutes, stirring all the time. Apply the mixture with a small brush. Draw your pattern when your plaster gets hot, which you can tell is the case when you see steam coming off.

THE KANSAS WHIRLWINDS.

THE KANSAS WHIRLWINDS.

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

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

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

THE STEAM ENGINE OF THE FUTURE, AND THE FUTURE OF THE STEAM ENGINE.

In the form of a pamphlet the well known author of many valuable works on the steam engine has now given forth some admirable suggestions, and sensible previsions, as to the future of the wondrous machine. We shall at present content ourselves with allowing Mr. Bourne to speak for himself on this pregnant subject. He observes that "the benefit of working steam engines expansively is well known to engineers, as also the necessity of employing a steam jacket in engines so worked, to obtain the full benefit of the expansive principle. It is not generally known, but is nevertheless the fact, that in high speed engines there is a further benefit arising from the inability of the cylinder to become sensibly heated and cooled at each stroke, from the shortness of the time given for that process, and in such engines the cylinder approaches to the condition of a non-conductor, which is known to be favorable to the economical generation of power. Then, in the case of all high pressure engines, it is easy to see that a considerable pressure must be more beneficial than a lower pressure. To raise a given quantity of water into steam takes just the same quantity of heat, whether the evaporation is effected at the pressure of the atmosphere or at six or eight times that pressure. But at the low pressure the steam will not generate any power, whereas at the high pressure it will generate much power. A very high pressure of steam, however, is inconvenient, as it involves a correspondingly strong and heavy boiler, an extra strong and heavy engine, and separate expansion gear, which is not compensated by the small amount of increased economy obtained from excessive pressure. I have found a pressure of about eight atmospheres to be, on the whole, the most eligible that can be adopted. . . .

"Supposing a good and cheap small engine to be available—an engine that will be strong, simple, safe, light, noiseless, and economical in fuel—not only would all its industrial applications be extended, but it would find a new and wide sphere of usefulness in ministering to domestic wants, one of the most widely pervading of which is the want of a simple motive power. In American hotels steam engines have long been employed for brushing boots and cleaning knives. They are the docile and inexpensive Helots of the age, and the domestic production of the electric light is a new and important sphere for their energies. But besides these functions, a domestic engine may be employed in roasting meat, driving washing machines and mangles, driving sewing machines, in brushing hair, in preparing aerated waters, and in the country for pumping, for sawing wood, and for performing many other laborious operations. A steam engine may be made to cool houses in summer and to warm them in winter, to maintain fountains in conservatories, to work punkas, to produce ice, and to create and maintain a vacuum in safes for the preservation of meat. For such purposes the engine must obviously be of the simplest, most compact, and most inexpensive character, and should be attached to the boiler, so that the whole may be lifted in a piece, like a hall stove. The boiler should be provided with a self-acting feed of water, and the fuel should be gas, which has only to be lighted to enable the engine to be put into operation. Gas companies will find ample compensation for the loss of their lighting function in the creation of a new heating function, which will become larger and more remunerative than the lighting has ever been. Instead of extracting from the coal only the illuminating gases, the whole fuel should be turned into combustible gas by the aid of superheated steam, and all the fires of houses could be maintained by this cheap gas burning in jets amid pumice, which it would keep red hot. There would then be neither dust from grates nor smoke from chimneys, and the gas-works would supply the fuel that is necessary for the generation of the electric light.

"I cannot pretend in this brief notice to enumerate all the improvements which the steam engine of the future should comprehend; but one essential quality is, that the boiler shall not be liable to internal incrustation, and that there shall be abundant facilities for easily cleaning it out. Most waters contain a certain proportion of lime, which is precipitated by boiling, and in tea-kettles this lime forms an internal crust, which is termed 'rock.' Such incrustation hinders the transmission of heat through the metal of a boiler, and is injurious in various ways. But there are known means of preventing its formation, and in the 'steam engine of the future,' it is an indispensable feature that these means shall be embodied.

"The application of the steam engine to the propulsion of carriages, omnibuses, and cabs, is now only hindered by its too heavy weight and too high cost. Asphalt pavements, which are objectionable for horses, afford for steam carriages a surface as eligible for easy traction as a railway, and without any countervailing fault. All wheeled vehicles, whether required to travel at a high or a low speed, will be propelled by steam instead of horses as soon as the steam engine is made sufficiently light and sufficiently cheap to warrant the substitution. Life boats, instead of being open boats propelled by a number of men, should be decked boats propelled by a steam engine, and managed by only two men, one to steer the boat and the other to attend to the engine. Such boats should be propelled by a water jet which will always act, whatever may be the roughness of the sea, and whether the stern of the boat is in or out of the water. The use of the steam engine for irrigation in connection with the centrifugal pump is an application of which the sphere is limited only by the cost and the deficient portability of the apparatus. To render the class of small engines so much more portable, so much more simple, and so much less costly as to remove the existing impediments to their use, may certainly be accounted one of the most important problems of the present time, and I trust it is not presumptuous to hope that the cursory hints here given may accelerate the desired solution.

Useful Information.

EMBELLISHING METALLIC PLATES.

The decoration of sheet-iron or of tin or terne plates by printing with colors, by lithogalvanography, and by stamping is considered to be defective whichever is used, so that in the opinion of Messrs. Trottier & Co., of Hennebont, France, a blank remained to be filled up in order to supply the numerous manufactures employing sheet-iron and tin with a product which, while presenting essentially a decoration suitable for the article for which it is intended, offers great resistance to the tools with which it is to be made, and will bear the usage to which it will be subjected. Such is the object sought and which is believed to be fully attained with the novel products forming the subjects of this invention. These products, which it is proposed to term "litho-plastic iron and tin," may in fact be applied to all purposes of manufacture. The plates of iron or other metal having been polished and grained, are submitted to lithographic printing with inks non-saponifiable by acids, amongst others those having a base of wax, linseed oil and asphaltum, or linseed oils vulcanized by the action of azotic acid, or made so that they cannot be attacked by acids by means of an addition of Jews pitch, and two or more solutions of concentrated india-rubber.

The object or impression being obtained, the parts not covered by the fatty inks are bitten in or deepened by chlorhydric, sulphuric, nitric, or nitrous acids, pure or diluted, or by any other body capable of forming with the iron a soluble combination, or by the aid of an electric current in baths suitable for this work. The duration of the action necessarily varies with the relief which it is desired to obtain and the nature of the dissolvents used. The fatty inks which have formed the reserves are then removed either by heating the plates or by dissolvents of the fatty matters. In this state the iron is submitted either to ordinary tinning or to galvanizing, or to any kind of galvanic deposit, according to the use for which it is intended. The electro-chemical deposits may be applied as reserves, this application being based upon the property possessed by certain metals of not being attackable by acid, whereas the same acids act upon iron. The same lithographic composition will then give an object or impression the reverse of that obtained by the previously described process.—*Mining Journal Sup.*

DYEING.—A new process, by which novel effects may be produced upon textile materials, has been introduced by MM. Gillett & Son, Lyons. The thread or textile fabrics are first dyed black by any known process, and are then treated with gelatine or albumen, and allowed to dry. After this, the materials are placed in a bath (more or less dense) of color obtained by the distillation of coal, and vaporization is then effected either in a wet or dry condition, according to he effect which it is desired to produce; after these operations the materials are washed. The threads or fabrics thus dyed are then ready to be submitted to the operations of drawing, lustering, calendering, pegging, and other manipulations intended to increase their brilliancy. The treatment of the threads or fabrics with gelatine or albumen may be dispensed with, but without them the coloring matters will not be so well fixed, although they may be brighter. Good results and different effects may be obtained by placing the materials to be treated alternately in baths of logwood and of acetate of copper. The same colors obtained by the distillation of coal may also be employed, not only for materials which have first been dyed black, but for those which have been first dyed with colors more or less dark. For instance, a fine effect may be obtained by the application of aniline violet on French blue; or quite a different effect may be produced by the application of such colors on chestnut or other shades of brown.

THE SIGNIFICANCE OF SALT IN WELL-WATER.—In Prof. Lattimore's report on the analysis of well-water, which was proved to be the cause of a serious epidemic of typhoid fever in Rochester, he lays special stress on the significance of the presence of common salt in well-water in general. No single indication, he holds, is of so great sanitary importance in judging of the purity or impurity, and consequently of the safety or danger, of any water. He proceeds then to show that, though from the universal diffusion of this substance in the air and in the soil, we should expect to find it in all waters, whether from rain, springs or wells, because of its extreme solubility, nevertheless, he argues, the quantity of salt that should be found normally from the causes named in well-water is extremely small, and therefore, whenever "it rises above a very few grains per gallon, it becomes certain that it comes from some other source than the soil;" and he concludes with the logical inference that, as nearly all the salt used for domestic purposes escapes by the way of two channels, the water-closet and the house-drain, we should therefore expect, "what is always found on examination to be true, that, whatever sewage may or may not contain, it always contains salt."

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

PECULIAR ACTION OF GELATINE ON GUM.—Gelatine, it is said, has a peculiar action on gum; if gum be added to gelatine, and the mixture sensitized with ammoniacal potassium bichromate the behaviour of the latter substance is very little altered by the addition of the former. Its solubility in hot water is somewhat increased, and to obtain the same degree of insolubility for the image as with pure gelatine the exposure must be longer. But if the mixture be acidulated with acetic acid, the film after exposure and desiccation is less soluble than one consisting of chromated gelatine only with acetic acid. Gum, therefore, renders an acid solution of gelatine less soluble, and the reason for this is believed to be that glutin and arabic acid form a compound solid only with difficulty. Borax thickens a gelatine solution, and the alkaline reaction of the same substance tends to render the chromated gelatine more insoluble. Calcium nitrate gives to gum an enormous power of adhesiveness.

BLACKBERRY ROOT GOOD FOR SUMMER COMPLAINT.—We have great faith in a decoction of fresh blackberry root for looseness of the bowels. Last summer it completely cured a severe case of chronic diarrhœa, after the other remedies of the best physicians had proved unavailing, and it invariably cured in many other cases where it was afterward recommended. Dig the green roots, rejecting those that are large and woody. Wash thoroughly clean, and steep in water at the rate of a quart to half a pound of the root, boil down one-half and then strain or pour off. Put the liquid in a bottle with about one-eighth of its bulk of brandy, whisky, or alcohol, to keep it from souring, and cork tight. A tablespoonful of this, rather less for a child, is to be taken three or four times a day, say before each meal time. We would not go from home, especially southward, without taking this preparation along. The blackberry brandies or cordials made from the berries are of little account as remedies for the diarrhœa. The virtue lies in the roots, not in the berries.—*Agriculturist.*

A WORD TO INSURANCE OFFICERS.—The *Plumber and Sanitary Engineer* suggests to life insurance companies, that instead of merely hammering at a man's chest to find if he has a tendency to any disease, would it not be well for the medical examiners of life insurance companies to inquire if he has not got a cesspool leaking into his well, or untrapped pipes beneath his basins and closets?

More persons die of zymotic diseases in New York than from almost any other malady, yet a man living in the midst of contagious influences, and hence daily liable to take diphtheria or typhoid fever, would yet find little trouble in getting a heavy policy on his life.

If insurance officers would give this subject their attention they might save many losses to their companies, and also benefit the public generally; for if men found that their homes were rated as "hazardous," they would soon begin to think of finding a remedy for the difficulty.

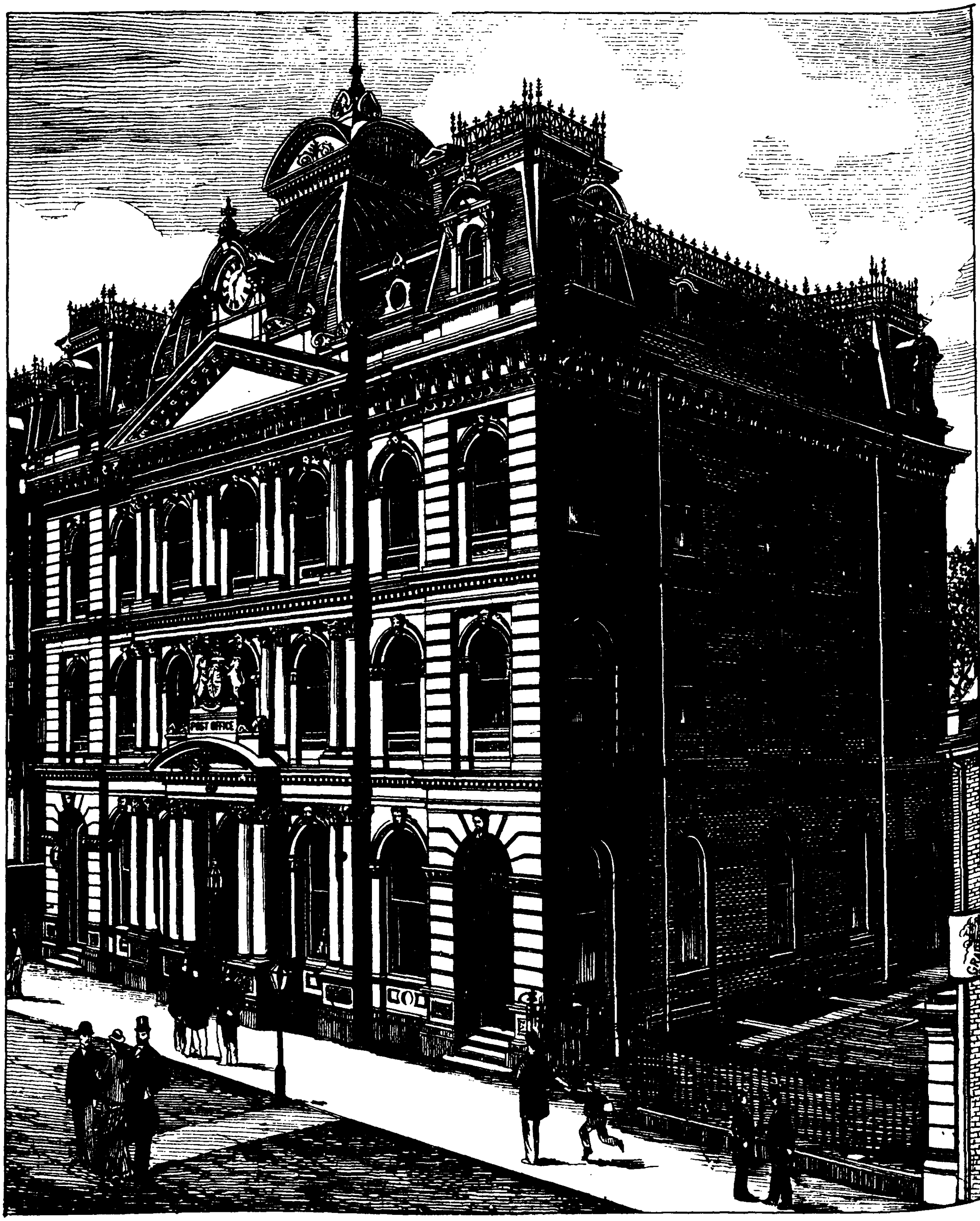
TESTS FOR BUTTER BY LIGHT.—A writer in the *Hannoversche Monatsschrift* is even more sanguine than Mylius, who first proposed the examination of butter by polarized light, of the value of his method of testing the purity of butter. Under such light the peculiar crystals come out very distinctly. He has discovered that different fats, like the minerals, produce characteristic marks whereby they can be determined in the polarization colors, and he intends soon to publish plates showing the peculiar forms and colors of each fat, whether raw or melted, or crystallized from glycerine. Mutton tallow gives a blue tone; ox fat, green and white; hog's lard, red and blue, with other colors not so intense; cacao butter, a play of color from the deepest red to the brightest green. Besides being useful as tests of the genuine nature of butter, these optical reactions are said to be available for the detection of foreign fats that may be fraudulently added to chocolate or cocoa.

TO ATTAIN LONG LIFE.—He who strives after a long and pleasurable term of life must seek to attain continual equanimity, and carefully to avoid everything which too violently taxes his feelings. Nothing more quickly consumes the vigor of life than the violence of the emotions of the mind. We know that anxiety and care can destroy the healthiest body; we know that fright and fear, yes, excess of joy, become deadly. They who are naturally cool and of a quiet turn of mind, upon whom nothing can make too powerful an impression, who are not wont to be excited either by great sorrow or great joy, have the best chance of living long and happy after their manner. Preserve, therefore, under all circumstances, counsels *The Sanitarian*, a composure of mind which no happiness, no misfortune, can too much disturb. Love nothing too violently; hate nothing too passionately; fear nothing too strongly.

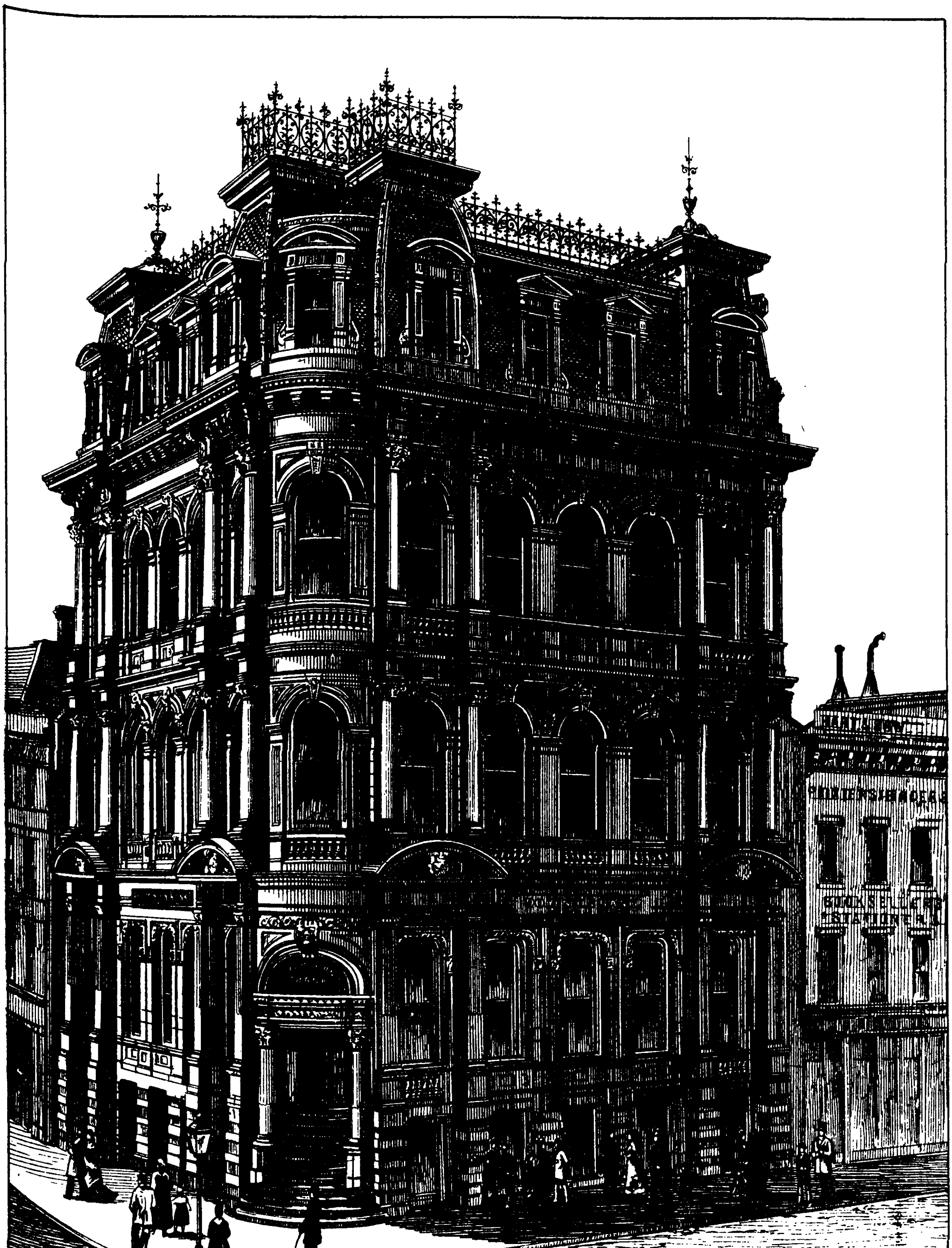
Machine Construction & Drawing.

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

We regret that we have been obliged to postpone the lithographing of the plates referred to in this work until its completion. They will all be supplied in the last two numbers of this year's volume, and properly indexed, so as to be easily referred to when bound. This work is alone worth more than the cost of the Magazine itself. Next year we shall give further instructive matter of a similar kind, but on separate illustrated sheets.—EDITOR S. C.



THE NEW POST OFFICE, TORONTO.



DOMINION BANK, TORONTO.

Household Elegancies.

WINTER BOUQUETS, GRASSES, ETC.

As usual, at this season, we have inquiries as to the preparation of grasses, flowers, etc., to use for winter decorations. It is not practical for us to go over all the details, but for the benefit of our readers, we give the principal points. In Europe, the preservation of flowers is a regular business carried on in large establishments and employing many hands. Great numbers of these flowers are imported by our dealers, both made up in wreaths, bouquets, baskets, etc., and in bunches or clusters all of one kind. Most of the made-up affairs are not of a kind that appeal to our taste, the object being, apparently, to crowd the greatest possible variety of the most positive colors—even to black (!) in each design. The effect, as a general thing, is artificial and tawdry.

AS TO GRASSES.

These are largely imported, and of late years some dealers have offered many of these collected in various parts of the country. These for the most part are dyed of various brilliant colors, and look, to our taste, so thoroughly unnatural, that we are repelled rather than attracted by them. The pleasing effect of grasses is in form, rather than in color, and when we see specimens which are naturally of a soft green or straw color, dyed with the most intense crimson or blue, or of a green, the like of which no grass ever presented, the eye is arrested by the "stunning" color, and takes no note of the beauty of form. Others load their grasses with crystals of alum ; and worse yet, others are given a metallic appearance by the application of bronze powders. We can describe how these things are done, but we can not find beauty in them.

THE TIME FOR COLLECTING GRASSES.

Each month there will be some grasses in season, and though many of the earlier ones have gone by, there will be found, during this month and next, a sufficient variety, especially of the larger kinds. As some of the most pleasing kinds are of no agricultural value, they are not generally known by common names, and to give their botanical names would be of no use except to botanists, who do not need them. We therefore simply say, that by road sides, in meadows, and especially in moist and swampy land, grasses are to be sought for. Not only the more showy kinds, but those which have delicate, fine panicles of flower clusters should be collected. Secure long stems, and cut away the leaves. In most grasses the upper joint that bears the flower cluster will pull out readily from the sheathing leaf; this will often leave the stem too short to make up conveniently, and it is better to take several joints of the stem and cut away the leaves. If one can choose the time for collecting, the grasses should be watched as they develop, and taken when in flower, which may be known by the protrusion of the *anthers* or the feathery *stigmas*. Some grasses if gathered much later than this, will drop portions of their flowers, or shed their seeds in an unpleasant manner. Still, if one is but temporarily at a locality, a desirable grass should be taken in the condition it is found at the time.

DRYING THE GRASSES.

Those in which the panicle is graceful and drooping, should be dried so as to preserve the natural form. If such are tied in bunches and hung up carelessly, they will be disappointing when dry. A handy method is to have a broad and not very deep box of sand, and stick the stems in this. Those kinds in which the flowers are in a close and spike-like cluster, may be tied in convenient bunches and hung up, heads down ; a little practice will teach the proper treatment if it be remembered that the form in which the grass is dried can not be afterwards changed. Any airy place will answer for drying, such as an unoccupied room, or an old-fashioned garret. When the stems are quite dry, the flower cluster will be so ; and if the drying place is not quite free from dust, they should be put away from dust and from flies, which are very fond of collecting upon them.

BESIDES THE TRUE GRASSES

there are various members of the Sedge Family that are worth collecting, especially the Cotton-grasses (*Eriophorum*), which show their white and brownish plumes in the boggy meadows. Indeed, whatever plants by grace or beauty of form commend themselves to the collector, should be gathered, without reference to botanical relationships.

PRESERVING SHOWY FLOWERS.

While grasses are as much flowers as roses and camellias, they are not popularly so regarded, and in the trade, "preserved flowers *and* grasses" are offered. We compromise the matter by calling the others "showy" flowers, of which a large number are prepared abroad. The class of annuals known as "Everlastings," are cultivated by many with a view to the use of their flowers in winter decorations. The majority of these require only to be picked as they just come into bloom, carefully dried and kept from the light and dust until wanted. A large number of the imported flowers are preserved by means of sulphur fumes, the process being precisely that used in bleaching straw hats. A box or barrel is provided, which if not tight, may be made so by pasting paper over the joints ; this should have a small opening near the bottom to admit air, which can be closed when needed ; a few inch and a half holes to be stopped with plugs will answer. An arrangement should be made to support cross-wise sticks at the top ; a tight fitting cover and an old iron pan, or flower-pot with the hole plugged, to hold live coals, complete the outfit. The flowers are tied in small clusters in such a manner that the fumes can reach all parts, and hung upon the cross-sticks, live coals being put in the pot or pan, a few lumps of sulphur are thrown upon them and the cover placed on ; if the cover does not fit closely, put folds of wetted cloth under it and a heavy weight on top. When the box or barrel is well filled with fumes, close the lower air hole and leave all untouched for 24 hours. At the end of this time, remove the flowers and hang them in an airy room to dry. When quite dry they may be laid away in boxes. All flowers do not succeed equally well, and there is room for experience. Among those we found most satisfactory were, China Asters, Fuchsia buds, Larkspurs—the dark colored kinds, Red flowered Spiræas, Golden-rods, Roses—the rod well filled and not over-blown ones answering best. As a general thing, the flowers are better if taken just as they are opening ; some, such as the Fuchsias, even in the bud, to be opened afterwards. Some flowers after sulphuring will be quite bleached ; but the color in most can be restored, as we may show in speaking of making them up.

Health and Home.

LABOR AS A FORM OF ATHLETIC EXERCISE.

Open-air labor is the most effective cosmetic, an almost infallible panacea against all kinds of bodily deformity. But the remedial virtue of labor, *i. e.*, sound bodily exercise, is greater than that of open-air life *per se* ; for among the rustic population of Scandinavia, Scotland, and Northern Germany, who perform a large portion of their hard work in-doors, we frequently find models of health and vigor ; far more frequently than among the inhabitants of Italy, Spain, etc., who pass the greater part of their indolent lives in the open air.

But besides all this, athletic exercises have a moral value, which our social reformers have strangely failed to recognize ; they afford a diversion and a vent to those animal energies which otherwise are sure to explode in debauch and all kinds of vicious excesses. The sympathetic thrill by which the mind accompanies a daring gymnastic feat, and the enthusiasm of athletic contests, form the most salutary, and perhaps the only normal gratification of that love of excitement which is either the legitimate manifestation of a healthy instinct, or else a wholly irremediable disease of our nature. The soul needs emotions as the body needs exercise, and the exciting sports of the palæstra met both wants at once. We try to suppress these instincts, but their motives remain, and if thwarted in their normal manifestations they assert themselves in some abnormal way, chemically instead of mechanically, as Dr. Boerhaave would say, by convulsing the organs of digestion, since the organs of motion are kept in unbearable inactivity. In times of scarcity the paupers of China and Siam silence the clamors of their hungry children by dosing them with opium ; and for analogous reasons millions of our fellow-citizens seek relief in alcohol ; they want to benumb a feeling which they cannot satisfy in a healthier way.

After finishing his day's work the Grecian mechanic went to the gymnasium, the Roman to the amphitheatre, and the modern European and American goes to the next "saloon," to satisfy by different methods the same instinct—a longing for a diversion from the dull sameness of business routine. There is no question which method was the best—the only question is which of the two bad substitutes may be the worse : the brutalizing, *i. e.*, soul-hardening spectacles of bloodshed of the Roman arena, or the soul-destroying poisons of the liquor shops ? -- *Dr. F. L. Oswald, in Popular Science Monthly.*

THE POISON OF THE RATTLESNAKE A FERMENT.—Hitherto the general belief has been that the poisonous matter secreted by certain species of reptiles was nothing more that a poisonous saliva, acting in the manner of ferments. M. Lacerdo has been making, at Rio de Janeiro, some researches into the action of the venom of the rattlesnake, which throws much new light on the subject. His investigation shows that the saliva contains what are called figured ferments, the analogy of which with bacterides is very remarkable. From a young and vigorous *crotalus*, subjected to the action of chloroform, he obtained a drop of the venom on a chemically clean piece of glass, and at once placed it under a microscope. Almost immediately he observed the formation of a filamentous pulp in an arborescent disposition. Gradually the thickened filament, after having pushed out spores, dissolved and disappeared, and the liberated spores swelled and enlarged visibly, each of them sending out a minute tube which lengthened rapidly. After a very short period the latter separated from the first spore, and constituted another nucleus for engendering the deadly contamination. In the examination of the blood of animals killed by the bite of one of these snakes, M. Lacerdo noticed that the red globules of the blood commenced to change by presenting some small, brilliant points on the surface, which spread with great rapidity, and ultimately the globules melted one into the other, forming a sort of amorous paste which could no longer circulate in the veins. Other animals, in which that blood was injected immediately after the death of the first, expired in a few hours, presenting all the smyptoms of having themselves been bitten, and their blood always showed the same alteration. M. Lacerdo concludes his memoir by stating that numerous experiments have shown that the true antidote for serpent poisoning is the injection of alcohol under the skin, or its administration through the mouth.

MEDICINAL EFFECTS OF ONIONS.—A mother writes to an English agricultural journal as follows: "Twice a week—and it was generally when we had cold meat minced—I gave the children a dinner which was hailed with delight and looked forward to. This was a dish of boiled onions. The little ones knew not that they were taking the best medicine for expelling what most children suffer from—worms. Mine were kept free by this remedy alone. It was a medical man who taught me to eat boiled onions as a specific for cold in the chest. He did not know at the time, till I told him, that they were good for anything else." The editor of the journal adds: "A case is now under our own observation in which a rheumatic patient, an extreme sufferer, finds great relief from eating onions freely, either cooked or raw." Dr. G. W. Balfour, in the Edinburgh *Medical Journal* records three cases in which much benefit was afforded patients by the eating of raw onions in large quantities. They acted as a diuretic in each instance.

THE TEETH.—As the result of numerous trials made by the exposure of recently extracted teeth to the action of various substances, M. Maurel comes to the conclusion that if various medicinal substances are injurious in their action on the teeth, others in still larger numbers prove, in their habitual employment, quite inoffensive. Thus, if we are required to take great precautions respecting citric acid, tannin, chlorides of zinc and antimony, perchloride of iron, sulphate of copper and alum, we may continue to employ with complete safety arsenious and carbolic acids, vinegar, corrosive sublimate, chloride of potash, alcohol, tincture of benzoin, essence of mint, tincture of quinine and eau de cologne. Tobacco, whether used in chewing or smoking, does not injure the teeth beyond their discoloration.

VENTILATION BY THE CHIMNEY.—A parlor-fire will consume in 12 hours 40 pounds of coal, the combustion rendering 42,000 gallons of air unfit to support life. Not only is that large amount of deleterious product carried away and rendered innoxious by the chimney, but five times that quantity of air is carried up by the draft, and ventilation thus effectually maintained. The ascent of smoke up a chimney depends on the comparative lightness of the column of air within to that of an equal column without; the longer the chimney, the stronger will be the draft, if the fire be sufficiently great to heat the air; but if the chimney be so long that the air is cooled as it approaches the top, the draft is diminished.—*Faraday.*

MAGNESIUM STEEL.—Magnesium also causes a remarkable change of structure in other metals. A coarse-grained steel becomes fine-grained on the addition of one-fifth per cent. of magnesium. In performing the experiments referred to, the magnesium must be introduced through a hole in the cover of the crucible after the oxygen has been first removed by the addition of a few pieces of charcoal. Without this precaution violent explosions are apt to occur.—*Ber. d. Chem. Gesell.*

JUDICIOUS ADVERTISING.

A man was standing on the corner of Santa Clara and First streets yesterday, denouncing newspaper advertising to a crowd of listeners. "Last week," said he, "I had an umbrella stolen from the vestibule of the ——— Church. It was a gift, and, valuing it very highly, I spent double its worth in advertising, but have not recovered it."

"How did you word your advertisement?" asked a merchant.

"Here it is," said the man, producing a slip cut from a newspaper. The merchant took it and read:

"Lost—From the vestibule of the ——— Church last Sabbath evening, a black silk umbrella. The gentleman who took it will be handsomely rewarded by leaving it at No. —— San Fernando street."

"Now," said the merchant, "I am a liberal advertiser, and have always found that it paid well. A great deal depends upon the manner in which an advertisement is put. Let us try for your umbrella again, and if you do not acknowledge then that advertising pays I will purchase you a new one."

The merchant then took a slip of paper from his pocket and wrote:

"If the man who was seen to take an umbrella from the vestibule of the ——— Church last Sabbath evening does not wish to get into trouble, and have a stain cast upon the Christian character he values so highly, he will return it to No —— San Fernando street. He is well known."

This duly appeared in the paper, and the following morning the man was astonished when he opened the front door of his residence. On the front porch lay at least a dozen umbrellas of all shades and sizes, that had been thrown in from the sidewalk, while the front yard was literally paved with umbrellas. Many of them had notes attached to them, saying they had been taken by mistake, and begging the loser to keep the little affair quiet. —*Detroit Free Press.*

WESTON'S ELECTRIC LIGHT GENERATOR.

Mr. Edward Weston, of Newark, N.J., who has earned a great reputation as the inventor and manufacturer of the dynamo-electric machine, now used in many electro-plating and electrotyping establishments, both here and abroad, has for some time given his attent on to the construction of a similar machine, especially adapted for the production of electric light, and of the lamps used in connection with the same. In the adj ined engravings Fig. 1 represents the machine, Fig. 2 the lamp exteriorly, Fig. 3 another form of lamp, showing details of carbon carriers and of electro-magnet and armature regulating their position, and holding the sliding rod with a clamp, which automatically releases and keeps the light steady. This is one of Mr. Weston's latest improvements to the electric lamp. Fig. 4 represents the iron armature of Fig. 1, without its coils.

The machine (Fig. 1) is constructed with a view of keeping it in continuous operation without heating it to such a degree as to necessitate its stoppage so as to allow it to cool off, a feature in which many machines of this kind have failed. For this purpose the large stationary soft iron electro-magnets are, where they are not covered by the coils, perforated by slits. Fig. 1 shows these slits in the centre of the top and on the sides, and when in motion the hand can feel the currents of air pass out of these slits, being propelled from the rotating centre to the circumference by the centrifugal tendency, on the same principle as the action of rotary fan blower. This continuous current of air, taken in cool at the centre, and blowing out at the circumference, is most effective in keeping the machine cool, which, without this provision, loses much of its effectiveness, as the magnetic power of iron descends when the temperature rises, and the conductivity of the coils for electric currents diminishes from the same cause. Therefore, even if a machine does not become hot enough to necessitate its stoppage, it is of importance to keep its temperature at as low a degree as possible, so as to secure its maximum effectiveness.

The power required to drive these machines is from two to twelve horses, and depends on their size, of which the price varies from $200 to $1,200, the larger ones being capable of furnishing several lights. They are commencing to be largely used for brilliant illumination purposes in New York and vicinity, for instance, on the new iron pier at Coney Island.

These machines excel in simplicity and compactness; they appear to be eminently durable, and are claimed to be the most powerful for their size and cost of any in the world, as it is reported that actual tests showed them to yield more than double the amount of light per horse-power absorbed than that obtained from any other machine built in this country.

The ability of the company to execute satisfactorily any orders for electric light, can be inferred from the fact that they have now in successful operation nearly seven hundred dynamo-electric machines among the largest manufacturers in this country and in Europe.

Figs. 2 and 3 represent lamps with ground glass globes, seen below, and which contain the carbons, the lower one being fixed to the bottom and the upper one suspended from the conducting rod, which is capable of sliding downward, but this down-sliding motion is arrested and regulated by a small clamp, worked by an electro-magnet, situated in the cylinder seen in Fig. 2, and its interior arrangement in Fig. 3 ; Fig. 4 shows the revolving armature, placed inside Fig. 1. The little electro-magnet in Fig. 3 is charged by the current ; when its magnetism becomes too strong by a too close proximity of the two carbon electrodes, its attraction closes the clamp and draws the rod upward, separating the carbons. When the current, by this separation, suffers resistance enough to become weaker and cause the electro-magnet to relieve the armature by diminished attraction, it allows, by relieving the clamp, the rod to slide down and bring the carbons closer together. This simple device works so well that we have watched the light for hours and did not notice any perceptible change in it.

We advise parties desiring the use of electric light, before ordering a machine, to communicate to the manufacturers full particulars in regard to the buildings and localities to be lighted, to give, for instance, the size of the rooms or areas, the amount of power disposable, where it is located, etc. They can be sure that the manufacturers, the Weston Dynamo-Electric Machine Co., of 286 Washington street, Newark, N.J., will without delay give all particulars as to cost of machines, etc.

WESTON'S ELECTRIC LIGHT GENERATOR.

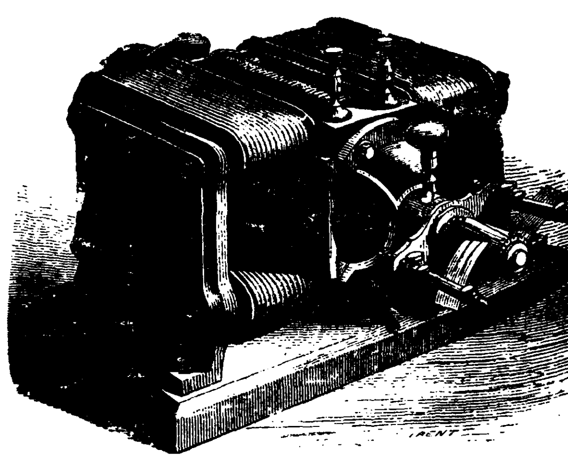


Fig. 1.—The Light Generator.

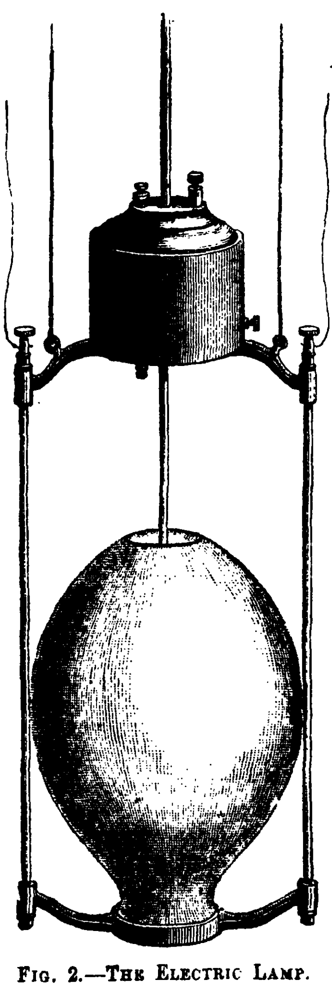


Fig. 2.—The Electric Lamp.

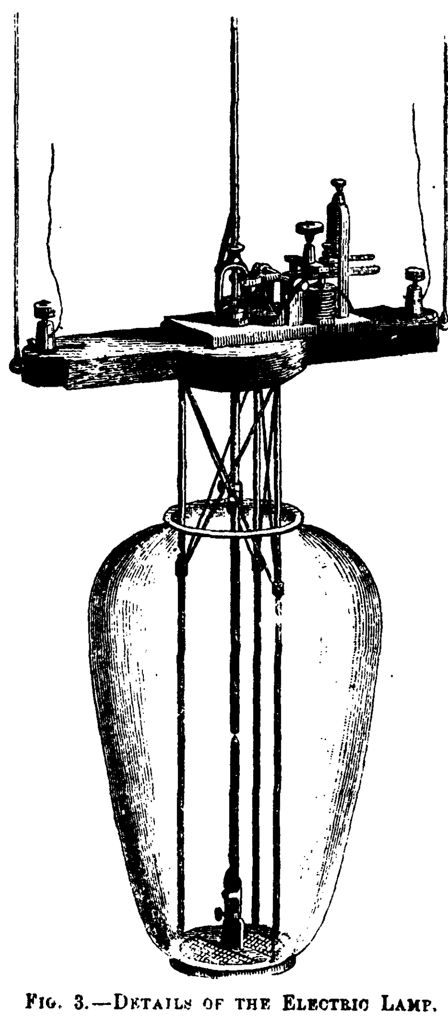


Fig. 3.—Details of the Electric Lamp.

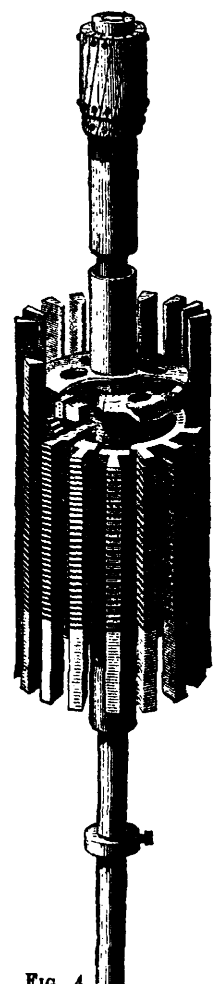


Fig. 4. Armature of Light Generator.