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SCIENTIFIC CANADIAN

MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 7. JANUARY, 1879. No. 1.

TECHNICAL EDUCATION.

THE importance of this subject to the advancement of Arts, Sciences and Mechanical progress in these Provinces cannot be overrated; in fact, we do not, as yet, seem to realize the great necessity of imparting more technical instruction to our youth, and the immense benefits sure to accrue from it in the future. It is a subject which we have several times, already, brought to the notice of our readers in past numbers of this Magazine, and to which we shall continually return, it being one of paramount importance to mechanics and to the advancement of the industries of the Dominion.

Surely when we see so much importance attached to Technical Training in Great Britain, France, and other advanced civilized Powers of Europe, as well as in the United States—countries which owe their present greatness in ratio to the perfection they have arrived in art, science and mechanical inventions—we should strain every nerve to take such steps as will be most conducive to produce similar results.

Not long since an executive committee was appointed by certain of the Livery Companies of London, to prepare a scheme of an Institution. Their report for the Technical Training of Artisans has been published, and is, undoubtedly, an important document. The first step taken by the committee was to apply for advice to a number of gentlemen, selected from their knowledge of pure science, for their acquaintance with scientific education and technical examinations, or on account of their position as employers of skilled labour, and the letters obtained by this means contain a number of ideas and opinions of considerable value, which the committee have summarised and collated, and on which they have based their proposals. At the commencement of their report the committee state that it would be unwise to attempt to teach workmen skill in handicraft in the training institution, because such skill can be best acquired in the workshop, except in the case of the introduction of a new industry or the revival of an old one, when, under special circumstances, an opportunity might be afforded for the training of artisans in the actual work of their craft in the institution. The wisdom of this decision will commend itself to employers of labour, except those who would like to obtain skilled workmen without the trouble of teaching apprentices. The committee, consequently, recommend that the teaching should be confined to imparting a knowledge of the principles of science and art—to familiarising the artisan with the great facts and theories upon which the industry he is to pursue is based. To illustrate by instances: they would not propose to instruct an ironworker in the actual manipulation of his tools and appliances, but they would endeavour to impart such instruction as would enable him to understand why, in spite of his manual skill, his puddle bar is occasionally bad, or his pig-iron of an inferior quality. Chemistry, as applied to iron working, would therefore be the most important subject in the curriculum of technical education for ironworkers. Similarly with regard to textile manufactures. It would be unwise to establish model factories, as has been done on the Continent, with the view of enabling the operator to acquire extra dexterity; but it is essential to improvement that the pick of the workmen should have such an acquaintance with chemistry as to appreciate the effects of different kinds of water, and to estimate the properties of dyes and their effects upon the materials; while their artistic taste should be trained to avoid those combinations and designs which offend against the accepted-canons. This is a fair exposition of the principle upon which an institution for promoting technical education should work, and if the details are well worked out and adhered to in practice, the result will doubtless be of incalculable benefit to the country at large. But it is important to observe that the instruction in chemistry, for instance, must not be of that kind which is required for passing the present examinations of the Science and Art Department. Applied chemistry is what is required—not theoretical, we had almost said hypothetical. Neither the ironworker nor the maker of textile fabrics will need to be versed in atomicities, valencies, and the arguments by which the various formulæ are supported:

those are for subsequent study. What he will require is a knowledge of chemistry as it affects the industry in which he is engaged, or which he is about to follow. Its further and deeper study must be left to his own inclinations, for no institution for technical training can afford to devote more time than is absolutely necessary to its students—the aim being, as we take it, to spread a knowledge of principles amongst the mass of workers rather than to turn out a limited number of specially skilled and highly-instructed artisans. The committee direct particular attention to the advice of Sir W. Armstrong, and others, that too much should not be attempted at once, but that the scheme should be so formulated that a small beginning may develop step by step into a thoroughly successful and widely-extended system. The proposition put forward by the committee is, then, the establishment of a *central institution* with local trade schools. The central institution would furnish competent teachers for the local schools, but no one would be received into the classes who had not shown, by previous examination in some of the existing science and art schools, or otherwise, a sufficient degree of knowledge to enable him to profit by the instruction given at the central institution.

The rules suggested by the committee for carrying out the wishes of the Livery Companies are not such as would be applicable to this country, and probably would require much modification before being adopted in England. In the first place it would be necessary that Technical Education should form part of the curriculum of all our public schools, but which should not be made compulsory, but only applied to such scholars as were intended for mechanical trades or by such as expressed a wish to be instructed in the elementary knowledge of the principles of science and art. In connection with these there might be trade schools in some of the principal cities and towns into which those desiring to be advanced in applied chemistry and practical knowledge would be passed from the common schools, provided they had acquired sufficient elementary knowledge of the principles of art and science in that particular branch of mechanics intended to be pursued, and for this purpose text-books should be supplied specially adapted to the want of each artisan. An ironworker, for instance, requires a knowledge of inorganic chemistry; a maker of textile fabrics is most interested in the organic branch of that subject; a carpenter, in the strength and durability of woods and in constructive art; but none of these need be obliged to study any branch of art or science not necessarily appertaining to the art or trade he has selected, unless it is his own desire to do so. The principal object should be to convey as much practical information as possible, in the shortest period of time, and not waste the student's hours in the study of abstruse sciences—further and deeper study should be left to his own inclinations; but the first consideration should be to ground him thoroughly in what concerns his particular line of art or trade, so as to make him a perfect workman in that branch.

This is a subject well worthy the consideration of Government, and an annual grant for such a purpose would receive the approbation of the country.

We have too long neglected this most important subject —Technical Education; therefore it is to be hoped that no time will be wasted before steps are taken to establish a central institution, and that in the principal centre of industry in the Dominion. Trade schools would afterwards soon be established, prepared to affiliate with any that may follow in smaller cities and towns.

This is the first of a series of articles that will be continued monthly in this Magazine, on subjects connected with the advancement of Art, Science and the Industries of the Dominion.—[Ed. S. C]

THE VALUE OF THE MINOR WOODS OF OUR CANADIAN FORESTS—THEIR UNCONSIDERED USES.

We have hitherto considered those woods of particular marketable value which we export in bulk to England and the United States. But is it not time that we should be giving more attention to opening up a business in other kinds of smaller lumber which abound in our forests, besides sending abroad timber only fit for building and engineering purposes?

There is, in Great Britain particularly, a great consumption of various kinds of wood, besides pine and oak (our staple exports), of which we as yet supply but a minor portion of that used, but if we were at once to commence a trade in this line, it would not take long before the demand for it would become as constant as it is now for pine and oak.

Of the various kinds of wood which can be worked up for a great variety of household, ornamental, and agricultural purposes, we possess in our forests a great abundance. We have black and yellow birch and cherry, for furniture; basswood and elm for carriage work; cedar, for fences and boxes; ironwood, for machinery; ash, for agricultural implements, and which is also now much used for furniture; beech, for planes; tamarac, for purposes where strength and durability are required; and a great variety of other kinds which could all be partially worked up into shapes and sizes, for agricultural and mechanical purposes, and thus afford much employment in many country places to our mechanics, particularly during winter.

We have not the slightest doubt that, were a company formed for manufacturing our minor forest trees into the numerous purposes to which they could be applied in the old country, quite a demand for such lumber would be the result.

An active and intelligent agent in England would soon obtain orders for a variety of woods that could be shaped or cut into sizes in this country, and thus save freight to the purchaser and give employment to our people.

We believe that from a trade of this kind a source of much profit and benefit would accrue to the country, and that it seriously deserves the attention of capitalists.

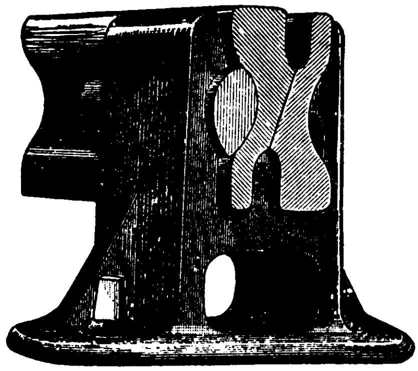
The Chinese Government Denouncing Opium.—An important and very stringent edict regarding the cultivation of the poppy appears in the Pekin *Gazette* of March 9th last. It is worthy of note that the largest number of victims and the earliest victims to the famine have been the opium smokers. The edict now issued speaks of the people as foolish, coveting wealth, and forgetful of the injury that is being done by the cultivation of the poppy instead of cereals, and it enacts that for the future the cultivation of the noxious drug must cease; disobedience thereto to be visited with severe punishment. This edict applies to the whole of China. The district magistrate of Tientsin has personally visited the opium-smoking resorts, and closed them all. Soldiers and officials are strictly prohibited from smoking, under heavy penalties.

Engineering.

TRAMWAY RAIL EXPERIMENTS.

Tramways are now becoming a subject of great interest to the engineering world and the general public. Improvements in detail are still being continually made ; but much remains to be accomplished, and in no direction can more effectual improvement be introduced than in the road and rails. Upon the durability and freedom from repairs of the road depends very much the financial success of the tramway. We may all easily understand the time and money constantly being expended in our streets in taking up large stretches of the roadway to relay tram rails. To minimize this outlay two objects should be kept in view in the construction of the road. In the first place the rails and road should be solidly constructed, and supported so as to offer the best resistance to wear and tear ; and, secondly, the rails and attachments should be made so as to offer the greatest facility for removal of the rail without disturbing the roadway. Messrs. Aldred and Spielmann have introduced a split rail and chair. The running over this compound rail is most smooth, and puts an end effectually to many complaints which travellers in tramcars, railway trains, omnibusses, and even cabs, are often ventilating. We may, with advantage, give a synoptical outline of the system here.

Fig. 1.



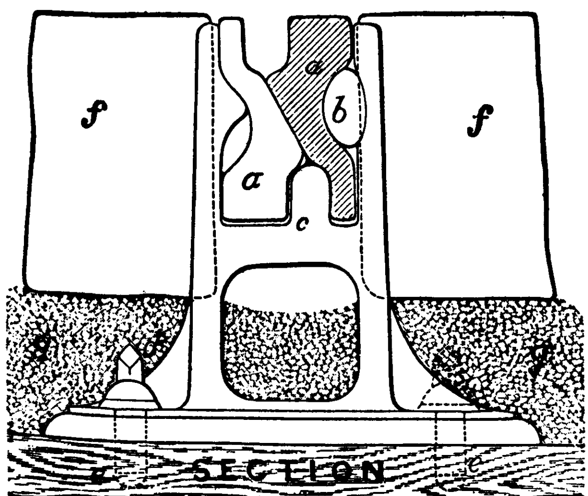


Fig. [2.

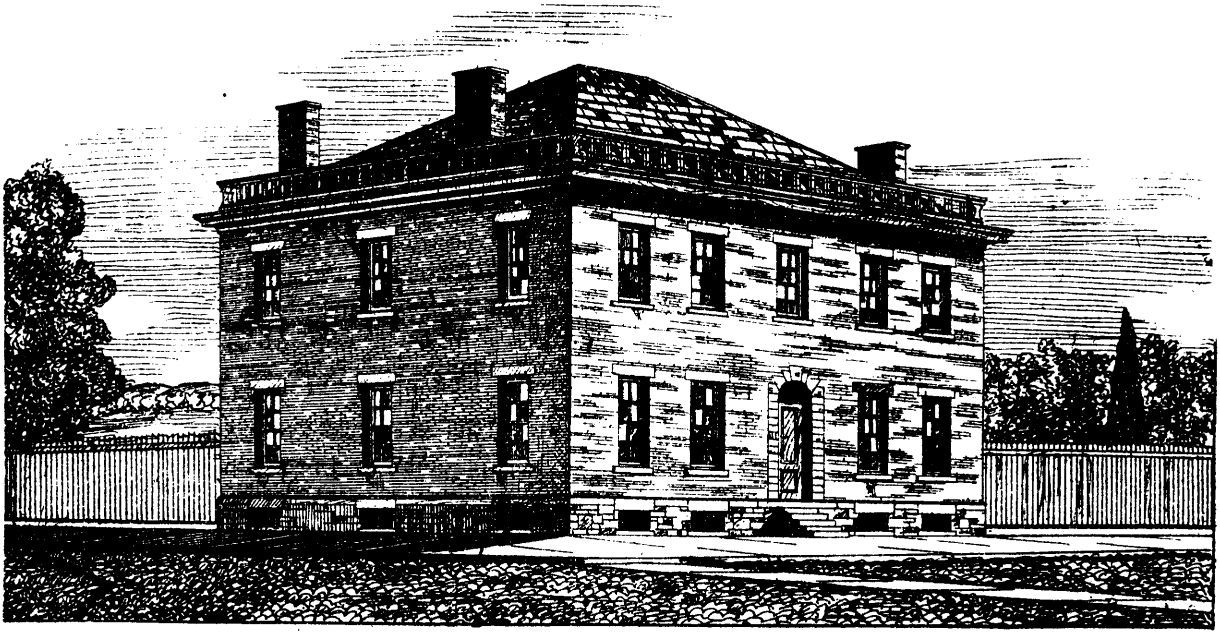
The rail is a compound split one, formed from two similar duplicate halves reversed to one another. So that the broad head of one is uppermost, while the narrow head of the other half forms a guard to the broad tread. The two halves of the rail meet one another on an inclined surface, so that the downward pressure on the one half is received and resisted by the other half. When one half is worn out, the rails can be reversed, and the worn half turned down and used for a guard. The split diameter of the rail enables the joint to be made only in one half at a time, so that in no place is the rail wholly broken and dependent only on fish plates for its continuity. The rail has the joint broken only in one half in one place, and always in a chair, the rails overlapping, and thus always forming a continuous and well supported line. The joint in the chair is secured by a wedge or key in the hollow chest of the rail, thus making everything secure at the joint, and entirely dispensing with fish plates and through bolts and punching of rails. This makes the road and metals very cheap, so that a much heavier and stronger road can be made for the same money than the light and flimsy patterns in use. The inventors have sample lengths of line giving great satisfaction in other parts of London and Great Britain, and are now carrying out some large orders. This rail seems to supply a want in tramway roads, and is now being adopted so freely as to induce the belief that the owners of tramways recognize in it a remunerative successor to the old rail.—*Scientific American.*

THE BELGIAN SHIP CANAL.

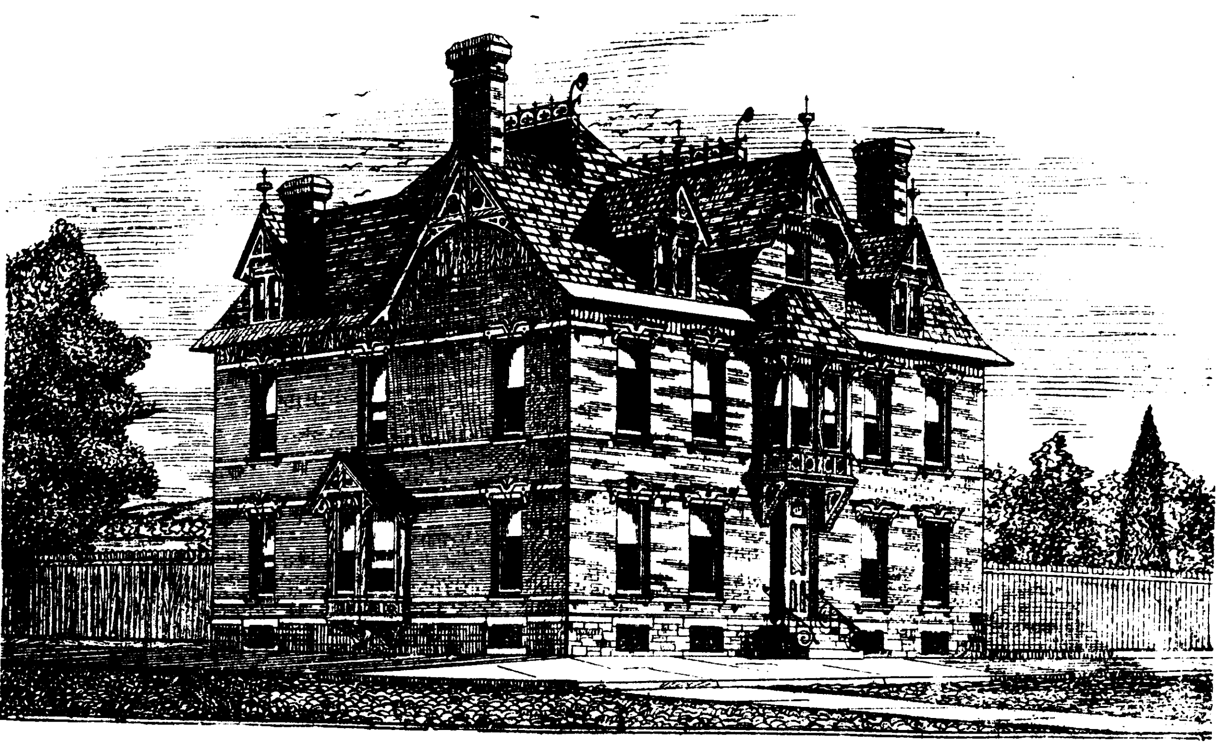
The ship canal from Ghent to Terneuzen was originally laid out with many bends, rendering navigation difficult ; it had a depth of 14 feet 4 inches and a width of 98 feet 6 inches at the water level. The works which are at present in course of execution have especially for their object the deepening of the canal to 21 feet 3 inches, with a width of 55 feet 9 inches at the bottom and 103 feet 9 inches on the water line. The slopes have a uniform inclination of one to 3, and the towing paths on each side are placed at 6 feet 6 inches above the water level, and are 32 feet 8 inches wide. In many instances also the course of the canal has been altered and straightened for the improvement of navigation ; several important diversions have been made for this purpose. The excavation has been effected by hand, by dredging, and by the Couvreux excavator, figured on page 8.

The earth excavated was carried to spoil, and in many cases was employed to form dykes inclosing large areas, which served as receptacles for the semi-liquid material excavated by the dredging machines with the long conductors ; the Couvreux excavator used will be readily understood from the engraving. It had already done service on the Danube regulation works. The material with which it had to deal, however, was of a more difficult nature, being a fine sand charged with water and very adherent. The length of track laid for the excavator was about 3 miles along the side of the old canal, which had been previously lowered to the level of the water.

THE ENGLISH STEEL SHIP.—It seems that the steel ship built by the British Government is a success, and the London *Times* says that "whatever doubts may have been entertained with respect to the speed performances of the *Iris*, steel despatch vessel, were conclusively set at rest by the long and varied trial to which she was subjected on the measured mile in Stokes bay. She was proved to be not only the quickest ship in the navy, but the quickest ship afloat, having surpassed the highest speed realized by the *Lightning*, torpedo vessel, and even outstripped the most sanguine expectations of Mr. Barnaby, her designer." We read that the *Iris* was in every respect an essentially experimental craft. There was nothing resembling her in the service with reference to the proportion of midship section to length, the extreme fineness of her entrance and run, and the ratio of her enormous horse power to displacement ; and as a result there were only very imperfect data to guide the Constructive Department as to her probable performances from the actual performances of previously existing ships. The ship was trimmed by ballast and coal to 15 feet 8 inches forward and 20 feet 6 inches aft, which was near about her load line ; and the new experimental four-bladed screws were 16 feet 3 inches in diameter, and had a pitch of twenty feet. The blades were smoothed to prevent friction, and conical caps had been tapped into the bosses over the nuts which secure the screws to the shafts for the purpose of preventing the wave which has been found to follow a bluff ending, whereby the resistance against which the ship has to contend in passing through the water is augmented. The result of the trial was in every respect more than satisfactory. Four full-power runs were made on the mile with the following surprising results : Steam at engines, 62 lbs. ; vacuum, 27 inches ; revolutions, 96 starboard and 98 port ; horse-power, 7,734.85 ; speed of vessel, 18.572 knots. The engines thus developed fully 700 horses more than the contract, while the ship realized two knots in excess of the speed obtained from the larger screws, and fully a knot more than the Constructive Department anticipated to get out of her.



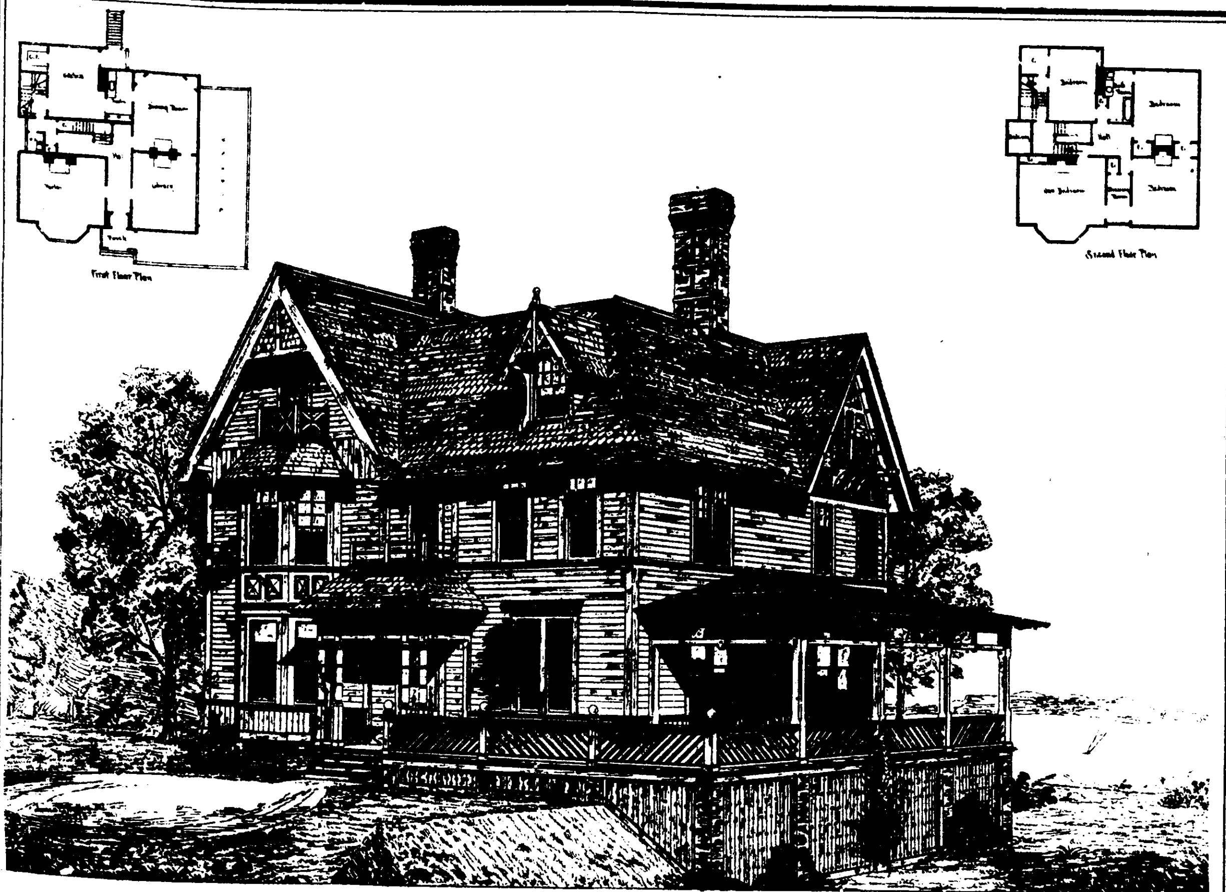
VIEW BEFORE ALTERATION.



VIEW AFTER ALTERATION.

OLD HOMES MADE NEW.

This design, which is taken from a work entitled "Old Homes Made New," published by J. BICKNELL & Co., New York, is here illustrated to show how the old style of suburban and country houses can be modernized. The roof it will be seen is the principal figure in the alteration, and upon the taste and adaptation of it to the style or form of the old building, will depend the architectural effect produced after the alteration has been made.



DESIGNS FOR SUBURBAN VILLAS.—(From the *American Architect and Building News.*)

Fine Arts.

HOW TO PAINT IN OILS ON UNGLAZED POTTERY.

Owing to the great variety of surface in this unglazed pottery we are considering, the different degrees of hardness in baking,

EGYPTIAN.

and also different kinds of clay used in its construction, it is difficult to make rules without many exceptions.

The same difficulty makes it hardly worth while to make paints already mixed for use, as their consistency would have to be constantly varied, to suit different qualities of surface.

But, nevertheless, some idea can be given of the mixing and manipulation of the paints, through giving some of the most decided points; therefore we have drawn up the following suggestions, shall we call them, rather than rules.

As to material, it always pays to get the best. Winsor & Newton's (tube colors) are the best. The oil and spirit used are the two points about which it is most important to be particular. Get the best boiled linseed-oil, and *fresh* spirit of turpentine; always keep them, when not used, in the *dark*, and well corked, or they will in a few days become oxidized by the light, and so becoming gummy, will be unfit for use.

We will give here a list of most of the colors that will be needed for various styles of ornamentation, such as will be mentioned here:

Ivory Black,	Burnt Umber,	Venetian Red,
Indian Red,	Burnt Sienna,	Flake White,
Chinese Vermilion,	Antwerp Blue,	Chrome Yellow.

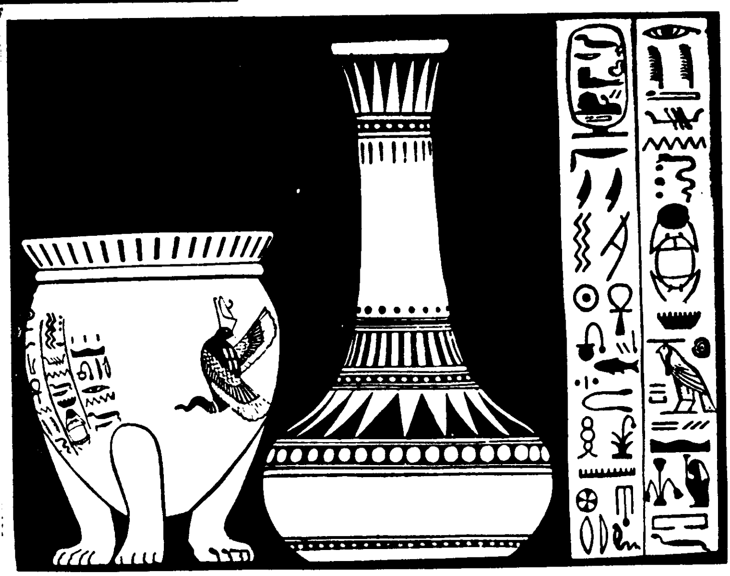
These are as few colors as one can well get along with, and for gilding, "Bessemer's" gilt comes in little bottles; it is a bronze powder, and is accompanied by a bottle of liquid with which it is mixed at the time of application. It dries very rapidly on the palette and in the brush, thus causing some inconvenience, and is, on the whole, the most difficult color to use.

But it is very effective if *well* used. It shows defects of application more than any other color, but presents no great difficulties after one has got well acquainted with the working of the other colors.

Camel's-hair brushes are preferable, as they leave no mark of the hair. Half a dozen or more assorted will be needed—say two or three of the smallest for faces and fine work, some medium and one or two larger for grounds, and a couple of fine stripers three inches long; also two or three handles to put them in, and a square mahogany palette.

The "striper" is considered to be so hard to use, that an amateur can hardly be expected to use it with any considerable degree of skill, but it is not so; it is the hardest brush to use, but the "knack" comes quicker than one expects, *after* getting familiar with the use of the *other* brushes.

Provide plenty of cotton rags for washing



EGYPTIAN.

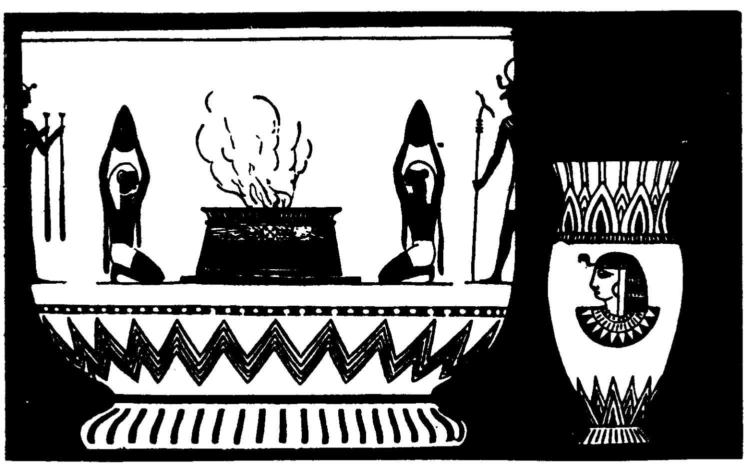
brushes, which, by the way, must be washed well with turpentine after each time of painting; they must not be left *once*. It is best also to clean up the palette each time. In mixing the paints, we use oil and spirit where they admit the use of both. Some paints will not admit the use of *any* oil, or they will glaze, while others will not admit the use of any spirit, or they will "smut" or rub off. They should be thinned to about the consistency of thin cream, in such a way that they will sink in and dry with a "dead" finish, neither "glazing" on the one hand or "smutting" on the other. Therefore, judgment must be used with the following statements:—

Flake white must always be used with *oil* alone.

Chinese vermilion with *oil* alone.

Venetian red with *oil* alone.

Ivory black, Indian red, the umbers, sienna, and yellow require about equal parts of oil and spirit.



EGYPTIAN.

While the Antwerp blue alone, and with yellow making *green*, will hardly bear any oil.

The *red* ware, such as is made at North Cambridge, Chelsea, and Beverly, Massachusetts, absorbs the paint most, and therefore requires more oil in the paints used upon it; while the cream-colored ware made at Portland, (Me.,) being less porous, requires less oil. This last has a very delicate color, but not so fine a surface as the red ware. It is also glazed on the inside, while the red ware as a general thing is not, and where it is, it is not to be trusted, as it is liable to "crackle," thus allowing the water to ooze through and spoil the decoration. Where they are to be used for holding flowers, the glazing is quite an advantage; but even in the unglazed ware, pieces that have a wide mouth can have a glass of flowers, with water, set in them, and thus amount to the same thing.

Most of the pottery comes from the potter's quite smooth and ready for painting; but some is rough and needs to be sand-papered with a medium fine sand-paper; in fact, the smoothest is improved by being finished with a fine sand-paper.

Another precaution must be taken, to make the even, "dead" finish, before spoken of.

EGYPTIAN.

When any design is used that requires one color to be laid over another, the color laid over must be put on immediately after the ground color, before the former has had time to set.

In fact, the whole design should be painted consecutively within a few hours, so that the whole may sink in together: and remember that every touch of the brush after it has set will leave a semi-glazed spot.

Some paints set quicker than others, and also there are "drying" days, when *all* paints set quicker than on other days.

In making a ground color, out of *two* or *more* colors, enough should be mixed for the surface required; for it is almost impossible to match it again, and the difficulty is just in proportion to the number of primary colors used. In laying on grounds, a *large* brush should be used, and the color laid on in broad strokes, so that the surface may look *even;* otherwise, it will look mottled all over, and fussy.

In selecting shapes and designs, care should be taken that they correspond. Egyptian figures should not be put on a Greek urn, or a Grecian pattern on an Egyptian amphora, and what is still worse, styles should not be mixed on the same vase.

(To be continued.)

SIZE.—The best size for distemper colors is made from the clippings of the skin of animals, which must be subjected to strong boiling. Take quantity necessary, put it into an iron kettle and fill it with water; let it stand twenty-four hours till the pieces are thoroughly soaked. Let the size boil five hours, occasionally taking off the scum. When it is sufficiently boiled take it from the fire, and strain it through a coarse cloth. If the size is to be kept for a length of time, dissolve two or three pounds of alum in boiling water, and add to every pailful. The size must then be boiled again till it becomes very strong; it must be strained a second time, put into a cool place, and it will keep sweet several months.

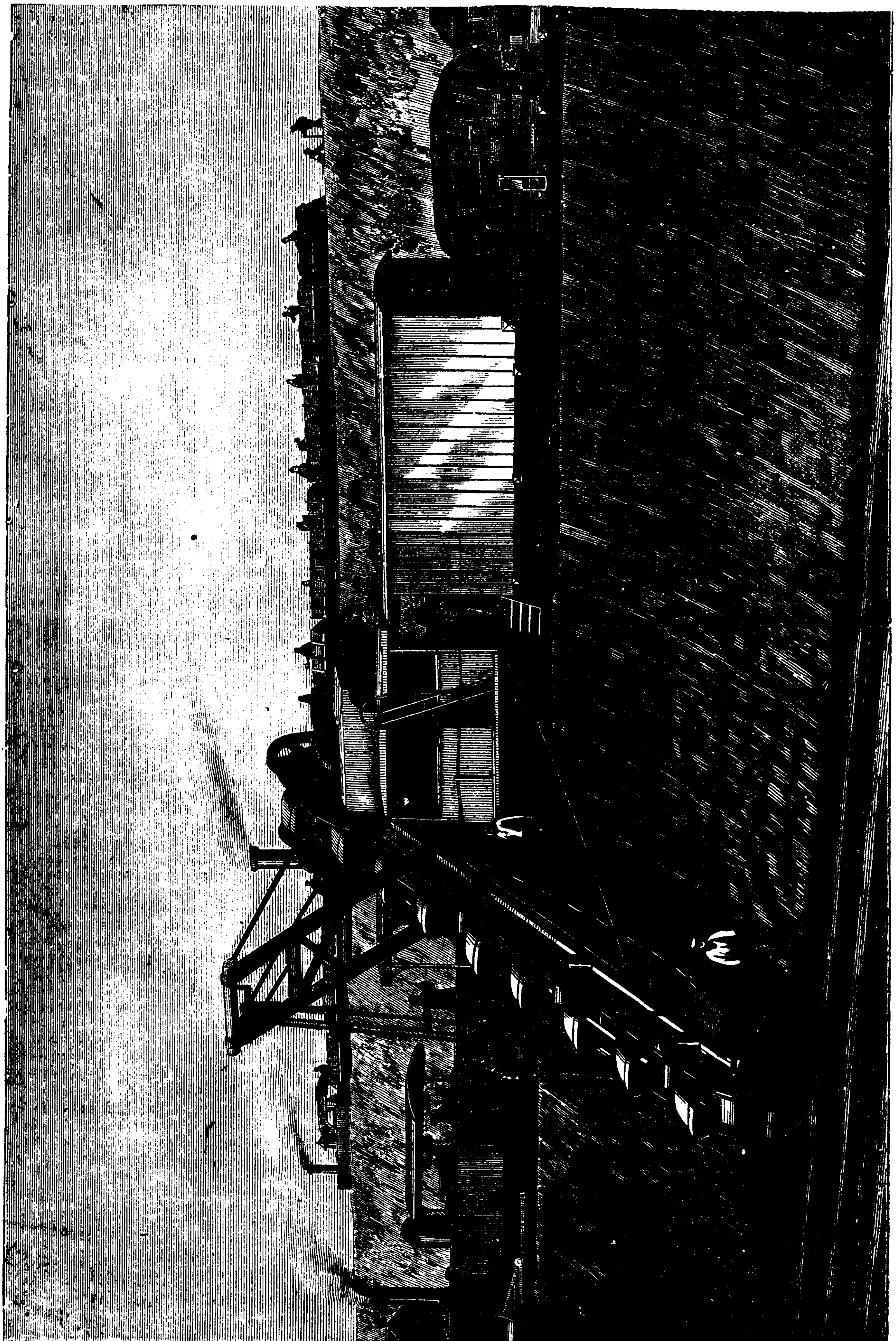
MOSAICS.

The modern process of making mosaics now commonly followed at Rome is thus described by a foreign contemporary: A plate, generally of metal, of the required size, is first surrounded by a margin rising about ⅝ inch from the surface. A mastic cement, composed of powdered stone, lime and linseed oil, is then spread over as a coating, perhaps ¼ inch in thickness. When set this is again covered with plaster of Paris rising to a level with the margin; upon which is traced a very careful outline of the picture to be copied, and just so much as will admit of the insertion of the small pieces of smalto or glass is removed from time to time with a fine chisel. The workman then selects from the trays in which are kept thousands of varieties of color, a piece of the tint which he wants, and carefully brings it to the necessary shape. The piece is then moistened with a little cement and bedded in its proper situation; the process being repeated until the picture is finished; when the whole, being ground down to an even face and polished, becomes an imperishable work of art. The process is the same for making the small mosaics so much employed at the present day for boxes, covers, or articles of jewelry; and this work is sometimes upon almost a microscopic scale.

The Florentine mosaic, which is chiefly used for the decoration of altars and tombs, or for cabinets, tops of tables, coffers, and the like, is composed of precious materials in small sizes or veneers: and by taking advantage of the natural tints and shades which characterize the marble, the agate, or the jasper, very admirable effects may be produced in imitation of fruit, flowers, or ornaments. The use of this kind of mosaic is extremely restricted, on account of the great value of the materials.

PAPIER-MACHE IN THE ARTS.—The use of papier-mache in the practical and ornamental arts has multiplied greatly within a few years past. In its improved character and manipulation, it is applied by the cabinet-maker and upholsterer, with really surprising effect, to the enriched cornices of book-cases and cabinets—to their moldings and corners, and to the center ornaments of panelling on their doors and sides; to the elaborate scroll legs of pier tables and similar pieces of furniture in the French style of manufacture; to ornamental brackets for clocks, busts, vases, etc.; to the decorative borders of rooms hung with paper or other material; ornamental parts of picture and mirror frames, however curved and detailed in their pattern; and in almost indefinite variety, to cornices for windows, ceilings, etc. With regard to the mode of fixing papier-mache, in cabinet work the simplest plan is said to be the most effectual, namely, to treat as if it were wood—that is, fastening it by means of brads, needle-points, or glue. It is cut with a saw or chisel, and may be bent by steam or heat, planed and cleaned up with sand-paper to the smoothest face and to the finest arris if required. The larger objects, such as brackets, canopies, etc., can be made either with a wood core or wholly of the papier-mache; in either case, two or three screws keep them in place, and when fixed the work can be painted and grained without any previous preparation. In gilding, the surface of this material is found to be better adapted to receive the gold than is that of any other substance, and the same is also true in silvering.

BRONZING PLASTER ORNAMENTS.—Obtain from some color store a bottle of Japan gold size, a rather broad camel's-hair brush, and the desired quantity and shade of bronze powder. Then, with an ordinary pig-bristle brush, give the article a coat of the Japan size to fill up the pores. When quite dry give another coat. Let it stand until it becomes "slightly sticky," (not too wet or else it will drown the bronze). Then dip your camel's-hair brush into the bronze, and carefully brush it over the article until completely covered, taking care to hold the work over a sheet of paper to save all the surplus bronze. The bronze is about 2s. 6d. to 3s. an ounce, but a ¼oz. goes a very great way. Some friends of mine, after the above operation, cover over with mastic varnish, but I myself prefer to see them without. Of course, if they are likely to be handled, the varnish will preserve them.



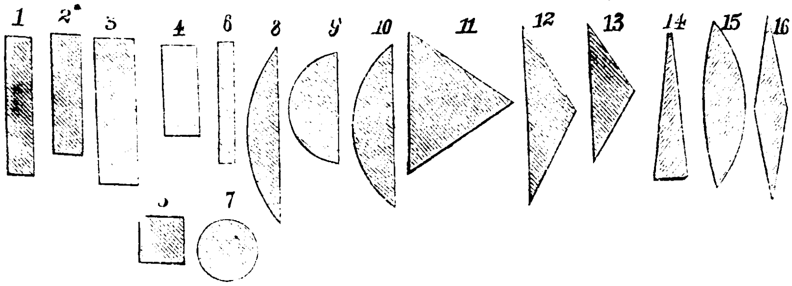
EXCAVATOR OF THE GHENT AND TERNEUZEN SHIP CANAL, DENMARK.

Mechanics.

ABOUT FILES.

BY JOSHUA ROSE, M.E.

The Nicholson File Company has recently issued a treatise on files, which is highly commendable for the thoroughness with which the subject is treated and the value of the matter it contains. From this valuable work we condense the following



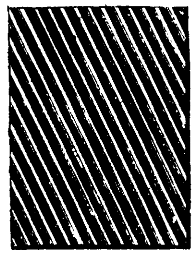


FIG. 17.

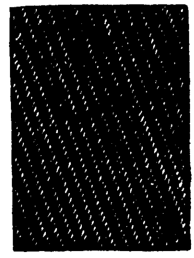


FIG. 18.

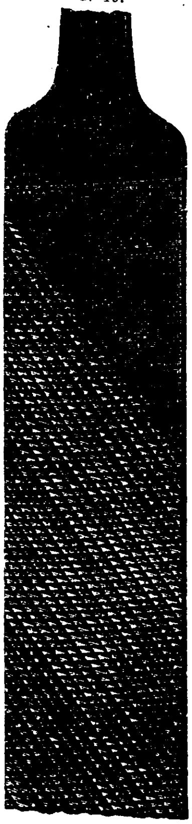


FIG. 19.

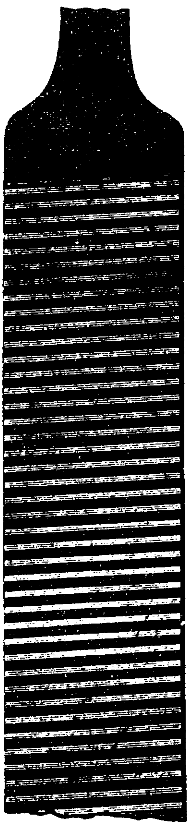


FIG. 20.

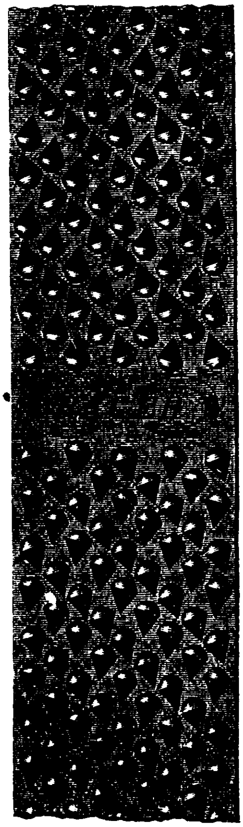


FIG. 21.

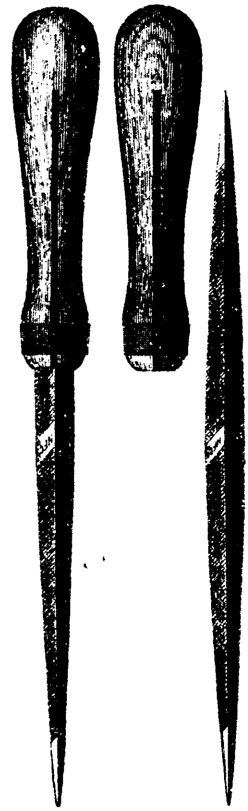


FIG. 22.

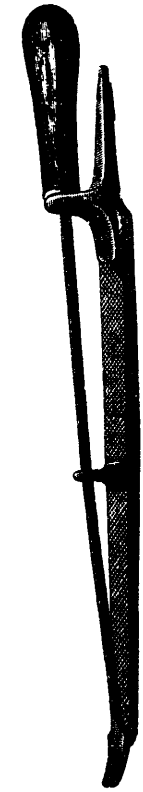


FIG. 25.

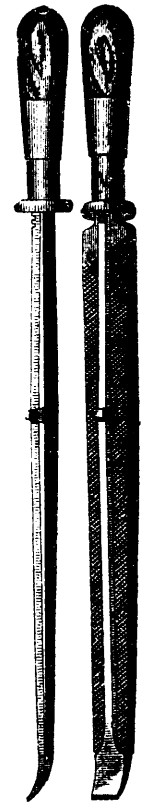


FIG. 26.

FIG. 23.

FIG. 24.

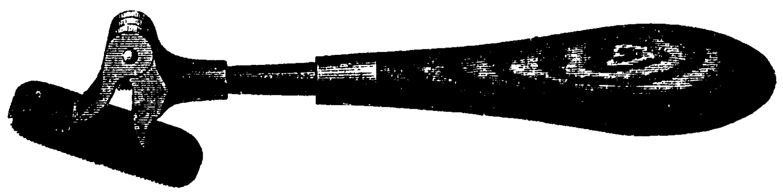


FIG. 27.

facts. Files have three distinguishing features: Their lengths (measured exclusively of the tang); their name, which is governed by the shape and the use the file is intended for; and the cut of the teeth, which is varied to suit the nature of the work and the required coarseness of the file.

Mill files, flat files, hand files, and pillar files are of similar form, their cross-sections being as shown from Figs. 1 to 4.

Fig. 1 is a mill-saw file; Fig. 2 is a flat, Fig. 3 a hand, and Fig. 4 a pillar file; the difference being in the proportion of the thickness to the width. Fig. 5 is a square; Fig. 6, a warding, and Fig. 7 a round file in section. Figs. 8, 9, and 10 are sections of half-round files, termed respectively cabinet, pit-saw, and half-round files. Figs. 11, 12 and 13 are termed respectively three-square, cant, and lightning. Fig. 14 is a knife, 15 a cross, and 16 a feather-edge file.

There are three distinct forms of cut for the file-teeth, known respectively as single-cut, double-cut and rasp. Each form of cut has degrees of coarseness, governed by the distance apart of the teeth; the widest being known as bastard, and progressing to bastard second-cut and smooth, the latter being the finest.

Single-cut files are those having but one row of chisel-cuts to form the teeth; the cuts being parallel to each other and running diagonally across the file, as shown in Fig. 17. Double-cut files have their teeth formed by two rows of chisel-cuts, as shown in Fig. 18. Both illustrations show coarse files.

Rasps differ from the above in that each tooth stands alone. The diagonal slant of the rows of teeth across the file is varied in degree to suit the work. Thus, while Fig. 18 is suitable for wrought-iron, Fig. 19 is designed for brass or similar soft metal; and while Fig. 17 is suitable for iron or steel, Fig. 20 is for lead. This is necessary to prevent the file from sliding laterally during the forward stroke.

Even in rasps it is found an improvement to let the faces of the teeth stand somewhat diagonally, as shown in Fig. 21, which not only gives the teeth a shearing and hence a cleaner cut, but also enables the steadier using of the rasp.

Some novelties in the holding devices for files claim especial attention. Thus Fig. 22 is a file-handle that will hold the file at either end ; hence the file may be cut at what is commonly the tang of the file, thus utilizing both ends of the file. To enable the using of a file over broad surfaces, the tang of the file is sometimes bent, as in Fig. 23, or the handle may be made to accomplish the same end, as in Fig. 24.

Other forms of file-holders are shown in Figs. 25 and 26. These latter, however, spring the file, giving its cutting surface a convexity which is at all times desirable, and in many cases highly advantageous.

For holding stub-files, for use in out-of-the-way places, the holder shown in Fig. 27 is employed.

Messrs. Nicholson give in the later pages of their book some hints on filing, which will prove of interest to all those who are interested in the expert use of the file ; and they also explain the advantages arising from their specialties ; more particularly their well-known increment cut file, which has attained a very prominent position in our workshops.—*Polytechnic Review.*

PROGRESS IN TOOLS FOR ACCURATE MEASUREMENT.

Eastern mechanical writers assure their readers that there has been, of late, as much, or more, improvement in tools or instruments for measuring as any one branch of mechanics' tools. Only a few years ago the vernier callipers were comparatively unknown, and working to the one-1000th part of an inch a myth ; now, in almost every machine shop, the vernier is a common tool, and everything of any importance is measured by it. Standard gauges in the form of cylinders for both outside and inside measurement have been in use in some of the larger and better equipped shops, but have not come into general use on account of their cost. They are made now at more reasonable rates, and should take their place in every shop, seeing that they will be found to more than pay for their cost in the time saved in working up the accurate sizes. The gauge should never be allowed to go into the shop to be used in common, but be kept for reference, and for setting slide gauges. Used in this way they will last a lifetime and retain their accuracy.

Screw thread gauges are now made adjustable, and can be used for fitting threaded work, as they can be closed together even when worn ; and in connection with the screw thread gauge is the V or angular gauge of 60 degrees for grinding threading tools and also for turning lathe centers. The practice of grinding threading tools and turning off lathe centers without this gauge—and by the eye only—should never be allowed. "Snap," or calliper gauges are now made very cheaply and accurately, one variety having both outside and inside measurements. Such tools will pay for their first cost in a year.

The idea of making everything to a standard measure should be encouraged in every way possible. The advantage of interchangeable work can hardly be counted in dollars and cents ; for instance, imagine every maker of gas pipe to have his own standard of sizes and thread ; why the confusion at the Tower of Babel was nothing compared to what it would be if this "no standard" system were to prevail. It would be but little worse than the loose way in which the general run of shops make some of their work — the system of making bolts and nuts, for instance.

CARE IN DRILLING AND BORING.

"When I first came to this country, I was given some engine cylinders to fit up, and in getting my tools in order I found I had no round files, so I asked for some, and was in turn asked what I wanted them for. I replied, 'To correct holes that might not come fair. The rejoinder was, 'If you properly use the tools and jigs given to you, I will give you five dollars for every hole that does not come fair,' and by thunder I found it just so." These remarks were made to us not long since by a working machinist, and they suggest the importance of having holes drilled with the greatest of care. In the first place, holes, whether to receive bolts to permanently fasten or to act as pivots, are the fixed points to which every thing else must accommodate itself, so that if a hole is drilled out of its proper position, it must be corrected, or the other parts will not come in their proper positions. A round file is one of the most awkward tools the machinist uses, and furthermore a hole filed out on one side is not true and is, in fact, a botch job. When a large number of pieces are to be drilled, it will pay to make a jig guide, which, if correctly made, will insure that the holes will be correctly located in all the pieces, which will hence be interchangeable. If holes are to be drilled to fit the bolts or pins, and are drilled from circles struck with compasses, there should be two circles marked for each hole. The largest should be of the size of the bolt, and the smallest about one half that size. The latter will serve as a guide to alter the hole if it does not start true, while the former will serve as a second guide as to truth.

Drills are more apt to run on one side when the point is too thick or when the centre-punch mark, defining the centre of the hole, is not made deep and large enough ; therefore, after the holes are marked, it is a good plan to re-mark the centre holes with a large centre-punch.

Another and good plan is to drill a small hole first and then test its correctness of position, altering it if necessary, and then using a full-sized drill.

A well-made flat drill will (in sizes from $\frac{3}{8}$ up to an inch) drill faster than a twist drill, providing the holes are not much deeper than their diameters, and also provided that there is ample clearances for the cuttings to find egress.

FIXING THE QUALITY OF BOILER PLATE.

It seems that sharp competition has so cut into prices for steam boilers that boiler makers have prevailed upon plate makers to roll out very inferior stock for them to secure it at a low price. The plate makers now propose to agree among themselves not to produce this dangerous material, and the *Iron Age* heartily approves the proposition. It is impossible, says our exchange, to say what action will be taken by the meeting, but all manufacturers of good brands are interested in keeping up a high standard. This is fully understood and appreciated by the Inspector General, who evidently desires to work to the same end so far as the provisions of the law under which he acts will allow. The present law, however, is considered very defective in fixing the ultimate strength of boiler plate as the standard of quality. It is well known that a hard, brittle iron will sometimes show a tensile strength as high as that of a more ductile plate, and sometimes much higher. Among the greatest strains to which boilers are subjected are those which result from the expansion and contraction of the iron, and a soft, tough plate will best stand this class of strains under ordinary conditions. If buyers of boiler plates wanted only those of good quality, and were willing to pay what they are fairly worth, it would be a matter of small consequence what the law provided. Unfortunately, in times like these of sharp competition, cheapness becomes a matter of prime importance, even with steam users. A meeting of the trade cannot fail to be productive of good results in calling public attention to the fact that the law gives no guarantee of security for steam users against the consequences of using inferior material or accepting cheap and second-rate workmanship in boilers.

Wire Rope as a Substitute for Chain Cable.—Two of our largest manufacturers of wire rope offer to rig a ship free of expense, including Manton's patent windlass, for the purpose of demonstrating the superiority of wire rope as compared with chain cable. The offer is made by Roebling's Sons and by J. Lloyd Haigh. The latter, a few days ago, completed his contract for the delivery of 7,000,000 pounds of wire for the rope of the Brooklyn Bridge, at a cost of $600,000. The introduction of wire rope for ships' cables is much discussed at the present moment, both in England and the United States. In 1812, the clumsy hemp hawser was displaced by the chain cable, and it is claimed that the revolution thus brought about within the last sixty years in the equipment of ships is no greater than would result from the adoption of wire rope. The merits of the latter, however, remain to be tested in practical navigation.

A Curiosity in Book-Making.—A woven book has been manufactured at Lyons, the whole of the letterpress being executed in silken thread.

Inventions.

A NEW VENTILATOR.

At this season of the year, when—with all the double windows up - the ventilation of houses is very imperfect, compared to summer time, many double windows have only one small ventilating hole cut in the bottom of the sash, which only admits a small portion of cold air, but there is no egress for the foul air to pass off, particularly during the night, during which period these apertures have to be closed against an extreme cold atmosphere. We all know, or at least ought to know in these days of sanitary instruction, that in a close apartment the air which is continually inhaled and exhaled through the lungs and vitiated by impure matter of all kinds, becomes unfit for respiration unless it is often renewed.

Therefore it is with much pleasure that we desire to make known more generally a ventilator which is undoubtedly the best and cheapest we have seen, for it not only thoroughly ventilates a house by carrying off all the foul air, but, as a natural consequence of its perfect action, it removes smoke and all smell of cooking.

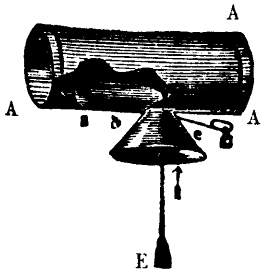


Fig. 1.

Figure 1 represents the ventilating apparatus.

To the stove pipe A A A A is adapted a tube B D of a smaller diameter, which communicates with the interior of the room by means of the valve C.

This valve opens and closes at will by means of the cord E.

In order that foul air may escape quicker, the lower end of the tube is made in the shape of a funnel.

One of the new characters of this apparatus is the bent tube B D which fills two ends. Ist. It prevents the opening in the stove pipe from acting on the drawing of the chimney. 2nd. It prevents the soot and fire from escaping through this opening.

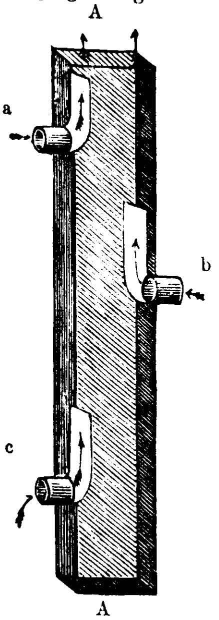


Fig. 2.

In rooms where there are no stove pipes (and such is often the case, especially during the summer season), it is quite easy to use the same system, by means of a metallic tube placed in the ceiling and which communicates with the chimnies.

Figure 2 represents this tube which is proportioned to the size and numbers of rooms which are to be ventilated.

The main pipe A A enters in the chimney. Pipes of a smaller size are soldered to the main pipe, as indicated by the letters a b c, and ventilation is obtained in the same manner as described in figure 1.

Following the same rule, if an exhausting air apparatus in the shape of a scuttle, such as shown by the letter A in Fig. 3, is adapted to a kitchen stove pipe, the foul and unwholesome air which often fills the kitchen escapes, as for instance when accidentally or through neglect greasy substances are thrown on the stove. If this exhausting air apparatus drives off too much heat, by closing the valve B it stops all further escape of heat.

Likewise in rooms heated by means of coal stoves, which are now very much in use, the inconvenience or rather danger arising from the escape of foul air, especially when they are filled with coal, can be avoided, by adapting the exhausting air apparatus A shown in Fig. 3, but of a different shape.

This system has the great advantage of renewing the air continually and by degrees. When a room needs to be ventilated, it is the general custom to open the door or the window ventilator. Then the air rushes in from outside, and by mixing with the inner air improves the latter which assumes a higher temperature, and if the persons residing in the house are in the least state of perspiration, they are apt to catch a cold, or a disease of the throat or of the lungs.

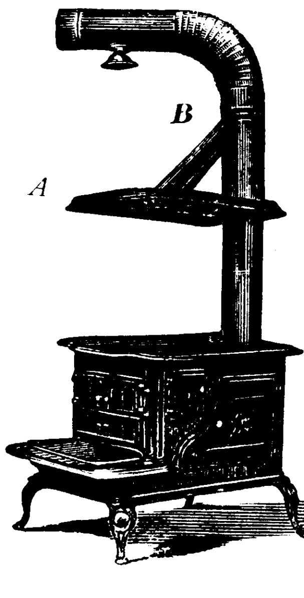


Fig. 3.

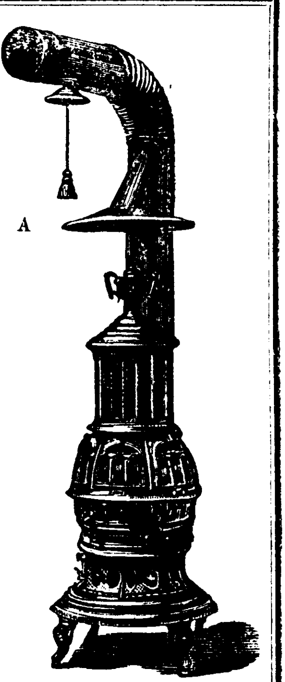


Fig. 4.

Yon's ventilator avoids these dangerous consequences. The apparatus works regularly. The impure air contained in the room escapes and at the same time fresh air from the outside is admitted inside by the door or window cracks, but in such small quantity that it is not perceptibly felt.

It must be observed that when a window ventilator is opened for the purpose of ventilating a room, the air from the outside does indeed rush in and cools the inside temperature and makes it more pleasant to breathe, but the noxious gases which are gathered near the ceiling do not escape. By using Yon's ventilator these gases are carried through the chimney as soon as they are generated.

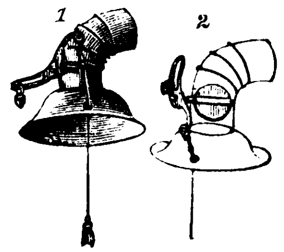


Fig. 5.

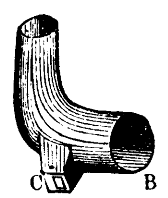


Fig. 6.

Figure 5 shows the working of the valves, which is so plain that it needs no explanation. An examination of the figure will make it perfectly plain.

As the reader might wish to know how the exhausting tubes herein before described, are adapted to chimnies, by looking at figure 5 he will see how the apparatus for that purpose is made.

It is a bent pipe of cast iron A B C, provided with a valve at the point C used for cleaning it. A is the upper end which is adapted to the chimney ; C is the lower end to which is adapted the exhausting apparatus from the interior of the room.

It is needless to give further explanations concerning this system of ventilation. It is so simple that any one will understand it at first sight.

Some of the highest medical authorities in Montreal have testified as to its merits, from their personal use of the same.

For stopping holes in castings, or for covering scars, a useful cement may, it is said, be made of equal parts of gum arabic, plaster of Paris, and iron filings, and if a little finely pulverized white glass be added to the mixture, it will make it still harder. This mixture forms a very hard cement, that will resist the action of fire and water. It should be kept in its dry state and mixed with a little water when wanted for use.

Sanitary.

VENTILATION OF BEDROOMS.

The ventilation of bedrooms, a very important matter, is, as a rule, much neglected. The circulation of the blood is not nearly so active during sleep as when awake. The *Lancet* has some important notes on this subject. The sleeper is entirely dependent upon the atmosphere supplied to him for the means of carrying on the chemical purification and nutrition of his body. He must breathe the air that surrounds him, and he does this for a lengthy portion of each period of twenty-four hours, although it is probable that in a large majority of cases the atmosphere has become so deteriorated by the expiration of carbon and the emanations from the body generally, that if the senses were on the alert some change would be sought as a mere matter of preference.

When a person places himself in a condition to take in all air, without being able to exercise any control over its delivery, he ought to make sure that the supply will be adequate, not merely for the maintenance of life, but for the preservation of health. If a man were to deliberately shut himself for some six or eight hours daily in a close room, with closed doors and windows (the doors not being opened even to change the air during the period of incarceration), and were then to complain of headache and debility, he would be justly told that his own want of intelligent foresight was the cause of his suffering. Nevertheless, this is what the great mass of people do every night of their lives with no thought of their imprudence. There are few bedrooms in which it is perfectly safe to pass the night without something more than ordinary precautions to secure an inflow of fresh air. Every sleeping apartment should, of course, have a fireplace with an open chimney, and in cold weather it is well if the grate contains a small fire, at least enough to create an upcast current and carry off the vitiated air of the room. In all such cases, however, when a fire is used, it is necessary to see that the air drawn into the room comes from the outside of the house. By a facile mistake it is possible to place the occupant of a bedroom with a fire in a closed house in a direct current of foul air drawn from all parts of the establishment. Summer and winter, with or without the use of fires, it is well to have a pure ingress for pure air. This should be the ventilator's first concern. Foul air will find an exit if pure air is admitted in sufficient quantity, but it is not certain pure air will be drawn in if the impure is drawn away. So far as sleeping rooms are concerned, it is wise to let in air from without. The aim must be to accomplish the object without causing a great fall of temperature or a draught. The windows may be drawn down an inch or two at the top with advantage, and a fold of muslin will form a "ventilator" to take off the feeling of draught. This, with an open fireplace, will generally suffice, and produce no unpleasant consequences even when the weather is cold. It is, however, essential that the air outside should be pure. Little is likely to be gained by letting in a fog or even a town mist.

THE FILTRATION OF DRINKING WATER.

Dr. A. B. Prescott remarks, in the Michigan *Medical News:* It seems to me more attention might well be given to the purification of rain water, river water, etc., by that simple means, everywhere and at once cheap and available, the use of a portable filter with a good bed of pulverized charcoal in layers with gravel. I do not disparage filters set in cisterns or reservoirs. If made on right principles they may do the work expected of them. They have an advantage of permanence and uniform supply without daily attention, but they are much more liable to failure from neglect of the true conditions of filtration than the simple movable filters manufactured for sale.

Some of the definitions and conditions of a good water filter may be given as follows:

1. It must be more than a strainer, and remove more than suspended matters. A brick partition (of bricks mortared edge to edge) in the cistern or reservoir makes a good strainer, removing undissolved matters, but not much else.

2. It must remove from the water the dissolved colloids—the organic matters. The power of a bed of powdered charcoal, especially bone charcoal, to withdraw coloring and other colloid matters, is familiar in manufacturing operations.

3. The good water filter, instead of becoming filled with the organic matters it removes, causes their prompt oxidation. To do this it must have air. A filter constantly submerged under water can act only with the attenuated oxygen dissolved by the water, and cannot effect half the oxidation it would if exposed to the air for the greater part of the time. Without oxidation of its gatherings, a filter can render only a brief service.

SPONTANEOUS COMBUSTION.

Dr. Hoffman has called attention to some curious cases of spontaneous ignition of hydrogen in air. The phenomenon has been noticed in factories where large quantities of zinc were being dissolved in hydrochloric acid for the preparation of zinc chloride. Violent explosions took place when no flame was near; and it was eventually ascertained that the gas took fire spontaneously. It appears to be caused by fragments of very porous zinc, which, when lifted above the surface of the liquid during the violent evolution of the gas, and so brought in contact with hydrogen and air, act just as spongy platinum would do under the circumstances. The author recommends the performance of such operations in the open air. The ignition can be shown by treating a few kilogrammes of finely divided zinc with acid. The "zinc dust" may even ignite by contact with water.

OFFICIAL REGULATION OF HOUSE DRAINAGE.

THE BYE-LAWS OF AN ENGLISH TOWN, WITH COMMENTS.

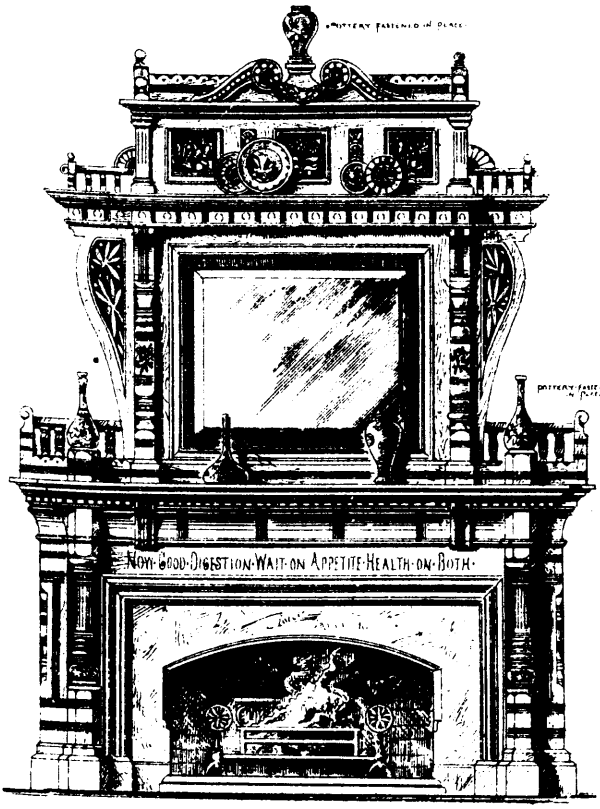
The *Plumber and Sanitary Engineer* of New York, in its November number, contains the following extracts of the bye-laws of an English town (Uppingham) for regulating drainage and the ventilation of sewers. We quite agree with the Editor's remarks, but the difficulty in Montreal is that, although we have some excellent bye-laws for Municipal government, they are not, as a rule, vigorously enforced.

"§ 1.—Every drain from a house or building shall be laid down in a straight line, with proper falls and true gradients, and shall be of glazed stoneware or iron pipes, carefully jointed and made water tight. No right angled junction shall be allowed except in the case of a drain discharging into a vertical shaft, and the work shall be executed in a substantial and workmanlike manner, and shall be inspected by the surveyor to the Sanitary Authority before being covered up."

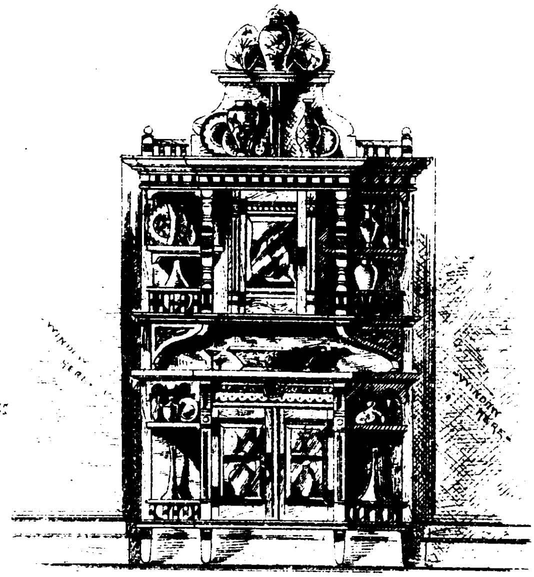
"§ 2.—No drain should be constructed so as to pass under a dwelling house, except in particular cases where absolutely necessary. In such cases, the following precautions shall be adopted. The portion of the drain which passes under the house shall be constructed either of glazed stoneware pipes, bedded or covered in concrete, or of cast iron pipes, and such portion shall be ventilated at each end by a suitable pipe or opening, according to the provisions in §4."

The above two sections are as well adapted to our climate and circumstances as to those of England. Except that here we do

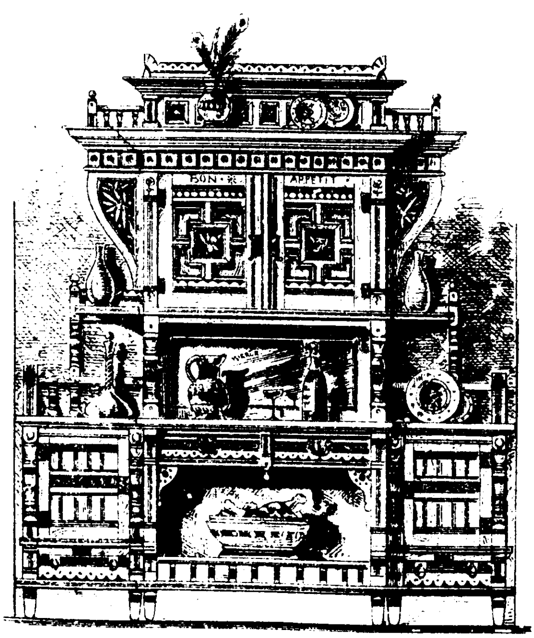
FURNITURE DESIGNS.



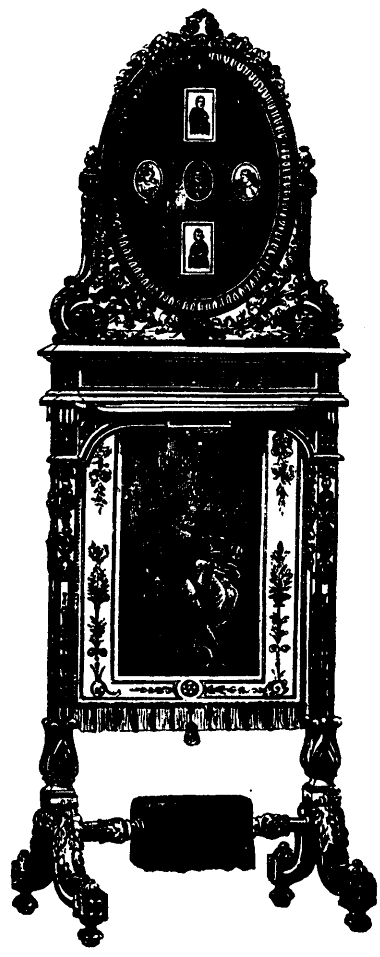
MANTEL PIECE.



BRIC-A-BRAC CASE.



SIDEBOARD



DESIGN FOR A FIRE-SCREEN.

not as a rule use so tight concrete as that made of Portland Cement in England for covering stoneware drains. The writer has seen such drains carefully laid and covered with a concrete of American (Rosendale) Cement, as good as the average of cellar bottoms, yet incapable of preventing an escape of sewer gas into the house. It came up, without a doubt, through the pores of the concrete before putting in an outside trap, showing that this stoneware pipe is far inferior to cast iron with lead joints for use within the walls of the house.

We would call particular attention to the clause requiring ventilation *at both ends* of the drain within the house, so as to secure a constant flow of pure air through it.

"§ 3.—Every drain shall be arranged so as to be kept at all times free from deposit; and if in any case this cannot be effected without flushing, it shall be necessary to provide special flushing arrangements, so as to effectually remove all foul matter from the house drains to the public sewers."

The above regulation is a very important one, and but poorly understood and appreciated by many of our drain layers. Our climate is more favorable than that of the eastern part of England in enabling us to avail ourselves of the rain fall for flushing house drains at frequent intervals. That is, we have violent rains at more frequent intervals than near London. Yet many drains are laid here with too little inclination, or too large to be self-cleansing, and with no provision for admitting rain or any other means of flushing. The best automatic apparatus for this purpose we have ever seen is the flushing tank of Mr. Rogers Field of London, which is now to be found at some of our sanitary warerooms.

"§ 4.—Every drain shall be ventilated by one or more suitable pipes or openings, and no pipe or opening shall be used for ventilation unless the same be carried upwards without angles or horizontal lengths, and with tight joints. The size of such pipes or openings shall be fully equal to that of the drain pipe ventilated, except in particular cases where the Sanitary Authority shall give permission for the use of a smaller size, which shall, however, be under no circumstances less than four inches bore. Rain water pipes shall not be used as ventilators, except in particular cases where their upper extremities are at a distance from any windows, openings or projecting eaves, so that there is no danger of the escape of foul air into the interior of the house from such pipes."

This regulation is similar to the practice often recommended in our columns. In applying ventilating pipes to old systems in houses which have soil pipes without them, it may not be always practicable to run them up "without angles." It is doubtless best to have them as direct as possible, but it might often occur that a perfectly straight line of pipe would so deface an old house that it would be better to deflect it by smooth bends, to accommodate the circumstances of the case. A smooth bend in a pipe does not obstruct the flow of air by any additional *friction*, properly so called, but merely by loss of *momentum* in the moving column. The pipes should, however, always be as direct as possible.

The objection urged in § 4 against using rain-water pipes as ventilators is a sound one.

"§ 5.—A properly constructed trap shall be placed on the line of drain between the house and the public sewer, with a suitable ventilating pipe or opening to the drain in the house side of such trap." (See § 4.)

This is what we have always recommended in our columns, as is now generally done by all the best authorities. The only excuse for its omission is the most thoroughly constructed and perfectly ventilated system of sewers, such as hardly exist to our knowledge. Where no sewers are yet built and where cesspools are used instead, the use of this trap is of still greater importance.

"§ 6.—All inlets to the drains or openings for ventilation shall be efficiently protected by gratings or otherwise, to prevent the introduction of improper substances. All inlets shall be properly trapped except when left open for ventilation of the drains. In the case of inlets or openings used for ventilation or disconnection (see § 11), every such grating or protection should be so arranged as to have a free air space of at least twelve square inches in the case of four inch pipes, and of twenty-five square inches in that of six inch pipes and gullies."

This regulation is doubtless well adapted to an English climate, but if applied in our own, in the latitude of New York or Boston, the inward draft of such openings of the cold air in extreme weather, would in a few hours fill the drain with an accumulation of frozen sewage, and finally break it up by the expansion produced in the process of freezing. Such ventilation inlet holes if constructed as large as above described for summer use in our climate, would require to be filled with straw or similar non-conductor of heat in winter, largely diminishing the amount of air that can enter, and keeping its quantity so limited that it can be warmed up to 32° by the heat of the drain and its surrounding soil.

"§ 7.—Whenever dampness of site exists it shall be necessary to lay subsoil or land drains, and no such subsoil or land drain shall pass directly to any drain or sewer, but shall have a suitable break or disconnection." (See § II.)

This section is universal in its application and should never be disregarded. If a direct connection be made, the foul air of the drain will pass up through such subsoil drains to the cellar, and thus pervade the house. Of course the flow of water from such drains is so uncertain and subject to such long intermissions in times of drouth, that no reliance could be placed upon a trap in these drains, which might be dry by evaporation during half the time.

"§ 8.—Every water closet or slop sink shall be efficiently trapped by a suitable trap, not being of the kind used as a D trap. The soil pipes from all water closets and waste pipes from slop sinks for urine shall be continued above the eaves of the house for ventilation, and there terminate with the end thereof open to the air, and if such ends be at or near any window of the house, it shall be necessary to further continue such pipes to the edge of the roof. Every such continuation shall be of the full size of such soil or waste pipes."

This is in accordance with the practice recommended hitherto in our columns. We would call attention particularly to the condemnation of the D trap, and would class with it the Boston cylinder traps and all others which hoard up filth for decomposition by any shape of lateral expansion of their walls. They are, one and all, inventions of the enemy.

"§ 9.—Except in the particular cases provided for in §4, where a rain water pipe may be used as a ventilator, no rain water pipe shall pass directly to any drain or sewer, but shall be disconnected therefrom by delivering into an open channel or over an open gulley with a suitable trap, or in some other way so as to have its discharging end open to the air."

The importance of such protection as here described arises from the fact that no trap in the line of the rain water conductor is reliable in the time of drouth, a reason which operates with even greater force here than in England. The provision of open gullies as recommended above must always be so modified as to exclude frost in our climate; so that this provision is often difficult to enforce with us, except in certain favored situations, or modified by entering the rain water in a ventilating well over the main drain trap.

"§ 10.—No overflow or waste water pipe from any cistern or rain water tank, or from any sink other than a slop sink for urine (see § 8), or from any bath or lavatory, or safe of a bath, or of a water closet, or of a lavatory, shall pass directly to any drain, soil pipe or trap of a water closet, but every such pipe shall be disconnected therefrom, by either itself passing through the wall to the outside of the house and discharging with an end open to the air, or by delivering into a pipe which so passes and discharges. All overflow or waste pipes shall be properly trapped, except in particular cases where their ends discharge in such a position that the passage of foul air to the interior of the house through such pipes from drains, disconnecting traps, ventilators, or rain water pipes, is rendered impossible."

The last paragraph of this regulation is applicable here without qualification; but the rigor of our climate forbids our adoption of the first paragraph, viz.: discharging waste pipes from lavatories, bath tubs, sinks, &c., "into the open air" in winter. Such a course would soon build up a pyramid of frozen sewage at every point of discharge. It is well enough to discharge the overflow of tanks and safes into the open air, for they do not deliver water enough to make trouble by its freezing. But even with these a more convenient and equally safe method can be adopted without going through the house walls, viz.: overflow the tank into the bath tub, and the safe wastes over the kitchen sink or cellar floor. In either case their discharge would attract attention to the fault above, before any harm would be done. As to overflows of lavatories, bath tubs, plunger water closets, etc., we consider it safe to discharge them into their own wastes above or into the traps which should always be provided as close as possible to the point of discharge of the vessel to be emptied. These wastes can also be safely discharged into soil pipes or main drains if each waste be properly trapped. The trap should be a running or syphon trap, and provided with an air vent as large as the waste to guard against it being emptied by syphoning.

Such an arrangement seems to be giving satisfactory results when tried in many hundreds of houses, and is adapted to our climate and wants.

"§ 11.—There shall be no gully inside a house in cellar, or basement or otherwise, unless absolutely necessary. Where such gully cannot be avoided, it shall be properly trapped, and the outlet pipes shall not pass directly to any drain or sewer, but shall be disconnected therefrom by passing through the wall to the outside of the house, and there delivering with an end open to the air over a suitable trap. Subsoil or land drains shall also have a similar break or disconnection between them and the drain or sewer."

This is an excellent regulation, perfectly adapted to all climates and localities. It is rendered necessary by the uncertainty of keeping such gully traps supplied with water, when not often used.

The above is the last of the "Regulations" under the Uppingham By-laws. But some of these by-laws are worthy of notice. No. 2 is as follows: "Every person erecting a new building shall cause all rain water to be so drained or conveyed from the roof of any building as to prevent its dripping on the ground and causing dampness in the walls." This is sound, and applicable as well here as in England.

"By-Law No. 3.—Every person who shall construct a water-closet in a new building shall construct such water closet or earth closet in such a position that one of its sides at the least shall be an external wall, and no part of such water closet or earth closet shall be situated beneath any habitable room."

It is doubtless very desirable to locate water-closets against an external wall, for the purpose of giving ample ventilation to the apartment. But in well-built houses we do not consider this as absolutely essential, especially if to be tenanted by a class of people of cleanly habits, who can be depended on to take good care of their premises. But whenever closets are provided in tenement houses, the immediate access to outer air becomes more essential and should always be provided. Such a situation adds much to the comfort of the housekeeper in any case, and should never be sacrificed where it is possible to attain it. We do not see the necessity, however, of prohibiting water-closets "under any habitable room" in houses that are well built and likely to be well taken care of. Air-drafts should always be provided to change and circulate the air around them. These safeguards are very important, but hardly enough to justify an interior location when the quality of work and style of fixtures are not first-class. Ordinary cheap water-closets, inadequately flushed with water, such as the majority of "pan" and "hopper" closets now in use, cannot fail to be nuisances anywhere inside the house walls, and the farther out we push them the better off we shall be. Yet we firmly believe that a really good fixture, whether one or other of several good varieties, if well cared for and provided with air draft around it, can be made a wholesome thing, even in the middle of a house when necessary. A want of care in the house-keeper will ruin the good name of the best fixture in the world, for we cannot expect servants and children will always be careful in their use; and no invention yet devised by man will compensate for allowing drops of urine to be spattered about on the floors or wainscoting, to pollute the air with its rapid decomposition.

The Uppingham engineer recommends soil pipes to be put outside the house walls. Our climate forbids putting water closets in towers or projections outside the walls of the house, and as we must keep them and the soil pipes also inside to avoid frost, it behoves us to be all the more careful in their workmanship and in their daily use and cleanliness, for this very reason. All parts should be made readily accessible to the housemaid's sponge and hot water, and a frequent use of these articles insisted on. Simplicity of construction is a merit never to be lost sight of in this regard.

How the Ancients Ate.—Two or three thousand years ago late suppers were not fashionable, as in the present degenerate age. The noble specimens of humanity of that day, whose deeds of valor and other wonderful achievements still inspire our respect, after a score of centuries, never formed the acquaintance of dyspepsia, that hydra-headed monster which renders miserable the lives of a large proportion of civilized human beings at the present day. This fact may be fairly attributed, in a great part at least, to the simple dietetic habits of those pioneers of science, art and civilization. Those noble Grecians who were the compeers and contemporaries of the great Hippocrates, the acknowledged father of medical literature, knew nothing of the elaborate courses, the infinite varieties, and the exquisite indigestibility of modern fashionable dinners. At that age of the world, man took but two meals a day, as do some at the present, a fact which is clearly stated in the writings of Hippocrates and other medical authors; from which it will be readily seen that in adopting the two-meal system one is but returning to the good old ways of his forefathers, rather than adopting any new or untried theory.

Strawberries and Constipation.—Professor F. H. Storer, of Harvard University, in a communication to the *Journal of Pharmacy*, calls attention to the fact, not generally known (and which certainly would scarcely be expected), that ripe strawberries are very apt to induce constipation. He remarks that in the United States particularly, "where an immense and well-nigh universal consumption of this fruit is coincident with the setting in of hot weather, the constipating action of the berry is complicated, and, as it were, increased by the excessive waste of water from the body, by perspiration, which occurs at this period; and there can be little doubt that, taking the two causes together, the strawberry season — though perhaps beneficial to some constitutions—is the occasion of much ill-health among the American people."

Educational.

SWEEPING REFORM IN TEACHING.

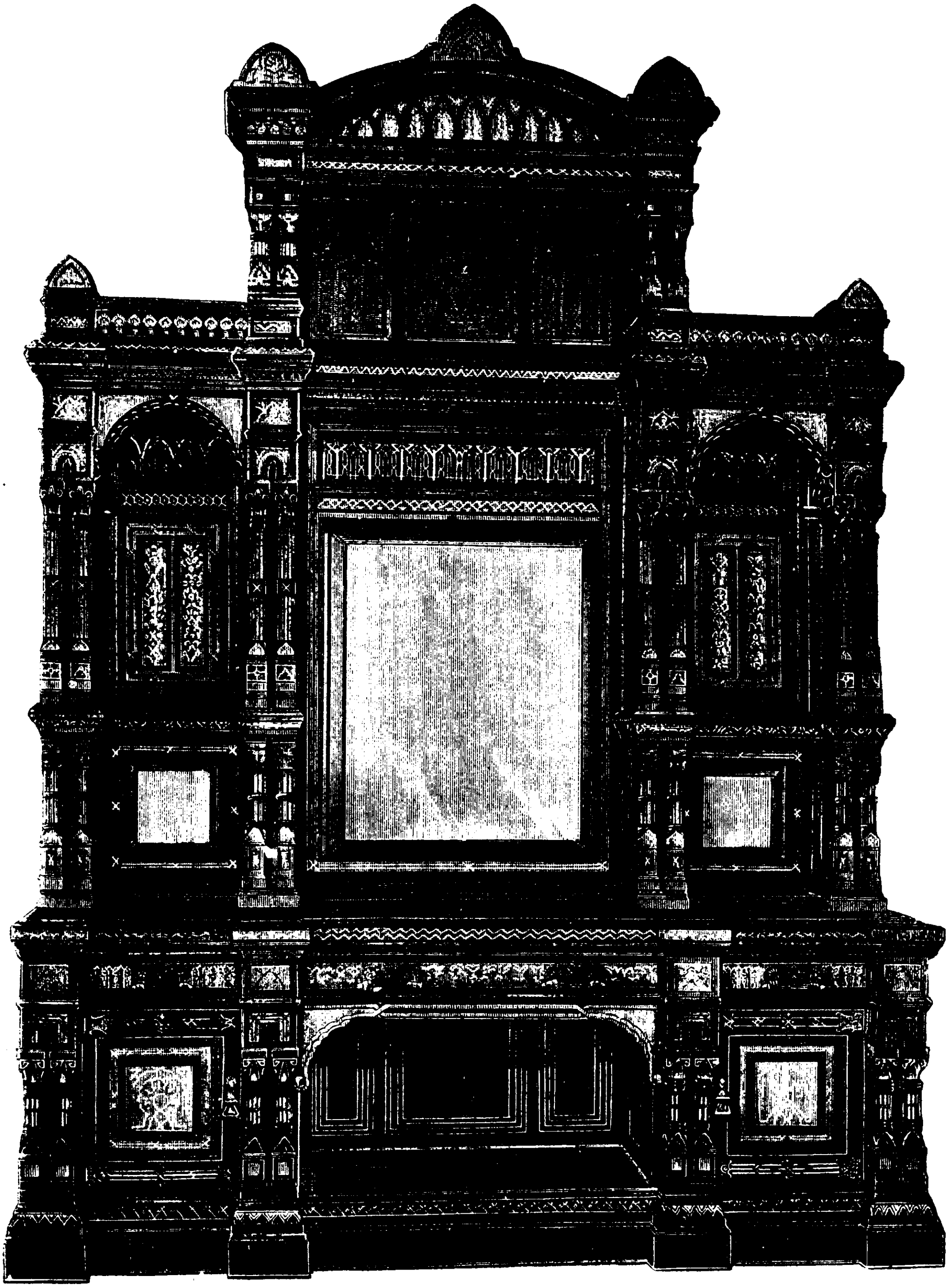
Enlightened Boston has taken the initiative to abolish the old and prevailing method of school-teaching, which was, and still is, to confine the principal work of the teacher to hearing recitations from text-books. In some schools this is abused to such an extent that the teachers are ignorant of the subjects, and think they have done their duty if the pupils can thoughtlessly and in a parrot-like manner recite their lessons, no matter whether the meaning of the same has been understood or not. But this is not all; to the great credit of Boston, be it said that the spelling-books and the grammars have been abolished in her schools; that the pupils will be taught by making them see and think, and that the teachers will be obliged to give talking lessons, so as to teach correct speaking; to teach the alphabet and spelling orally and by pictures, plants, animals, and reference to the children's everyday life and experience; to teach grammar, not by parsing and other technical work, but by lessons in composition, the use of capitals, letter-writing, arrangement of sentences, etc.

The lower classes will receive instruction in regard to the form, color, and other properties of objects; next in natural history of minerals, vegetables, and animals grouped by easily observed habits, and hygiene, especially of the human body. In the lower classes oral instruction will largely predominate, and also in the higher classes, only not to such an almost exclusive extent. Much of the time formerly given to geography will be devoted to natural philosophy and physiology, and very wisely, as man is more interested in his own body and his immediate surroundings, than in far-off countries. Biographical and historical sketches will be taught to the higher classes, but only to such an extent as may be useful for practical life or for forming their characters, as much time will be devoted to experiments in physics and technology.

In order to aid the introduction of the metrical system, the example will be followed which the Netherlands adopted fifty years ago, and by which they have successfully introduced it without the least trouble, namely, to teach the metrical system to the lower classes in the public schools, not by books, but from the measures themselves, and from the metrical apparatus. It is interesting to see how comparatively very young children attain clear notions about measures when they are allowed to verify that, for instance, 10 decimeters make 1 meter, or 10 deciliters of sand go exactly into 1 liter, and so on for other measures. The main advantage is that such practical trials impress the memory in such a way that the lessons are remembered while those from books learned by heart are most always forgotten when needed in practical life.

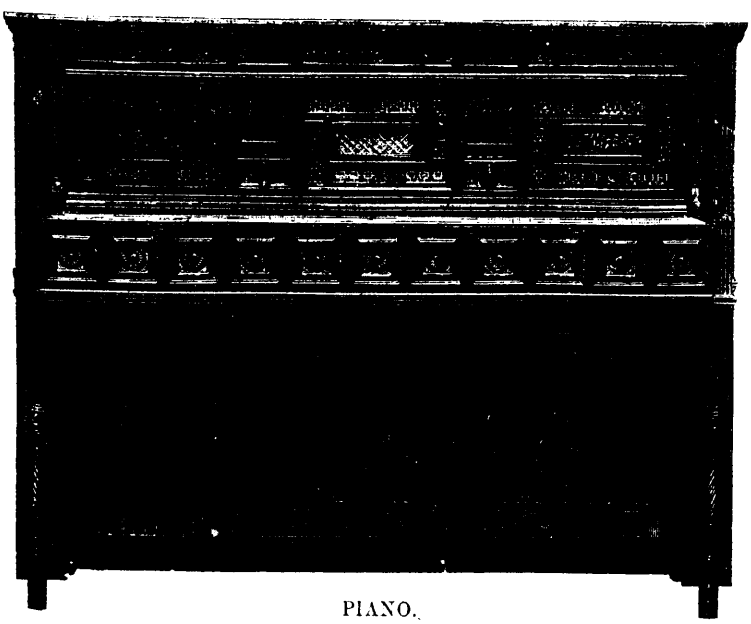
Our contemporary, the *Scientific American*, makes a few pertinent remarks on this subject, which we copy in closing. It says: "This method labors under one serious, we fear fatal, difficulty—the teachers will have to know something. Their knowledge will have to be real "live" knowledge, not dead verbiage; and they will need to know a good deal about the natural, social, and industrial life that the children come in contact with outdoors and at home. Such knowledge is not to be gained from books; and it is hard to turn a book student into a practical observer. We sincerely hope, however, that the teachers of Boston will succeed in their difficult task, and demonstrate to the rest of the world the feasibility of this promising and long needed reform."

FURNITURE DESIGNS.

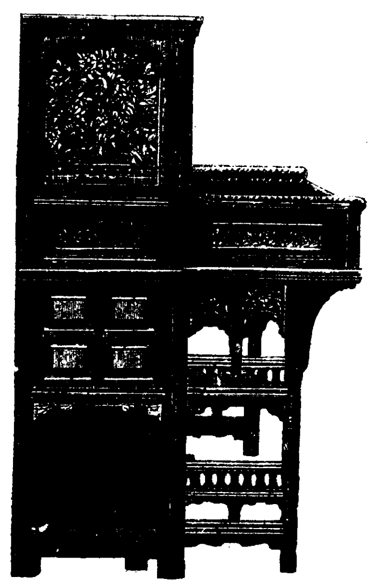


SIDEBOARD IN THE "ANGLO-MOORISH STYLE."
Exhibited at the Paris Exhibition by Mr. WALKER, Cabinetmaker, London Constructed of brown oak and relieved with pear-tree wood and ebony.

WRITING BOUDOIRS.



PIANO.



SIDE VIEW.

FURNITURE.

Exhibited at the Paris Exhibition by Messrs. JAMES SCHOOLBRED & Co., Cabinetmakers, England.

Cabinet Maker's Work.

DARKENING WOOD.—Equal parts of manganate of soda and crystalised Epsom salts are dissolved in twenty to thirty times the amount of water, at about 144 deg., and the planed wood is then brushed with the solution; the less water employed the darker the stain, and the hotter the solution the deeper it will penetrate. When thoroughly dry, and after the operation has been repeated if necessary, the furniture is smoothed with oil, and finally polished, the appearance being then really beautiful. Before smoothing, however, a careful washing with hot water will have the effect of preventing the efflorescence of the sulphate of soda formed. In the treatment of floors, the solution may be employed boiling hot, and, if the shade produced is not dark enough, a second application of a less concentrated solution is made; after it is quite dry, it is varnished with a perfectly colorless oil-varnish. On account of the depth to which the coloring solution penetrates, a fresh application, it is stated, is not soon required.

FURNITURE POLISH.—Pearlash, 1 oz.; water, 8 oz.; beeswax (genuine), 6 oz. Mix while hot, and add sufficient water to reduce it to the consistency of cream. For use, add more water, and spread it on the wood with a painter's brush. Let it dry, and polish with a hard brush or cloth. If white wax is used it may be applied to polish plaster casts, statues, etc. 2. Melt three or four pieces of sandarach, each of the size of a walnut, add 1 pt. of boiled oil, and boil together for 1 hour. While cooling, add 1 dr. of Venice turpentine, and if too thick a little oil of turpentine also. Apply this all over the furniture, and after some hours rub it off. Rub the furniture daily without applying fresh varnish, except about once in two months. Water does not injure this polish, and any stain or scratch may be again covered, which cannot be done with French polish.

DAMAGED LOOKING GLASS.—Take the glass out of the frame, and lay it face downwards upon a flat table; then carefully clean the portion of the glass from which the silver has been detached. Now get a piece of tinfoil, quite clean, and some good mercury; lay the tinfoil upon a second small glass, a little larger than the vacant space on the mirror; then pour a few drops of mercury upon the tinfoil, and with a tuft of cotton wool well rub the mercury into the foil until you obtain a good amalgam. Place a piece of clean tissue paper over the vacant space in the looking glass, and put on it a few drops of clean mercury; then upon this lay the tinfoil, press gently until the tinfoil is quite flat, and remove the tissue paper by gently drawing it from under the tinfoil. Allow the mirror to lie flat for at least two days, when it may be re-framed and hung again.

POLISH FOR FLOORS.—One pound of beeswax, one quart of benzine—the beeswax melted soft, to which add the benzine; put them over a range or stove, the fire closely covered, as benzine is highly inflammable; stir together till well mixed. These are the proportions; the quantity must depend upon the space to be covered. Apply to the floor, first making it clean, and rub in thoroughly. It shows the grain of the wood, and makes a permanent polish, growing better by use and rubbing in. It is free of dust, and clean, and is not laborious to take care of, twice a year rubbing, and sweeping, so to say, with a broom in a flannel cover. The floor of the Louvre has on it this preparation, and all who have seen it will recall its smooth and clean appearance.

HOW TO CLEAN A CARPET.—To clean a carpet after it has been well beaten and the floor is perfectly dry, it can be nailed down tightly, and then the soiled portions can be rubbed clean with soap and water. But, if it is much faded, a bullock's gall added to two quarts of cold water is the best wash for it. Rub it on with a soft brush, and wipe dry with a cloth. If a carpet is thick, like those of Brussels or Axminster, and is much soiled, take a clean mop and dip it into warm water, to which one teaspoonful of aqua-ammonia has been added for each quart. Wring out the mop as dry as possible, and rub it over the carpet in breadths. When the water becomes soiled take a fresh supply.

VARNISHING WOOD.—See that the woodwork is quite smooth, and then give two coats of good oil varnish that does not dry too quickly. Take some ground pumice-stone and woollen cloth and water, rubbing it until it gets quite even, then give it another coat and repeat the pumice. Now give a coat of good carriage varnish (which will not dry under 48 hours), and repeat the pumice. Let each coat of oil varnish stand 24 hours between each coat, and 96 hours for the carriage varnish. Do not rub down until this is quite hard.

IMPROVEMENT IN BENDING TIMBER.—The bending of hard wood, especially beech, is effected at present by means of hot water or steam, a process somewhat costly as regards fuel, and taking a long time. A patent has recently been taken out in Germany by Bahse and Hændel for making sieve hoops and like objects by a dry process, more cheaply and in shorter time, from cut wood. Two rollers are used, one above the other, and having less velocity, so that the upper acts by holding back, while the lower extends the wood fibers. When the board, thus bent, leaves the rollers, it is fastened in the mouth of the sieve. The upper roller is fluted, the under one smooth. If two smooth rollers were used a very much greater pressure would be necessary.

MORDANTS FOR STAINING WOODS.—Sulphuric acid, more or less diluted, according to the intensity of the color to be produced, is applied with a brush to the wood, previously cleaned and dried. A lighter or darker brown stain is obtained, according to the strength of the acid. When the acid has acted sufficiently, its further action is arrested by the application of ammonia. Tincture of iodine yields a fine brown coloration, which, however, is not permanent unless the air is excluded by a thick coating of polish. Nitric acid gives a fine permanent yellow, which is converted into a dark brown by the subsequent application of tincture of iodine.

EBONIZING WOOD.—Apple, pear, and walnut woods, especially the fine-grained sorts, may be satisfactorily ebonized by first boiling in a glazed vessel, with water, 4 ounces of gallnuts, 1 ounce of logwood chips, ½ ounce of green vitriol, and ½ ounce of crystallised verdigris, these being filtered while warm and the wood brushed a number of times with the hot solution. Thus stained black, the wood is then coated two or three times (being allowed to dry completely after each coating) with a solution of one ounce of iron filings in a quart of good wine vinegar. This to be prepared hot and allowed to cool before it is used.

POLISHING TABLES.—Buy half a pint of the best French polish; then rub in plaster of Paris, to stop up all the holes; then color it with a little dragon's blood, after which he must rub the polish in with a small piece of wool or a linen rag, keeping up a circular movement. After doing this for some time lay it on one side, and allow the polish to sink in and dry for some hours; then finish it off with polish, and a small drop of oil added.

POLISHING VENEER WOOD.—After scraping up veneer, first give a coat of size for stopping up grain, then color or stain, and proceed to polish. It is a great mistake to use too much oil. For all hard woods the polishing is the same, but not for stopping, as size is generally used for dark woods, and plaster or chrome for light. Putty-lime is a good stain for Honduras mahogany, chestnut, and other woods.

GILDER'S WATER SIZE.—It is easily made in the following way:—Buy some parchment cuttings (sold by first-class oil and color shops, at 1s. per lb.); put as much as will make the quantity you require in water, boil and allow it to simmer for an hour or so, strain off, and there it is. Strength depends on the quantity of water used.

POLISHING CROSS-GRAINED TOP OF BOX.—Get some naphtha, and dissolve some shellac—about ¼lb. to ½ pint. When dissolved allow it to settle until quite clear, and pour off. Paint the top of your box with it two or three times, sandpapering it off. Finish by polishing it with French polish.

TO TURN OAK BLACK.—The *Revue Industrielle* states that oak may be dyed black, and made to resemble ebony, by the following means. Immerse the wood for forty-eight hours in a hot saturated solution of alum, and then brush it over with a logwood decoction.

RENOVATING VENEERED COUCH.—Well clean the couch with a sponge and cold water; when dry give the couch a coat of varnish, made as follows: 1 gill brown hard varnish, ½ gill French polish, well mixed, and applied with camel hair brush.

TANNIN is said to be prepared in a liquid form at a manufactory at Elmira, in the State of New York. It is said to yield a fast black upon cotton, bears fulling, and is well adapted for fixing the coal-tar colors.

FOR joining the porcelain heads to the metal spikes used for ornamental nails, the *Prakt. Maschinen Construct.* recommends the use of a thick paste made of a mixture of Portland cement and glue.

Carvers' and Gilders' Work.

COMPOSITION ORNAMENTS.

The ornaments with which gold frames are mounted are of comparatively recent date, as they first came into use about a century ago for figures on chimney pieces, and afterwards for picture frames. They are made from a mixture, for which the following receipt will be found to answer well: any quantity can be made in the following proportions:—

Boil seven pounds of the best glue in seven half-pints of water; melt three pounds of white resin in three pints of raw linseed oil. When the ingredients are well boiled, put them into a large vessel and simmer them for half an hour, stirring it, and taking care it does not boil over. When this is done, pour the mixture into a large quantity of whitening (previously sifted and rolled very fine), and mix it to the consistence of dough, and it is ready for moulding into the required shapes. The above compo will keep for a long time in a damp place, or in a barrel of whitening.

Compo, when cold, is very hard, and is heated by means of steam, when it assumes the consistency of dough.

The ornaments are made by pressing the compo into *moulds*. The moulds are made of boxwood, and the required ornament is counter-sunk in the wood by a man who is by trade a mould cutter.

Composition ornaments are got out in the following manner: The workman takes the *mould* and well brushes into it oil and turpentine, to prevent the composition adhering to it. When composition enough, in a warm soft condition, is rolled up in the hands into a convenient form to go into the mould, it is pressed into every part very carefully by the fingers, and then a broard or flat surface of iron is wetted and placed on the compo remaining outside the mould, and the whole is put into an iron screw press, and the pressure, which is but for a few moments, drives the compo into all the deep parts of the mould and makes the board adhere to the back of the composition. When it is taken out of the press, the mould is removed from the ornament. After the compo has hardened a little, the ornament is cut off, and the remaining compo sliced off to be again heated and used. The ornament, when first cut off, is very soft and pliable, and can be then fitted to frames having beads, hollows, &c., without fear of breaking. These ornaments are fixed on with glue, and if corners to a frame, are sometimes supported with pieces of compo behind to secure them in the position required. When dry, they are quite hard and brittle, and are then to be *backed up*, that is, the spaces between the corner and the frame filled up with compo softened in hot water, which will make the ornament strong, and thicker than before. The mounting of these ornaments oftentimes requires skill and practice, as they have to be placed on a large proportion of the gilded articles sold in the trade. Some of the ornaments when made require supporting in other ways, beside that mentioned, as in the case of distinct fronds of ferns, a wire has to be placed throughout the back of the ornament, and secured by covering or backing up with compo, when it is found this beautiful but fragile pattern will wear well. Brackets, cornices, frames, whatnots, &c., each require the ornaments mounted so as to be graceful and suitable to the design.

The carver and gilder has a stock of moulds to suit the various descriptions of work. We have before remarked, the moulding manufacturer has facilitated the work of the carver and gilder, as the mouldings come to hand ready mounted with composition ornaments, so that in many instances the picture frame, when made, only requires suitable compo corners. Where looking-glass frames are made, they are mounted with handsome scrolls, &c., except where the pattern required is heavy and unsuitable for compo work, when, as mentioned before, the scroll pattern is carved out of soft wood, and whitened up.

On very large frames the ornaments are sometimes *papier-mache*, which is much lighter. These ornaments are made out of paper pulp, which is pressed between two moulds, and the ornament, when pressed, comes out thin and hollow. One advantage of these ornaments is that, if let fall, they are not so liable to break as compo. They are not held in favourable estimation by the gilder, as the paper pulp does not form such a good foundation for gilding as wood and composition.

The House of Lords and many of the best public places in the metropolis are decorated with papier-mache ornaments.

We will now say a few words on carving.

The ancient and classic cities of old attest by their ruins the antiquity of the art of carving. Capitals, columns, vases, and friezes show, as the poet Cowper wrote, that they did

"Not forget the carving and the gilding."

And not in stone only, but in wood they excelled, for figures of gods, heroes, and emperors, were cut most artistically; examples have come down to us in greater variety in stone owing to the more durable nature of the material.

From early times this art has been in requisition to represent incidents, fruit, flowers, &c.; and many of our mansions, manor houses, and choirs of ancient cathedrals show the beauty and extent to which the art has been carried. Gibbons, an English carver in the reigns of Charles the Second and James the Second, executed some beautiful work, which may be seen in Windsor Castle.

Before the art of Composition-ornament making was discovered the glorious paintings of the old masters were mounted in carved frames, and from this source alone the old carvers derived a good income. These frames are now imitated by composition ornaments. Frames made of broad deep mouldings, on which were carved leaves, bold ornaments and scrolls, were popular at a later period. Many very large frames are still carved, and bold light patterns are appreciated. The carver must be a man of taste, as he has often to do his best to imitate nature in flowers, foliage, and fruit. Unlike the carpenter or joiner, who works by rule, the carver must design as well as execute.

Soft wood is employed when the carved work is meant to be gilt, and wood of a harder description when it is meant to bear a polish and show the beauty of the grain. The soft wood is cut out of different thicknesses of planks, and in case of a deep pattern, a piece of wood is glued on. This plan has been found to answer well where the ornaments are gilded.

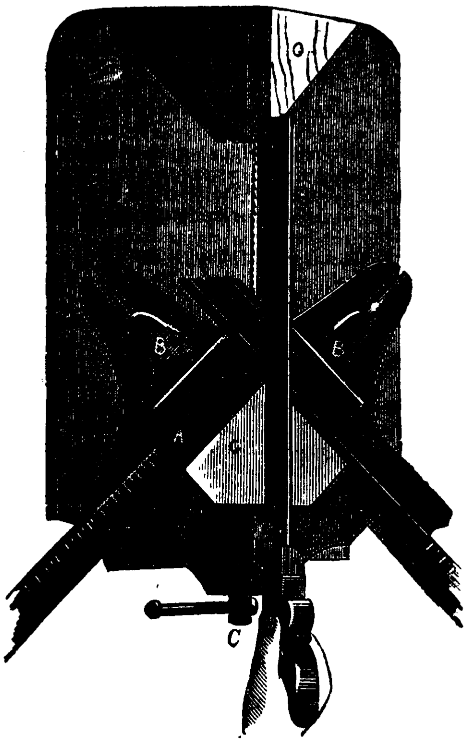
Scrolls, sweeps, fruit, flowers, &c., often decorate the centre and sides of a chimney glass, and when the design is made, the carver places it on the plank, and draws the outline, and also the holes which may be required in the pattern, and the whole is then cut out by a bow saw. The ornament thus cut out in the rough is secured to the bench, and the details worked out by gouges of various sizes and shapes. Although the ornamental scrolls and sweeps appear to be in one piece, yet oftentimes it is in several pieces. They are also generally chamfered after the details of the front have been put in, which gives the design lightness and elegance.

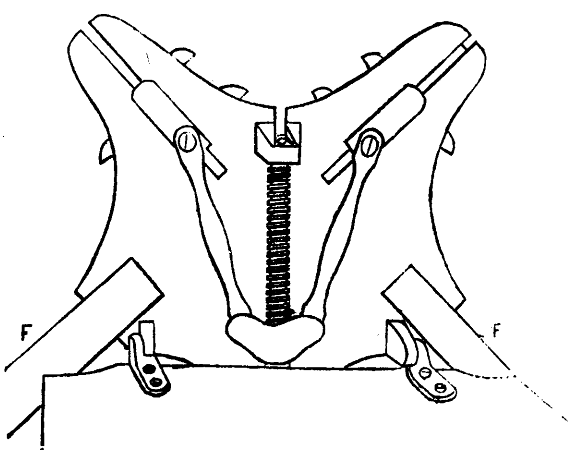
When a picture frame requires carving, it is generally made up first in the required wood, and afterwards carved the pattern decided on.

Much tact is necessary in using the tools of the carver, especially the gouges, as many sorts of wood would split if cut the wrong way of the grain. The use of the carver's tools can only be attained by practice.

The carver who supplies the cabinetmaker with work for chiffoniers, chairs, &c., does not generally supply carved ornaments for looking-glass, &c., which is almost a distinct branch of itself. These ornaments are roughly cut, and afterwards covered with whitening.

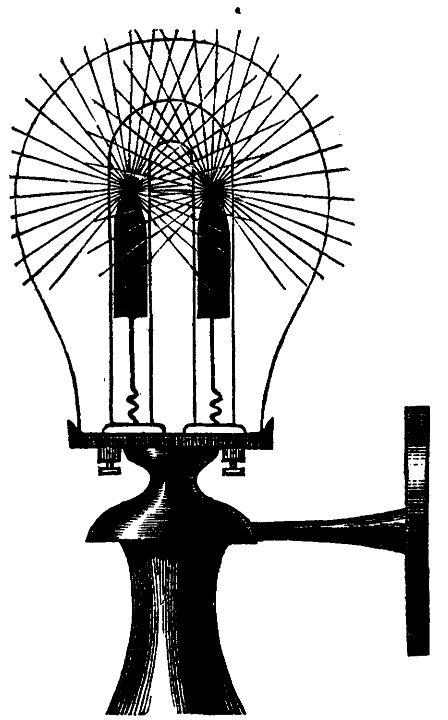
IMPROVED MITRE MACHINE AND FRAME VICE.—We will describe a simple, cheap, and durable device, by means of which frames can be easily made and put together without requiring the work of a skilled mechanic. It consists of a mitre-box for cutting the ends of the material to proper angles, and a vice which holds the frame firmly while being fastened together. The apparatus which is constructed of iron has on its table a square A, fig. I. B B are two moveable blocks which clamp the moldings to be mitred against the sides of the square, by pressing against the back of the pieces, and thus not injuring the faces. The clamps are moved back and forth by a screw C, on which travels a block in Fig. 2, to which are pivoted arms F, which are connected with blocks underneath the table as shown. The latter is hinged to the bench, and in Fig. 2 is represented as turned up so as to show its under side. The motion of the screw and adjacent parts is indicated by the dotted lines. After one end of the molding is mitred, the piece is placed on the other side of the square, and its extremity adjusted to the mark on the measuring arm F, as denotes the length desired. It is then cut by the saw, thus obviating the trouble of measuring each side of the frame, and also the liability of mistakes. After the pieces are mitred, they may be placed on the square and clamped tight by the blocks, when they can be readily nailed together. Thus constructed, the sides will be accurately fitted, as, being firmly held during the fastening, they cannot move out of square. This operation repeated for the other corners, completes the frame. If, in fastening, it is found that the moulding has become sprung or twisted, the joint, we are informed, may be quickly made perfect by running the saw through it, thus enabling the operator to use moulding which would, in the ordinary manner of working, be of little utility. The saw guide blocks G are of wood. One is screwed within the square and the other to the bench. The latter may be made to slide back and forth so as to be brought against the moulding. As the block wears away, they can be brought together, the screws underneath working through slots for the purpose. The machine may be hinged to the bench as shown, or may be imbedded in the latter flush with the surface. A circular saw may be employed instead of the hand instrument; if desired.





FAHRIG'S ELECTRIC LIGHT.

The annexed engraving shows a sketch of a new burner for the electric light. It consists of a glass tube one half inch inside and about ten inches long, which is bent to the shape shown, both arms as close as possible together. A small hole is drilled in the top of the bent tube to insert two pieces of wire, No. 30 platinum. Length of platinum wire one inch and three-quarters inside each arm of the tube. Two carbon pencils, well fitted to the tube and one inch and a-half long, connected on the flat end to a copper wire of No. 12 thickness, are now inserted into the tubes, the points toward the platinum wires, leaving one quarter inch space between the carbon points and the ends of wires. The tube is now warmed, and the air expelled, and quickly sealed and cemented with any fire-resisting cement. The two platinum wires are one pole, the two carbon wires the other pole, to be attached to the battery or magneto-machine power. The light so obtained is very brilliant, steady, and clear, having many advantages over the two-point carbon burner, and dispenses with the costly regulator. How far the success of the new burner can be estimated is not known, and must be proved by longer experiments, but as at present it is worthy of adoption and improving in this direction. A bell-shaped globe is better than a round one.—*F. E. Fahrig, in English Mechanic.*



FAHRIG'S BURNER FOR ELECTRIC LAMP.

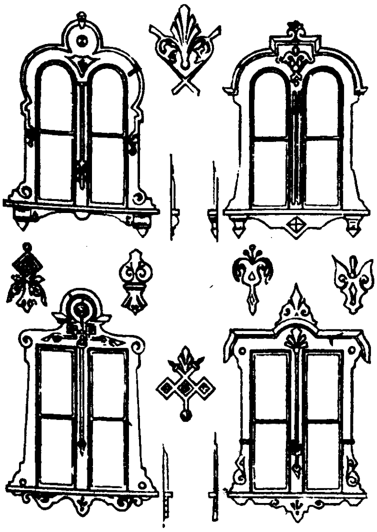
THE ELECTRIC LIGHT IN FACTORIES.—Mr. J. Lloyd Haigh, the contractor for furnishing wire for the East River Bridge, has made a contract for lighting his works in South Brooklyn with electricity. He calculates that he will ultimately save a large percentage of his gas bills by the change. One electric light is to be placed in the middle of the street to afford better light to workmen passing to and from the different buildings of the factory. Mr. Haigh was the first to use a telephone between New York and Brooklyn.

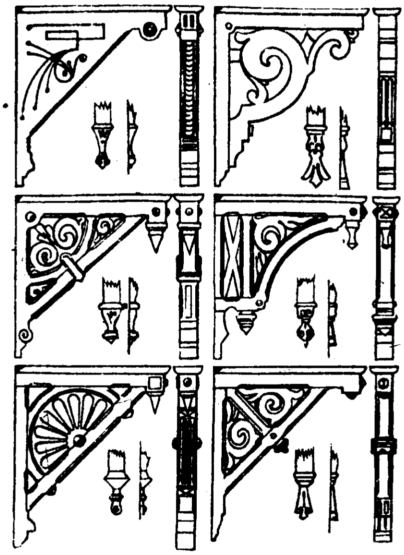
THE electric light has been introduced into some of the London theatres. Several foci of light are produced through one machine, and these can be made to burn independently of one another. The expense of the motive power and the carbons used in the lamps will, it is believed, enable a light to be produced at about half the cost of gas. The strong light is said to be admirably adapted to bringing out stage effects, and the experiments have been satisfactory.

NON-TRANSPARENCY OF FLAME.—It has been commonly believed that flame is transparent. Some observations have lately been made by M. Van Eyndhoven on the flame of a bat's-wing burner with one of Sugg's photometers, and he found in two experiments a difference of 1·5 candles, or 17 to 18 per cent, between the narrow and the broad side of the flame—the latter giving most light; whence he infers that the flame is not transparent. For this reason the entire luminous power is not obtained from an Argand burner. For good street lighting, the slit of the burner and the direction of the street should be at right angles to each other.—*Eng. Mech.*

HOUSE CARPENTRY.

MINIATURE DESIGNS.





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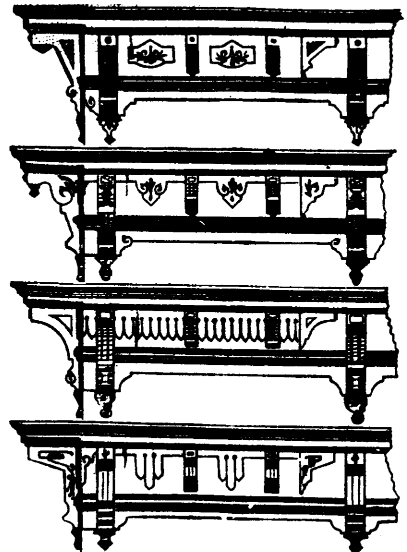
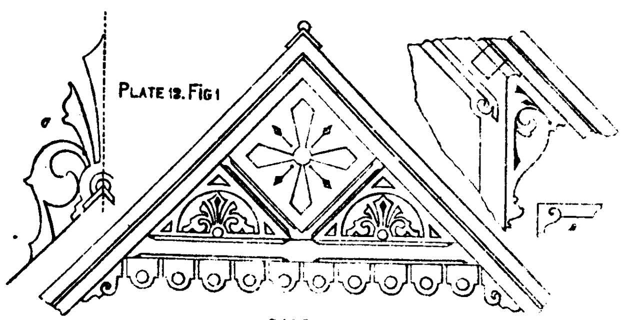
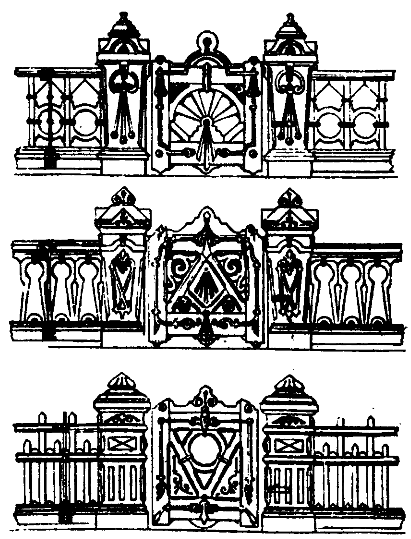


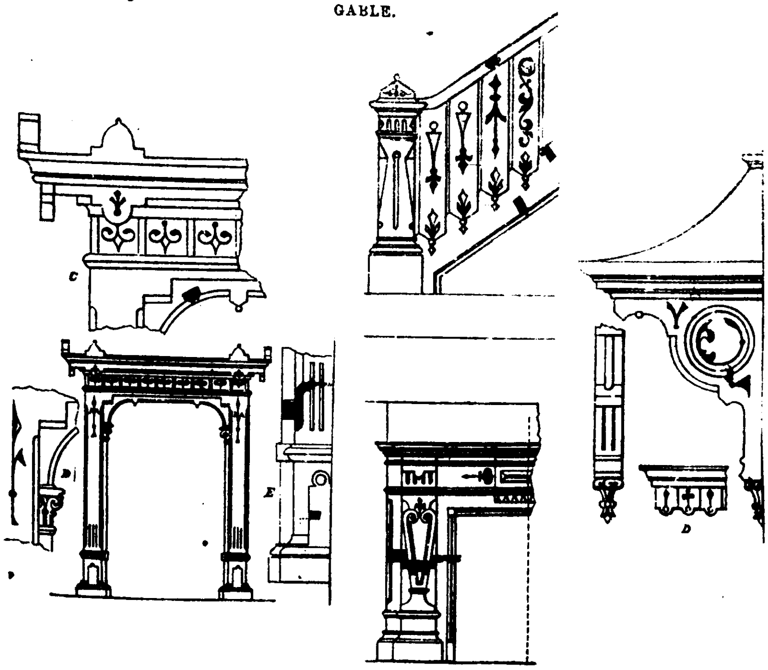
CORNICES.

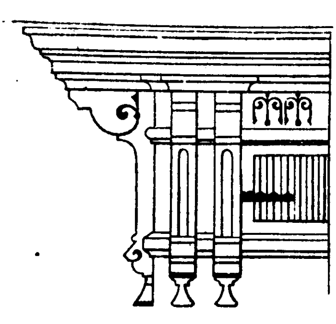


GABLE.



GATES AND FENCES.

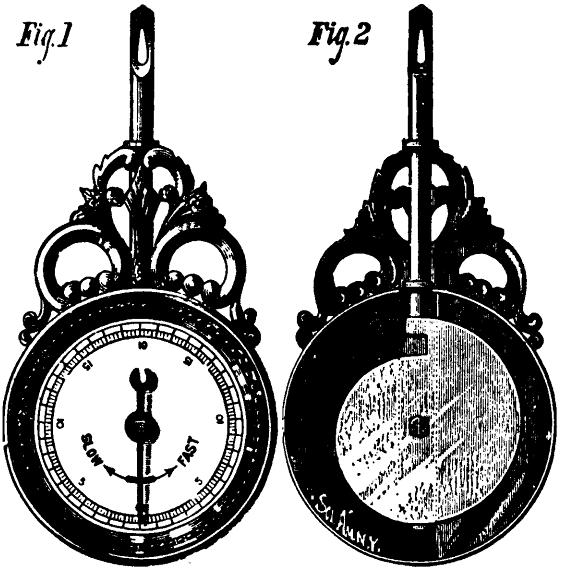




Horology.

New Regulating Attachment for Clock Pendulums.—We illustrate herewith, in two figures, a novel and ingenious device for regulating clock pendulums, recently patented by Mr. H. C. Jacot, of St. Louis, Mo. An arbor passes through the center of the pendulum ball, and is squared at each end to receive at the front an index, as shown in Fig. 1, and at the back a cam, which engages a lug on the extreme lower end of the pendulum rod, Fig. 2. The index moves over a small dial, which is gradu-

Fig. 1 Fig. 2



JACOT'S REGULATOR.

ated so that each number corresponds to one minute per day, so that by turning the index in one direction, the pendulum ball is lowered and the movement of the clock is retarded; by turning it in the opposite direction, the ball is raised and the movement accelerated. The key that is used for winding the clock is adapted to the regulator. This regulator is not only very useful, making the adjustment of the pendulum simple and positive, but it also adds greatly to the appearance of the clock, being itself an ornamental object.

Repairing Loose Watch Covers.—Some of our watchmaking readers may get a hint of value in the following, which we quote from *Art-Industry*, a neat journal which has arisen from the ashes of the *Silversmith and Watchmaker:* If the rims of hunting-cases become so worn by the friction of the springs that they will not close tightly, or not stay closed at all, the trouble can often be remedied by undercutting the rim at such an angle that the spring will draw the case tight. It is difficult to do this neatly with a graver or other hand tool, and the ordinary steel ratchet-wheel, taken from the material box and mounted on the lathe as a cutting-burr, will be found more to the purpose. A wheel should be selected with very fine teeth; and, if not hard, it should be hardened the same as any other cutting-tool, and mounted on the live spindle in the most convenient manner. This burr will cut and finish a square hole in a main-spring so narrow as to be difficult to punch, besides saving the risk of breaking small files in finishing the hole; the spring to be cut should be bent backwards, so that the hole will not be cut too long. It will also cut a solder from the grooves in spectacles after mending, and do a hundred other little things that no file will do.

The inventor of the luminous clock-dials, of which so much has been itemized in the newspapers, appears to be W. H. Balmain, and his secret consists in mixing a phosphorescent salt with paints and varnishes, which will store up light during daylight, and give it out at night. He uses a mixture of lime and sulphur.

Notes and Clippings.

Important Improvement in Dentistry.—Mr. Toomey, of Rathbone-place, Oxford street, is just introducing an invention by means of which persons residing at a distance can, without a journey to London, be fitted with false teeth. The invention consists of a small tray so arranged that on putting it into the mouth and closing the teeth, a complete model of the mouth is obtained. The inventor declares that nothing more than getting this model could be done if a visit were made, and nothing more is required by the dentist in order to make and fit any number of teeth. The plan hitherto adopted in taking models of the mouth has been to take the top and bottom jaw separately, and it will be at once seen that any deviation from the usual way of closing the mouth causes the teeth to fit badly, if not to utterly fail in answering the purpose for which they are required. This, we are assured, is quite done away with by means of Mr. Toomey's invention, as both the top and bottom sets are taken simultaneously, and it is almost impossible to fail in getting the straight "bite," so essential to secure perfect comfort and fit in artificial teeth. It is a difficult matter to get skilfully treated in many places at a distance, and as good workmanship and materials may be relied on, Mr. Toomey's ingenious invention will doubtless be largely patronised.

A New Treatment for Consumption.—The *Medical Record* gives the following: The theory of cure is to clear the lungs by a mechanical effort, chiefly by manipulating the muscles of the throat so as to cause more forcible breathing; second, to establish perfect digestion; third, to promote a process of healing the tubercles, so that they shall become chalky or calcified masses; fourth, to compel the patients to take plenty of fresh air, sunlight and outdoor exercise. To secure perfect digestion a special diet is ordered in each case, and the food is changed as the power of assimilating it improves. To promote the calcifying of the tubercles the salts of lime, which are found in most vegetable and animal food, must be supplied in a soluble condition; the theory is that too much heat in ordinary cooking destroys the natural combination of these salts with albumen and renders them insoluble to a weak digestion. Outdoor exercise is regarded as so important that the patients are instructed to go out in rain, snow, dampness, or even night air or dew, the habit thus acquired neutralizing the danger of catching cold from such exposure. Only strong head-winds and extreme hot weather need be guarded against. The patients sleep with the windows open, summer and winter.

The Mechanical Chess-player.—Mr. Gumpel's figure, Mephisto, of which we took a description from *Iron*, about five months ago, is now to be seen at the Westminster aquarium. His inaugural sitting was attended by a number of prominent players. Mephisto is unaltered in appearance, but is clad in a new and gorgeous dress. An important improvement, however, has been made in the board and men, which now approach nearly the ordinary Staunton pattern. No pressure is now required on the squares involved in the moves, but they may be made quite silently, and are fully observed by the unseen manipulator of the mechanism. This adds much both to the interest of a game and to the difficulty of penetrating the inventor's secret. The ingenuity of the contrivance is not only beyond question, but deserving of the highest praise. Its usefulness may possibly be doubted, but Mr. Gumpel, says *Iron*, is certainly entitled to the credit of having produced the most intellectual-looking machine we know of.

Inebriated Jelly Fishes.—At the recent meeting of the British Association at Dublin, Mr. Romanes read a paper to prove that jelly fishes are endowed with a nervous system. Among other experiments he told how he had made some drunk by pouring some whisky into a vessel in which they were kept. The effects were most demoralizing. The previous sober swimming motions became highly excited and hilarious, and the animals tumbled about in a rollicking manner. Later on, a drowsiness began to come over them, and eventually they subsided to the bottom of the vessel in a state of beastly drunkenness. They recovered rapidly when removed to fresh water.

The notion that ice purifies itself by the process of freezing is not based upon trustworthy observation. On the contrary, it is utterly wrong in principle to take ice for consumption from any pond the water of which is so foul as to be unfit for drink.

A New Poison for Rats and Mice.—At the Zootechnical Institute, in connection with the Royal Agricultural Academy at Prokau, a series of experiments has been carried out upon the comparative activity or inactivity of the various poisons most commonly employed for the destruction of rats, mice, and other rodents. The result of these are now published by the director of the Institute, Dr. Crampe. Of all the materials experimented with, the most efficacious proved to be precipitated carbonate of baryta. This occurs as a heavy, fine, white powder, devoid of taste or smell, and can be purchased at any ordinary drug store. In the experiments of Proskau, a portion of it was mixed with four times its weight of sound barley meal, and made into stiff paste with water, and small pellets of the soft cake introduced into the holes of rats, house mice and field mice. One great advantage of this preparation is that the smallest quantity of it proves fatal. Further, it appears to cause immediate and complete paralysis of the hind extremities, so that it may be assumed that mice eating of it in their holes will die within them, and so not prove destructive in their turn to domesticated animals that might otherwise devour the carcases. It was found in practice that neither fowls nor pigeons would touch the paste, either in its soft state or when hardened with the sun, so that its employment is probably free from danger to the occupants of the poultry yard. Some rabbits, on the other hand, that got access to the paste, ate heartily of it, and paid the penalty with their lives.

[The remedy is as bad as the disease. As the probability appears to be that the rats or mice become so soon paralyzed, they would be just able to creep into their holes and there die, and cause putrid smells in the house.—Ed. S. C. & M. M.]

Scientific Reliance on Soap.—Dr. Richardson lectured recently in this city on the germ theory of disease. He acknowledged his obligation to Tyndall for his microscopic investigation on air dust, spores and other comforting and salutary topics. It is worth while for common people to learn that 50,000 typhus germs will thrive in the circumference of a pin head or a visible globule. It is worth while for them to note that these germs may be desiccated and be borne, like thistle seeds, everywhere, and, like demoniacal possessions, may jump noiselessly down any throat. But there are certain things spores cannot stand, according to the latest ascertained results of science. A water temperature of 120° boils them to death, and soap chemically poisons them. Here sanitary and microscopic science come together. Spores thrive in low ground and under low conditions of life. For redemption, fly to hot water and soap, ye who live in danger of malarial poisoning. Hot water is sanitary. Soap is more sanitary. Fight typhus, small-pox, yellow fever, and ague with soap. Soap is a board of health.—*Philadelphia Press.*

The Spinal Cord.—One of the most remarkable cases in the history of surgery is that of ex-Sheriff Van Blascom, Hackensack, N. J. He was thrown from a buggy and had his neck dislocated. Few, if any, cases are on record where such an accident did not result in instant death. The spinal cord is the main channel of vital force, and in dislocations of the neck is either ruptured or so injured that all organs cease to act immediately. In Van Blascom's case the spinal cord may have been disarranged sufficiently to have produced unconsciousness, which, had it continued, would have resulted in death. The dislocated bone, however, was set, when the patient immediately returned to consciousness. In other words the spinal cord, not having been materially injured by displacement, continued its functions as soon as returned to its normal position. The case is not only a curiosity in surgery, but also a suggestive element in the problem of life.

Deep-sea Soundings. — Commander W. S. Schley, of the United States steamer "Essex," has recently reported to the secretary of the American navy that he has successfully run a line of soundings from St. Paul de Loanda, Africa, to Cape Frio, Brazil, *via* St. Helena. The greatest depth found between Africa and St. Helena was 3,063 fathoms, or 18,376 feet; and between St. Helena and Brazil the greatest depth was 3,284 fathoms, or 19,704 feet (nearly 3¾ miles). The soundings taken eastward and westward of St. Helena exhibit in profile that that island stands almost perpendicular in nearly 12,000 feet of water. After leaving the coast of Africa there is an abrupt descent of 900 fathoms in the first sixty miles from the coast, deepening up to 3,000 fathoms in a distance of about 700 miles, whence to St. Helena gradual reductions in depth occur, and an entire change takes place in the character of the bottom from mud to coral, rock, and sand.

Prize for a Milking Machine.—The Royal Agricultural Society of England has offered this year a prize of $250 for an "efficient milking machine," an implement of which Prof. Sheldon, of the Agricultural College of Cirencester, thinks dairy farmers at the present time stand most in need. He considers a milking machine one of the knottiest problems which inventive genius has got to solve, the difficulty being to combine motive power with the adaptability of the machine to all kinds of teats and udders, and which to be really valuable, must enable a man to milk 15 cows within the hour—milk them cleanly and thoroughly, and without injury to the udder or teat of the cow. The *American Dairyman* thinks the inventive genius of our Yankee nation will be found equal to the problem, and as so much has already been accomplished in this direction, its solution is not likely to be very far in the future.

Estimation of Iron as Ferric Oxide.—Mr. Sergius Kern, M. E., writes to the *Chemical News* touching the collection of the hydrated ferric oxide, and gives notice of the method used by himself, as it has been remarked that in certain laboratories this flocky precipitate is collected on paper filters—a very tiresome operation. In order to collect this precipitate, a thin platinum funnel is used. The tube of the funnel is closed by asbestos wool, previously ignited and weighed. The solution is next filtered, the precipitate washed. The funnel is then placed on a sand-bath, and when the precipitate is dry the bottom part of the funnel tube is closed by means of a platinum stopper, and the whole is next ignited and weighed. Knowing the weight of the asbestos and of the funnel, the weight of the ferric oxide may be calculated. In this way the weight of many flocky precipitates in a dry state may be estimated in a quick and convenient manner.

Unprofitable Agents.—A late Commissioner of Patents calls attention to a prolific source of disappointment and loss to inventors from incompetent patent attorneys, as follows: "A large percentage of the cases filed in the office are prepared by men who have little knowledge beyond mere forms. These are often subordinates dismissed from the office or from private firms for incompetency, or draughtsmen, or model makers. Specifications filed by these attorneys are frequently so imperfect and obscure as to be unintelligible and utterly unfit for publication, and the preparation of these cases increases the labor of the examiners, and are a fraud upon the inventors. Inventors are particularly cautioned against men who claim to have special facility in the office, or who intimate that money may be used to hasten or assure the allowance of their cases."

Phlegm in Throat.—I have suffered from this for years, and have never found any relief in medicine. The only method I have found of service has been to gargle the throat every night and morning with cold water. This loosens the tough tenacious phlegm, and enables one to spit it up. The practice has now become a habit with me, and I could not go to bed comfortably without doing it. Sometimes it is necessary to get up in the night to gargle, sometimes, also, in the course of the day — in fact, whenever the accumulation becomes troublesome. The plan has never failed to give me ease, and I recommend it with confidence. Perseverance and regular living, of course, are necessary.

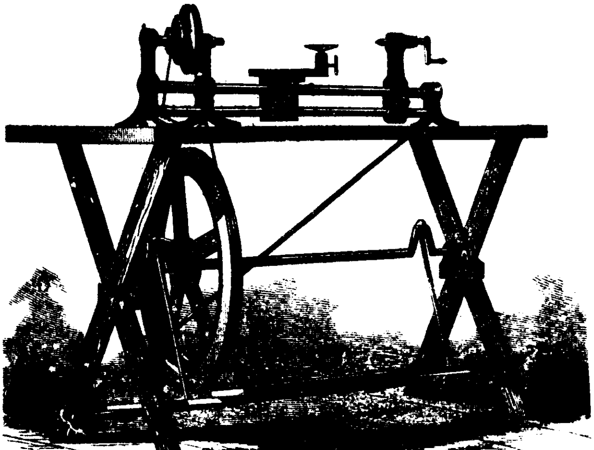
Lining for Boilers.—Mr. Franz Buettgenback gives the following recipe for the preparation of a coating for the inner surface of boilers to prevent the formation of scale. Gradually dissolve 5 pounds of a mixture of 25 parts of colophonium, 2½ parts of graphite, and 2½ parts of lampblack in 40 pounds of boiling gas tar, adding about one pound of tallow. The solution is diluted with about 50 per cent. of the petroleum and applied in a warm state. It has a pungent smell and should be put on rapidly, the precaution of using closed lanterns being necessary. Its effect is to cause the scale to come off in large flakes when picked.

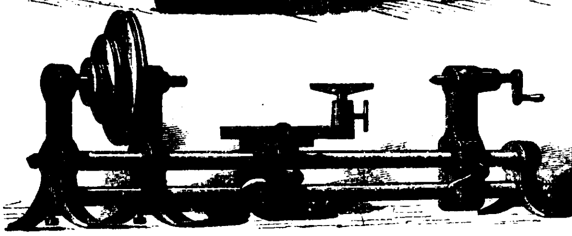
Mr. A. S. Wilson presents the following facts to show the marvellous industry of bees. Approximately 100 heads of clover yield 0·8 gram of sugar, or 125 heads give 1 gram of sugar, and, therefore, 125,000 heads 1 kilogram of sugar. As each head contains 60 florets (125,000 × 60), not less than 7,500,000 flower tubes must be emptied of their honey to obtain 1 kilogram of sugar. The honey may roughly be estimated to contain 75 per cent. of sugar, and hence we have 1 kilogram, equal to 5,600,000 flowers in round numbers, or 2,500,000 visits for one pound of honey.

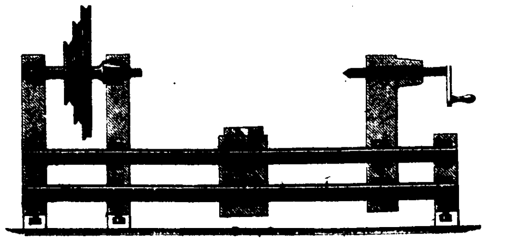
Amateur Mechanics.

THE LATHE.

For amusement, exercise, and profit we commend, to those who are mechanically inclined, the practice of working with tools of the smaller sort, either in wood or other of the softer materials, or in metals, glass, or stone. This practice renders the hands dexterous, the muscles strong, and the head clear, with the further advantage of producing something for either ornament or use. Of course, a bench with a vise and a few wood-working and iron-working tools will be required; but the most expensive as well as the most essential tool is a lathe. With this tool, not only turning in wood, metal, ivory, rubber, etc., can be accomplished, but it may also be used for screw-thread cutting, gear cutting, drilling metals, boring wood, spinning metals, milling, sawing metal and wood, grinding, polishing, moulding, shaping, and other purposes. A first-class plain lathe







of small size cannot be purchased for less than $50 or $60, and one of inferior quality will cost $20 to $30.

While the purchase of a lathe is recommended, there may be many who would prefer to make one. A lathe that will do admirably, and which may be easily made, is shown in the accompanying engravings, Fig. 1 representing in perspective the lathe complete; Fig. 2 is a perspective view of the lathe without the table; Fig. 3 is a vertical longitudinal section of the lathe, showing the manner of securing the head and tail stocks to the bars which form the bed or shears.

In making this lathe one pattern only will be required for the two standards of the head stock, and the support of the ends of the bars. The lower part of the tail stock is made in two parts, so that they may be clamped tightly together on the shears by means of the bolt that passes through both parts, and is provided with a nut having a lever handle. The rest support is also made in two parts, clamped together on the ways in a similar way.

The patterns may be easily sawed from $1\frac{1}{4}$ inch pine. The holes that receive the round bars should be chambered to receive Babbitt metal, used in making the fit around the bars forming the shears, around the head and tail spindles, and around the shank of the tool rest. The smallest diameter of the holes that receive the round bars should be a little less than that of the bars, so that the several pieces that are placed on the bars may be fitted to hold them in place while the Babbitt metal is poured in.

The dimensions of the lathe are as follows:

Length of round bars forming shears, 24 inches; diameter of bars, 1 inch; distance from the upper side of upper bar to centre of spindle, 3 inches; between bars, $\frac{3}{4}$ inch; between standards that support the live spindle, $3\frac{1}{2}$ inches; size of standard above shears, $3\frac{1}{4}$x$1\frac{1}{4}$ inch; diameter of head and tail spindles, $\frac{3}{4}$ inch; diameter of pulleys, 5 inches, $3\frac{1}{2}$ inches, and 2 inches; width of base of standards, 5 inches; height of standards, 7 inches.

The live spindle should be enlarged at the face plate end, and tapered at both ends, as indicated in the engraving.

The pulleys, which are of hard wood, are made of three pieces glued together, bored, and driven on the spindle, secured by a pin passing through both it and the spindle, and turned off. The bars forming the shears may be either cold rolled iron or round machinery steel; they will require no labor except, perhaps, squaring up at the ends. The castings having been fitted to the bars, and provided with set screws for clamping them, the two standards that support the live spindle and the support for the opposite end of the bars are put in position, when the bars are made truly parallel, and a little clay or putty is placed around each bar and over the annular cavity that surrounds it, and is formed into a spout or lip at the upper side to facilitate the pouring of Babbitt metal. The metal must be quite hot when poured, so that it will run sharp and fill the cavity. To guard against a possible difficulty in removing the castings from the bars, it might be well to cover the side of the bar next the screw with a thin piece of paper. The pieces of the tail stock and tool rest support are fitted to the bars by means of Babbitt metal, the metal being poured first in one half and then in the other. The bolts which clamp the two parts of the rest support and tail stock together are provided with lever handles. After fitting the parts to the two bars by means of Babbitt metal, the tail spindle, which is threaded for half its length, is placed in the tail stock parallel with the bars and Babbitted. A binding screw is provided for clamping the tail spindle, and the spindle is drilled at one end to receive the center, and has at the other end a crank for operating it.

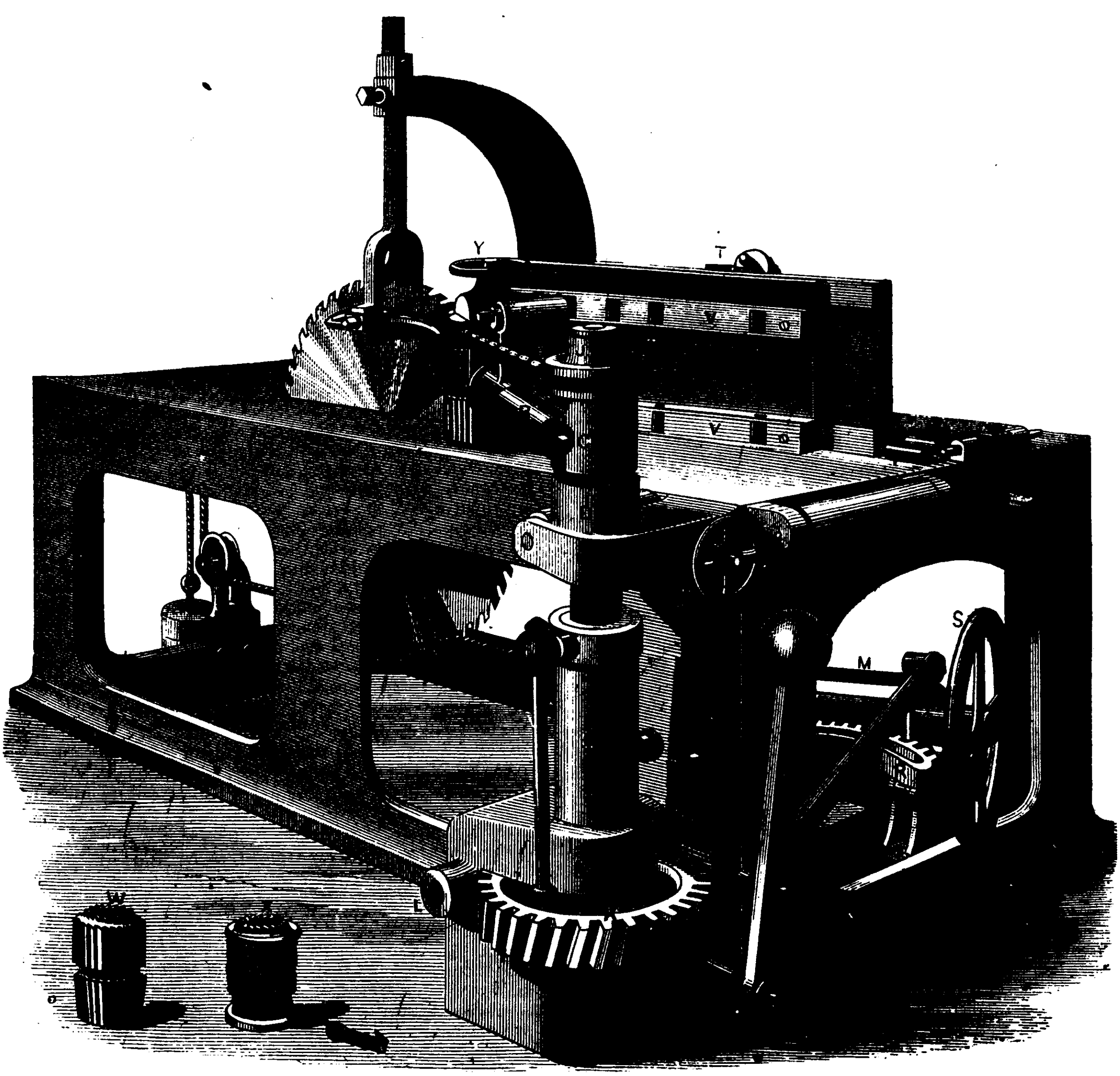
A steel or bronze button is placed in the hole in the stand, and that supports the smaller end of the live spindle, and the spindle is supported in its working position and Babbitted.

The thread on the spindle should be rather coarse, so that wooden or type metal face plates and chucks may be used.

The table shown in Fig. 1 is simple and inexpensive. It consists of two pairs of crossed legs halved together and secured to a plank top. A small rod passes through the rear legs near their lower ends, and also through a piece of gas-pipe placed between the legs. A diagonal brace is secured to the top near one end, and is fastened to the lower end of the rear leg at the other end of the table.

A block is secured to each pair of legs for supporting a pair of ordinary grindstone rollers, which form a bearing for the balance-wheel shaft. This shaft has formed in it two cranks, and it carries an ordinary balance wheel, to the side of which is secured, by means of hook bolts, a grooved wooden rim for receiving the driving belt. The cranks are connected, by means of hooks of ordinary round iron, with a treadle that is pivoted on the gas-pipe at the rear of the table. The shaft will work tolerably well, even if it is not turned. The cranks must have half round grooves filed in them to receive the treadle hooks. The size of the different diameters of the drive wheel may be found by turning the larger one first and the smaller ones afterward, using the belt to determine when the proper size is reached. The wooden rim may be turned off in position by using a pointed tool.

The lathe above described, although very easily made and inexpensive, will be found to serve an excellent purpose for hand work, and if the holes, instead of being Babbitted, are bored, and if the bars forming the shears are turned, the lathe may be converted into a kind of engine lathe by placing a feeding screw between the bars, and putting a small tool post in the rest support.—*Scientific American.*



CASSON'S SAW BENCH WITH STEADYING APPARATUS.

We give herewith a perspective view of a circular saw bench made by Messrs. Oliver & Co. (Limited), of Chesterfield, England, which we take from *Engineering*. The chief features in this machine are that it is fitted with Mr. John Casson's patent feed gear and apparatus for steadying the saws. This feeding arrangement has now been in use some years, and has been fitted to a very large number of circular saw benches. This being the case, and the arrangement being very clearly shown by our engraving, it will be unnecessary for us to describe it in detail here.

The saw-steadying apparatus, with which the saw bench we illustrate is fitted, is a novel arrangement, recently patented by Mr. Casson ; in the present case it is applied to two saws.

The steadying arrangement consists of accurately fitted sliding jaws mounted on the arms of a forked support, so that they can be moved and adjusted only by fine threaded screws, the jaws having their surfaces next the saws, accurately parallel with the plane of the collar of the saw spindle ; these jaws, A, are fixed when the adjusting screws are at rest, and they are faced with strips of greenheart or other suitable timber, secured by countersunk screw bolts, these faces forming a perfectly true guide for the saw blades.

For a single saw the guides just described would suffice ; but for two or more saws the outside guides must be supplemented by others between the saw blades.

It will be noticed that the support, F, carrying the guiding jaws, has a square stem sliding through the head of a suitable standard, and it can be readily fixed at any desired height by means of the set screw.

The arrangement we have been describing is well carried out, and there can be no doubt that it will do good service, and enable thin saws to be efficiently used with a heavy feed. We have received very satisfactory reports of its performances.

MOLTEN CARBONATE OF SODA IN PUDDLING.—The *Iron Age* translates from a French authority an account of the efforts which E. Vanderkeyn has made to use molten soda in puddling. He states that the main benefit to be derived is the elimination of silicon, especially from coke irons, and that experience has taught him that 2½ times the amount of silicon in carbonate of soda is sufficient. The best time to charge the alkali is 3 or 4 minutes before the iron comes to nature, care being taken to close the damper so that the powdery material is not carried off by the draft. Mr. Vanderkeyn has also found that phosphorus and sulphur are reduced in amount, and he considers the manufacture of high-grade iron from ordinary pig possible by the use of alkalies. Inferring from experience in the metallurgy of another metal, we would add that the purifying action of molten caustic alkalies is still more energetic.

Scientific Items.

DECORATING TIN SURFACES.

The peculiar effects produced by the surface crystallisation of tin have been often employed in the decoration of metallic articles, especially when made of what is known as tin-plate, tinned sheet iron, and tinned brass. It appears that when the effects are produced by means of acids, although very beautiful, they soon get dull, and the work is, moreover, irregular. Mr. L. Q. Brin, of the Borough, Southwark, has patented an improved process, the essential feature of which consists in the cooling of the metal in fusion on the surfaces of plates by the action thereon of air, water or steam; these agents being employed under pressure varying according to circumstances. The air and water may be cooled in their passage before touching the plates, and the steam may be superheated. These agents—water, air or steam—act as cooling agents, and, at same time, as regulators of the designs formed in the crystallisation. Employed under varying pressures they are easily directed, and for the same reason they are caused to act by jets as large or small as may be required, and in this way names, letters, and devices of varying descriptions are capable of being produced, the effects of which are very good. Plates treated according to the invention may be subsequently coated with varnishes, and be coloured or not, as desired. The machinery employed by the patentee consists of an air-pump, which is in communication with an air-receiver or vessel or vessels for containing compressed air, and adjacent to the air-vessel there is a water-vessel; these two vessels are in communication with a chamber or frame in which the plates to be treated are placed; the design or pattern required is formed on the frame cover. Communication between the air and water-vessels and the frame is made or cut off by taps. The plate frame is supported in a trough, which is provided with inlet and outlet pipes. Conveniently situate with respect to the plate frame there is a gas or other suitable furnace or apparatus for heating the plates to be treated. The following is the modus operandi when treating sheets or plates of pure tin:—The sheets of pure tin are laid on a plate of cast iron, which is heated slowly until the tin begins to melt. The plate of iron supporting the tin plate is heated and treated as the coated plate, and cooled in a similar manner. After this operation they are placed in a bath described, similar to those used for coated plates. To fix them to paper they are allowed to dry, and are fixed by means of gum and pressure so as to render them very adherent to the paper. The metal-coated sheet is placed on a gas furnace until the tin is in a complete state of fusion. As soon as the surface is liquid, which is easily seen, the sheet is, by means of pincers arranged for this purpose, immediately placed at the top of a chamber which is provided with supports to receive it. As soon as it is in place the valve is opened, and water entering under pressure is forced to escape by the orifices formed in the upper plate of the chamber. If air is employed, it is used in the same way as water. If air has been compressed by means of a blower or rotary fan the effects are different, but the mode or method of employment is the same. The plates are then cleaned in an acid bath consisting of, say, the following ingredients in or about the proportions named:—10 parts each of nitric, sulphuric, hydrochloric and oxalic acids, and 60 parts of water; or a bath composed of nitric acid, 2 parts; hydrochloric acid, 4 parts; and distilled water, 12 parts; or a bath of sea-salt, 10 parts; distilled water, 90 parts; oxalic acid, 10 parts. The bath is intended to uncover the angles of crystallisation. The plates are then thrown into fresh water, and subsequently are varnished, if desired. The effects produced and the designs are then brought out with effect. When steam is used it is applied in a similar manner to that of the air, but produces different results in the designs. If it is desired, immediately after the tinning of the plate, as soon as it comes out of the tin bath, it is immediately cooled and treated as before described, as if it had come from the gas or other heating apparatus. The effects will be only more brilliant and more regular with a working economy of at least 50 per cent.

VEGETABLE ivory is the hardened kernal of the nut of a species of palm of which there are several kinds. The Brazilian palm (*phytelephas macrocarpus*) grows freely in Central America and Peru, and yields what is known as the corsos nut of commerce. When shipped, the kernals are quite milky and soft, like white wax, and during the voyage they ripen and become hard. The nut is chiefly used for making buttons and other small articles.

LEATHEROID.—The *American Manufacturer* says that a new chemical product has just been brought out at Wheeling, West Virginia, under the name of leatheroid. This name was selected by its inventors on account of its resemblance to leather. It is made of two varieties, one being soft and flexible like leather, the other hard like gutta-percha or vulcanized rubber, resembling those materials in its density, strength and hardness, and like them is susceptible of a very high polish. The leatheroid is manufactured from vegetable fiber by a chemical process which is patented. It is made in sheets of 12 feet in length by 4 feet in width, and can be made of any desired thickness, from one-hundredth of an inch to one inch. The leatheroid has been thoroughly tested as a substitute for leather in the manufacture of trunks and washers, for gutta-percha in combs, napkin rings, etc., for tin and iron in roving cans and bobbin boxes for cotton mills, for whalebone in whips, for copper in shoe tips, for wood in chair seats, and also used in the manufacture of friction pulleys for machinery cams, and in fact there seems to be no end to the uses to which it can be applied. Leatheroid can be made of any color, though it is usually made brick red to imitate leather or vulcanized rubber; black, which is used in the manufacture of combs and canes; and walnut, which is used in chair seats.

SMOKE-BURNING FURNACE.—From Cleveland comes the report of a successful smoke-burning furnace, the invention of Dr. S. G. Clark. At the rear of the grate-bars is a small auxiliary furnace with grate and ash-pit. Over this rear furnace is thrown an arch of fire-brick, the base of the arch resting against the bottom of the boiler. The coal is fed in the usual way at the front of the furnace; as the smoke is burned off, the incandescent coal is gradually moved back toward the rear of the gratebars, where it falls with the cinders into the rear furnace. There sufficient air is admitted to cause a most intense heat immediately under the arch, where all the smoke and gases are instantly decomposed. One of these furnaces is now in successful operation in Newburg, at the Cleveland Steel Casting Works, near the crossing of the A. and G. W. and C. and P. railroads, who claim the saving of coal over the old setting to be 40 per cent.—*Cleveland (Ohio) Trade Review.*

EFFECT OF CONSTANT VIBRATION UPON IRON.—Shafts of side-wheel steamers and propellers sometimes break suddenly, and it is supposed that the constant vibration of certain qualities of apparently sound iron causes a crystallisation and loss of cohesion. Lately the steamer "City of Chester" was proceeding at an ordinary rate of speed in clear, calm weather, when, without a word of warning, two blades of her wheel dropped off simultaneously, crippling her at once. An examination of the remainder of the propeller will probably show again that the constant vibration had crystallised the metal, so that the wheel went to pieces all at once, like the deacon's "one-horse shay." The *Brooklyn* (N.Y.) *Eagle* suggests that this gradual crystallisation of iron is one of the dangers which threaten the elevated roads. How long the trestle-work will retain its strength of fiber under the ceaseless vibration it is called upon to endure, is a question which only costly experience will determine.

PUTTY FOR REPAIRING BROKEN WALLS.—The best putty for walls is composed of equal parts of whiting and plaster-of-Paris, as it quickly hardens. The walls may be immediately coloured upon it. Some painters use whiting mixed with size; but this is not good, as it rises above the surface of the walls, and shows in patches when the work is finished. Lime must not be used as a putty to repair walls, as it will destroy almost every colour it comes in contact with.

Another. Use plaster-of-Paris and white sand in nearly equal quantities, mixed with water.

INDELIBLE INK FOR MARKING LINEN.—Add caustic alkali to a saturated aqueous solution of cuprous chloride until no further precipitate forms; allow the precipitate to settle, draw off the supernatent liquid with a siphon, and dissolve the hydrated copper oxide in the smallest possible quantity of ammonia. It may be mixed with about six per cent. of dextrine for use. Before washing pass a hot iron over the writing.

HOW TO DESTROY CARPET BEETLES.—When these beetles have once taken possession of a carpet, it is very difficult to dislodge them. Cotton moistened with benzine, or preferably kerosene, and forced into the cracks of the floor, under the surbase, etc., has thus far proved the most effectual means of destroying them and preventing new innovations. The ordinary applications of camphors, pepper, tobacco, turpentine, etc., are powerless against it.

Alloy for Door Furniture.—It is stated that a very beautiful alloy, intended to replace brass in various ornamental uses, especially in window and door furniture, is composed of copper, tin, spelter, or zinc, and lead, which metals are transferred to the crucible in these proportions: tin $1\frac{1}{3}$ (say) 1 oz.; spelter or zinc, $\frac{1}{2}$ oz.; lead five-sixteenths of an ounce. These are the proportions the inventor prefers to use, as he has found them to yield excellent and satisfactory results, but he does not intend to confine himself rigidly to the precise proportions named, as they may, perhaps, be slightly varied in some particulars without detracting from the beautiful color of the alloy which it is intended to produce. The molten metals are kept well stirred, and any impurities therein removed. When thoroughly mixed, this alloy, which is termed the first alloy, is poured off into ingot moulds and left to cool. Copper in the proportion of eight parts to one of this first alloy is then placed in the crucible and brought to a melting heat, when the tin, or first alloy, is added and intimately mixed with the copper, for which purpose the molten mass must be well stirred for several minutes. It is then poured into ingot moulds for sale in the form of ingots, or it may be poured into pattern moulds, so as to produce the articles required. This is the mode of manipulation which it is preferred to employ, as an opportunity is thus afforded of removing any impurities from the first alloy before mixing it with the copper, but all the metals may, if preferred, be mixed together in the proportions given, and melted at one operation.

It is pointed out that the factor of safety or stability of the Cleopatra Needle is too small. As it stands, it is already calculated to bear a pressure of 90 lbs. to the square foot, whereas the force of no hurricane is believed to exceed 25 lbs. to the foot. Mr. John Holden, architect of Manchester, recalls the fact that on the 7th day of February, 1808, the pressure registered at the Liverpool Observatory was over 60 lbs. to the square foot. The instrument, in charge of Mr. Hartnup, only registered up to 60 lbs., but his opinion was that the pressure reached between 70 lbs. and 80 lbs. to the square foot. At Liverpool, on the 27th of September, 1875, the pressure registered was 70 lbs. to square foot; and at the same place some time in April, 1867, the pressure was 45 lbs. At Sydney, Australia, on the 10th of September, 1876, the Government Astronomer reports "that the wind in some of the gusts lasting several minutes attained the extraordinary velocity of 153 miles an hour, equal to a pressure of 117 lbs. to the square foot; and during twelve minutes between twelve and half-past the velocity of the wind was 112 miles per hour." The question of the velocity and pressure of the wind is of great importance, especially in the manufacturing districts; and for many years the firm of which Mr. Holden is a member, in calculating the stability of factory chimneys, has assumed the pressure to be not less than 80 lbs. to 90 lbs. on the square foot. —*Engineer.*

Burning Green Wood Greatly Wasteful.—Water in passing into vapor absorbs and hides nearly 1,000 degrees of heat. A cord of green wood produces just as much heat as a cord of the same wood dry. In burning the dry wood we get nearly all the heat, but in burning the same wood green, from one-half to three-fourths of the heat produced goes off latent and useless in the evaporating sap or water. Chemistry shows this, and why, very plainly. Therefore get the winter's wood for fuel or kindlings, and let it be seasoning, as soon as possible, and put it under cover in time to be dry when used. It will, of course, season or dry much faster when split fine......A solid foot of *green* elm wood weighs 60 to 65 lbs., of which 30 to 35 lbs. is sap or water. As ordinarily piled up, if we allow half of a cord to be lost in the spaces between the sticks, we still have a weight of about two tons to the cord, of which fully one ton is water or sap. Such wood affords very little useful heat; it goes off in the ton of sap. The great saving of hauling it home dry is evident—as we get the same amount of real fuel for half the team work. Beech wood loses one-eighth to one-fifth its weight in drying; oak, one-quarter to two-fifths.

Water-Proof Cement.—1. Soak pure glue in water until it is soft; then dissolve it in the smallest possible amount of proof spirit by the aid of a gentle heat. In 2 ozs. of this mixture dissolve 10 grains of gum ammoniacum, and while still liquid add half a drachm of mastic dissolved in 3 drachms of rectified spirit. Stir well, and for use keep the cement liquefied in a covered vessel over a hot water bath. 2. Shellac, 4 ozs.; borax, 1 oz.; boil in a little water until dissolved, and concentrate by heat to a paste. 3. Ten parts of carbon disulphide and one part oil of turpentine are mixed, and as much gutta percha added as will readily dissolve. 4. Melt together equal parts of pitch and gutta percha, apply warm, and press the parts firmly together until quite cold. 5. The ordinary marine glue consists of caoutchouc 1 oz.; genuine asphaltum, 2 ozs.; benzole or naphtha, q.s. The caoutchouc is first dissolved by digestion and occasional agitation, and the asphalt gradually added. The solution should have about the consistence of molasses.

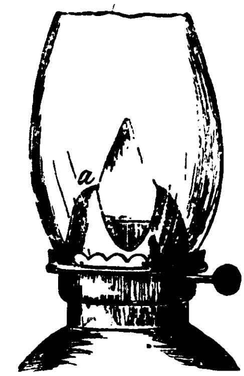


Fig. 1.

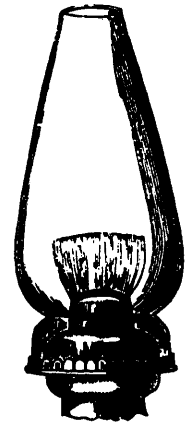


Fig. 2.

How Common Lamps Waste Light.—Did it ever occur to the reader, that most of the common lamps actually waste one-half or more of all the light produced, and are therefore doubly expensive? The flame gives off rays from its surface; but if we half cover the flame, half of the rays are intercepted and lost. This is just what is done in a majority of lamps. Figure 1 shows this. The metal cap, *a*, partly covers the flame; only the portion that rises above *a* gives out light to the room. In several of the lamps now made, this loss is saved by omitting the metal cap, and having the glass chimney set down below the bottom of the flame, as in figure 2. Such an arrangement is equivalent to saving half the expense of oil.—The Argand principle is of great utility. This is an arrangement for having a current of air pass up through the *centre* of a circular flame, furnishing oxygen to its interior. The combustion is much more intense, and the light correspondingly greater.

Mars' Satellites.—Last year some discussion took place as to the first mention of satellites to Mars. Voltaire was stated to be the originator of the suggestion, but Mr. Proctor claimed the honor for Kepler, and, writing to the *Times* the other day, he gives the passage Kepler wrote in 1610 to Wachenfels: "I am so far from disbelieving the existence of the four circum-Jovial planets that I long for a telescope to anticipate you, if possible, in discovering two around Mars, as the proportion seems to require six or eight around Saturn, and perhaps one each around Mercury and Venus." It was, says Mr. Proctor, from this suggestion, no doubt, that Voltaire and Swift borrowed their guesses, which, however, they present in such a way that some supposed they had really seen the satellites—an idea utterly inconsistent with possibilities, even if Kepler's original suggestion be overlooked.—*Eng. Mech.*

Volatilization of Arsenious Acid.—In chemical treatises there appear contradictory statements concerning the temperature at which arsenious acid gives off vapor. According to Thenard, volatilization begins at a cherry-red heat; according to Berzelius, if heated in open vessels, it softens and begins to sublime at incident redness. In the *Encyclopédie Chimique* it is said to soften and sublime under an ordinary pressure of 200° C. Wurtz gives the same degree, but without mentioning the softening to Wormley at 190° C. The author finds that it volatilizes at much lower temperatures, especially when assisted by the evaporation of a liquid in which it is contained. Under this circumstance, it is more or less volatile at temperatures ranging from 100°.

According to Mr. W. M. Preece, the British Post-Office Electrician, the telephone has not yet found much favor in England. It bids fair, he says, to be of use in some branches of telegraphy, but its progress has been disappointingly small. Its effects are feeble. It is too sensitive for practical use on existing lines. It requires complete quietude, not only in the air about it, but in the wires conveying its signals, and its employment has been checked by the outrageous terms demanded.

Machine Construction & Drawing.

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

CHAPTER I.

1. A DRAWING, as the representation of a machine, to be intelligible, should convey a correct idea of the size and proportion of the object represented, and, in most cases, of its several parts; also the various motions which the movable parts are capable of producing.

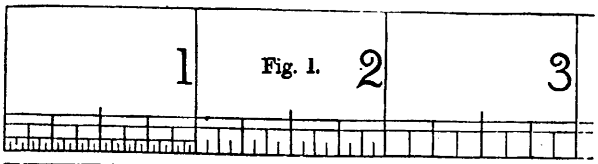
To make such a drawing of the same size as the machine, it is clear, in many cases, would be almost impossible; we therefore generally make our drawings to a reduced size, or, as it is termed, "*to Scale;*" that is, the drawing may be one-fourth of the size of the object, in which case we say, the drawing is to a scale of one-fourth, or 3 inches = 1 foot. However, to make this point clear, the subject of scales will be treated more fully further on.

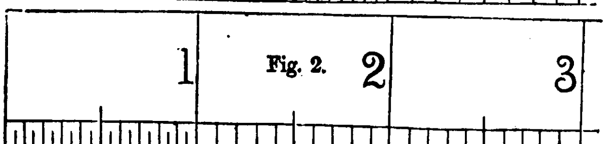
2. In drawings of machinery, approximations to the true form of some portions are often employed, and unfortunately too often by those unable to form a just approximation, owing to the want of a knowledge of those principles which are essential for the correct representation of objects. We therefore strongly advise all students to learn first how to draw correctly, so that they may be able to adopt approximations when necessary or advisable.

3. The standard of measurement used in this country is the *foot,* the one-third of the standard *yard;* this is divided into twelve equal parts, called *inches;* these are subdivided into 8, 16, 32, 64, &c., parts, and termed respectively *eighths, sixteenths, thirty-seconds, sixty-fourths,* &c., denoted by $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, &c., each subdivision being one-half of the preceding. It is usual to denote the size of an object by so many *feet, inches, eighths,* &c., as the case may be; this will be considered in the articles on *scales.*

In some engineering establishments the *decimal rule* is used, wherein the inch is taken as the standard, of which there are ten in each half of the rule, instead of twelve as in the *two-foot rule;* each inch in the decimal rule is divided into ten equal parts, these are again subdivided.

The common *two-foot* being the most used, we shall take our dimensions by means of it. Fig. 1 represents a portion of this rule; and fig. 2 the decimal rule.





CHAPTER II.

4. WE will now give the student a few hints on the use of the necessary instruments required for mechanical drawing, assuming that he possesses a drawing-board, a T-square, two set-squares, drawing-paper, a box of instruments, a scale, india-rubber, and pencils. One of the following sizes of board will be sufficient for present use,—2 ft. 4 in. × 1ft. 9 in., or 2 ft. × 1 ft. 6 in. The two set-squares should have angles 90°, 60°, and 30°, and 90°, 45°, and 45°, respectively (see figs. 3 and 4).

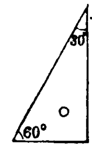


Fig. 3.

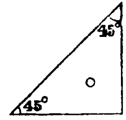


Fig. 4.

5. The drawing-paper for present use may be of a common kind, and fastened down by pins; convenient sizes of sheets are—*Royal,* 25 in. × 20 in., *Imperial,* 30 in. × 21 in. (using half-sheets). When the nature of the drawing demands it, a better kind of paper should be used, the most common being *Double Elephant,* 40in. × 26in.; the smooth is best suited for fine-lining and shading.* The box of instruments should contain at least—dividers, a set of large compasses with lengthening-bar, pen and pencil legs, small pen and pencil bows, a drawing-pen, and a protractor, also a few drawing-pins.

6. The drawing pencils best for ordinary use are, H, H H for fine work, and H B for sketching. Figs. 5 and 6 show how to cut the pencil for using with the squares and bow-pencil (this flat chisel-point will last a considerable time compared with the round point). A small smooth file or sand-paper is useful to rub the pencil upon.

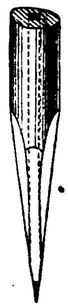


Fig. 5.

Fig. 6.

As our drawings are to be *inked-in,* the pencil lines should be fine, and made with as little pressure as possible; all lines should be drawn sufficiently long at first, so as not to require producing.

7. Lines parallel to the long edges of the drawing-board should be drawn with the T-square, as also lines at right angles to these, if longer than an edge of the set-square (see figs. 7 and 8).

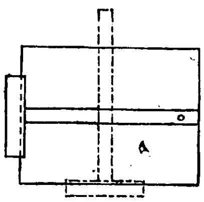


Fig. 7.

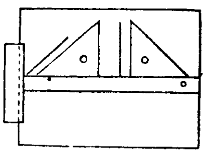


Fig. 8.

Lines not parallel to the sides of the board are best drawn by using the set-squares (see fig. 9), or T and set-squares; and lines at right angles to the one already drawn (whatever may be the position of that line) by reversing the set-square; in fig. 10 *ab* is the line first drawn, *cd* a line at right angles to *ab.*

Use the india-rubber as little as possible.

8. The following distinguishing lines will be used in this book,—Unbroken lines represent the form of objects, as *ab, bc,* &c., in fig 15.; if these lines cannot be seen from the fixed position in which we view them, they are shown by dotted lines, thus, - - - - -, as in figs. 15 and 16; these dotted lines are of the same thickness as the other lines of the object. Lines used to determine the form, or construction lines, are shown as dotted lines, ..., but not as thick as the former;* centre lines are shown thus, —.—.—; radius lines are shown thus, ←——→ dimension lines are shown thus, ←- - - - - -→

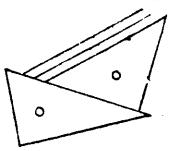
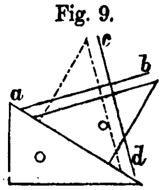


Fig. 9.



* If the drawing is to be coloured or shaded, it should be *stretched* and fixed with glue or gum and not with pins.

Fig. 10. Shade or *dark lines,* will be introduced and explained at a later stage.

The following notation will be used, one accent over a number, as $2'$, denotes feet; two accents, as $6''$, inches; thus, $1'..0\frac{1}{4}''$ means one foot and a quarter of an inch.

CHAPTER III.

9. Scales.—In fig. 11 let *a* represent a line two inches long, *b* one an inch long, and *c* one half-an-inch long; then if *b* represents a drawing of the line *a*, the scale would be $\frac{1}{2}$, or $6'' = 1$ foot; if *c* represents *a*, then the scale would be $\frac{1}{4}$, or $3'' = 1$ foot, and so on.

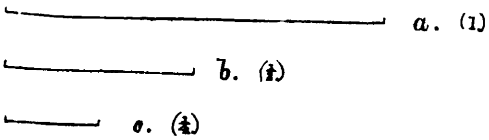


Fig. 11

10. When the scale is denoted by a fraction whose numerator is unity, as $\frac{1}{4}$, the denominator (in this instance 4) denotes how many times larger the object is than the drawing, the term larger to be used in the sense conveyed in the previous and following articles.

If the fraction is of the form $\frac{2}{3}$, the numerator being greater than unity, then we may consider the numerator as expressing how many units of length (feet, inches, &c.) there are in each line of the drawing, the denominator denoting the number of units in the object; for example,—a circle of $3''$ diameter if drawn to a scale of $\frac{2}{3}$ would be represented by a circle of $2''$ diameter.

11. The reduction in the size of plane objects, when drawn to scale, is to be made in all directions, thus the square, fig. 12, is of one inch side, a drawing of it to a scale of $\frac{1}{2}$ would be a square of $\frac{1}{2}''$ side, as fig. 13; one to a scale of $\frac{1}{4}$ would be a square of $\frac{1}{4}''$ side, as fig. 14.

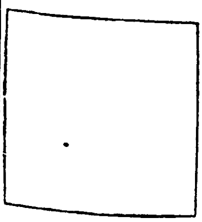


Fig. 12.

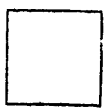


Fig. 13.

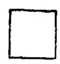


Fig. 14.

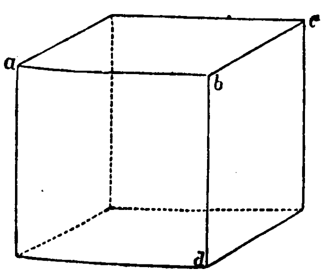


Fig. 15.

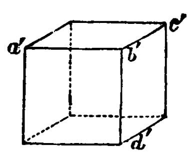


Fig. 16.

In the case of solid bodies, which is the most general one, the reduction in the size of the object, as represented in the drawing, is to be made in every direction,—for example, a cube of $1''$ edge, fig. 15, is required to be drawn to a scale of $\frac{1}{2}$, then every line in the drawing must be made one-half the length of the corresponding line of the object. Fig. 16 is a drawing of the cube to a scale of $\frac{1}{2}$, the lines $a'b'$, $b'c'$, $b'd'$, &c., being respectively one-half the length of ab, bc, bd, &c., in fig. 15.

CHAPTER IV.

13. We now pass on to consider the *first lines* to be made in a drawing, whether from a copy, a sketch of a machine, or from the rough sketch of a proposed machine.

First, as to the representation of surfaces. In all cases where a plane figure is symmetrical with respect to a given line, whether the line exists in the figure, or may be considered, for convenience, as existing in it, that line must be drawn first. For example, the circle in fig. 21 is symmetrical with respect to the lines *ab*, *cd*, these lines are to be drawn first, and the point of intersection, *o*, to be taken for the centre of the circle.

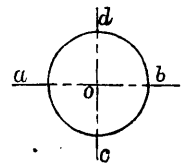


Fig. 21.

* The distance 0—12 *represents* a foot, but is really only $1\frac{1}{2}$ long.

CHAPTER V.

14. A drawing of any solid object is the projection of that object on one or more planes, giving one or more views of it. We will state what a projection is, and what are the names given to the different views. In fig. 25 ABCD is the horizontal plane (your drawing-

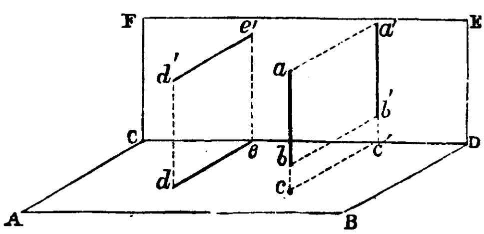


Fig. 25.

board, for instance); CDEF the vertical plane; let a line *ab* be held perpendicular to the plane ABCD (and therefore parallel to the plane CDEF) at a distance *bc* above it and in front of the plane CDEF. If now the line *ab* is produced to meet the plane ABCD in *c*, the point *c* is the projection of the line *ab*; * from *a*, *b*, draw lines perpendicular to the plane CDEF, meeting it in a', b', then a', b' are projections of *a*, *b*; and if a', b' be joined, the line $a'b'$ is a projection of *ab*. *c* is called a "*plan*," and $a'b'$ an "*elevation*" of the line *ab*. The two planes ABCD, CDEF, which are considered to be at right angles in fig. 25, are really one (the plane CDEF being turned down through a right angle), and are represented by the drawing-paper; the line CD in which the planes intersect is the "*ground line*" in our drawings, the line which divides the plan from the elevation.

* The point *c* would be termed a "*trace*" in practical solid geometry.

(*To be continued.*)

Geology and Astronomy.

THE AGE OF THE EARTH.

We copy from our contemporary, the *English Mechanic and World of Science*, a communication from its correspondent on a subject which will be found interesting to geologists and astronomers.

In recent numbers of the *English Mechanic* this subject has had frequent attention. To account for the extremes of climate which this earth has suffered during past geological ages, "a change in the position of the poles" has been supposed by several writers. If by this is meant that in bygone ages the position of the axis of rotation has altered geographically, maintaining all the while its original angle of inclination to the ecliptic, the proposition seems absurd. The axis and diurnal rotation have determined the oblate spheroidal form of the earth, and that axis could not alter its position geographically without disturbing this form, and bringing about convulsions and cataclysms of the severest kind. But if this "change in the position of the poles" mean a change in the obliquity of the axis to the ecliptic, no objection can be taken to it on that score. I am aware that many writers have adopted this explanation, and some have even ascribed these changes to a disturbance of the equipoise of the earth, produced by the elevation of continents in the northern, and the depression of land to form oceans specifically lighter in the southern hemisphere. Unless these elevations and depressions occurred uniformly and regularly both as to time and distribution—in other words, unless we could believe that the internal forces acted directly under some law which controlled and directed their intensity and distribution, we can scarcely ascribe to their influence the regular recurrence of such periods of tropical heat and polar cold as our earth has been subjected to.

We must remember that Agassiz discovered in Brazil that glaciers once deposited their boulders and moraines in latitudes within the present tropical zone at the sea level, and further that in the recent Arctic Expedition, coal-beds, the remains of a tropical flora, were found within the Arctic circle. That these extremes of heat and cold, so widely apart, were not exceptional, but rather recurrent, we gather from the records of geology. It is generally allowed that the primary condition of the earth was one of great heat. If we adopt Prof. Haughton's theory, we have the period during which the temperature of the earth exceeded that of boiling water, represented by the unstratified rocks. Then we have the period between the boiling points of water and the temperature at which albumen coagulates, represented by the stratified azoïc rocks. After these, however, we have the Laurentian, Cambrian, and Silurian rocks, equivalent to an immense age of geological time, and represented by forms, some of them as high as vertebrata. Succeeding this, we find towards the close of the old red sandstone, remains of a glacial epoch. This again is succeeded by the Devonian—which was, perhaps, partially contemporary with the old red—and by the carboniferous, which was undoubtedly a tropical formation. Then again we have the Permian system, separated from the Carboniferous by an uncomformity, which may represent an enormous age, and towards the close of it we find a second glacial epoch. In the secondary rocks which succeed this, separated from it by another uncomformity, we again find traces of a tropical climate, particularly in the Lias, where we have another coal formation. Between these rocks and the Pliocene we have evidence of a gradual cooling of temperature until in post-Pliocene times we find a third glacial epoch.

Now, it seems to me that any theory of past conditions which does not take these extensive changes into consideration is incomplete, and I submit the following as perhaps a possible explanation.

In the time of Eratosthenes, in the second century before the Christian era, the sun's declination was found to be 23° 51′ 19·5″, and this measurement was confirmed by contemporary observers. At present it is 23° 27′ 24″—that is a difference of 23′ 55·5″ in in 2,000 years, or 71·7″ yer century. Admitting the possibility of error in these early observations, we take, then, those of Bradley in 1755, and since his time the diminution of the obliquity of the earth's axis to the plane of the ecliptic has been at the rate of 45·7″ per century. It is plain, then, that the obliquity of the earth's axis is slowly changing, and has also probably changed during past geological ages. It is possible that there may be a limit to this motion—that the present diminution of obliquity may only be the return from a former increase. But it is equally possible that the revolution may be completed, and that in time the present position of the North Pole, with respect to the ecliptic, may be occupied by the South Pole—that the change may be continuous from zenith to nadir, and onwards from nadir to zenith again.

At present the magnetic poles do not coincide with the axis of revolution, and there is no reason for believing that they follow that axis in any change of position it may make. Supposing the obliquity increased to 30° or 35°, we should then have in our temperate latitudes great extremes of climate—a long and very severe winter, followed by a short but hot summer—a climate more rigorous than that of Canada, and somewhat like that experienced on some parts of the shores of the Yellow Sea in China, and sufficient to account for a glacial epoch. Again, when the axis of revolution coincided with the ecliptic, the present order of things would for the most part be reversed—the Poles would largely enjoy a tropical climate, and the Equator almost a Polar one.

Now, it is probable that this motion of the axis of revolution is not one in which our earth alone takes part, but one in which all the planets of the system join. We find these at all various angles of obliquity, from about 3° of inclination, or almost perpendicular in the case of Jupiter, to almost exact coincidence of the two planes in the case of Uranus.

Should this be a motion in which all the planets participate, we can easily understand their various obliquities, on the theory that they had at various periods been thrown off from the sun as it receded to its place in the centre of the system.

But now for the age which this would assign to the earth, at least since the time of the old red Sandstone. We have seen that the change is, according to the most recent measurements, 45·7″ per century—that is, 7,877 years per degree, or 2,835,720 years for a complete revolution. But since the conditions would be the same when the Poles were exactly reversed, the same latitude would experience similar conditions twice in the course of a complete revolution. And it is further evident that the conditions would again remain much the same at any point near the Poles during the period in which the Poles approached, crossed, and receded from the zenith. Starting, then, with the glacial epoch of the old red Sandstone:—As the diurnal axis, after crossing the ecliptic, approached to an angle of, say 30°, we might look for the beginning of such an epoch, and it would last till the zenith had been crossed, and a similar position reached on the other side—that is, while the axis passed through an angle of 60°, which is equal to a period of 472,620 years. After a similar period we—that is, our northern temperate latitudes—would be in the middle of a tropical period, represented by the Carboniferous, when the diurnal axis coincided with the ecliptic. This state of matters would last with varying intensities over a period of 945,240 years—that is, from the close of the old red glacial to the beginning of the Permian glacial. This latter period would, like that of the old red, last for 472,620 years, while the Pole passed through the nadir from 30° W. to 30° E. of it. Again, we would enjoy a tropical period of 945,240 years, corresponding to that of the Lias, and this would only be interrupted by the preliminary glaciation which appeared, comparatively recently, in post-Pliocene times, when the angle of obliquity would be about 30° or 35°.

The present angle is 23° 27′ 24″, so that rather more than 50,000 years may have passed since then. We are still moving towards the zenith, and as the diurnal axis approaches this point we may expect a renewal of glacial action.

No doubt countless ages must have elapsed while the primary heat of the earth was being gradually radiated into space, and further long epochs must have passed during the deposition of the Laurentian, Cambrian, Silurian, and earlier old red sandstone rocks; but dating from the close of this latter period, when glaciation first appears, we have seen that a more or less continuous period of glaciation lasted during .. .. 472,620 years.

The carboniferous tropical epoch more or less continuous, embraced a period of	945,240 "
The Peruvian glacial epoch occupied	472,620 "
The Lias tropical to the close of the Pliocene ..	945,240 "
And since the last glacial to the present time ..	50,000 "
	2,885,720 years.

According to Lyell, the earlier geologists were ever "prone to represent nature as having been prodigal of violence and parsimonious of time," but the undoubted tendency nowadays is to represent nature as having been parsimonious of violence and prodigal of time. The period given above, while greatly in excess of the calculations of the earlier geologists, is almost as greatly under those of some of the more recent ones; but let it be remembered that I do not assert that this is the age of the earth, but only that it is possibly an approximation to the period which has elapsed since the old red Sandstone—a period perhaps ten times as great as may have passed during the cooling and consolidation of the crust on which these subsequent stratifications have been deposited. I submit this only as a possible explanation of these repeated phenomena of glacial and tropical epochs. The continuous duration of each epoch, throughout the periods here assigned to them, is unlikely, and it is more probable that periods of temperate climate were frequently interposed. The extremes would likely be greatly modified locally by such phenomena as that of the precession of the equinoxes.

H. B. F.

Domestic Hints.

HEALTH AND HOME.

How to Sit.—*Hall's Journal* persists in robbing us of our comfort in this style: All consumptive people and all afflicted with spinal deformities sit habitually crooked, in one or more curves of the body. There was a time in all these when the body had its natural erectness, when there was the first departure on the road to death. The make of our chairs, especially that great barbarism, the unwieldy and disease-engendering rocking-chair, favors these diseases, and undoubtedly, in some instances, leads to bodily habits which originate the ailments just named, to say nothing of piles, fistula and the like. The painful or sore feeling which many are troubled with incessantly for years, at the extremity of the backbone, is the result of sitting in such a position that it rests upon the seat of the chair, at a point several inches forward of the chair back. A physiological chair, one which shall promote the health and preserve the human form erect and manly, as our Maker made it, should have the back straight, at right angles with the seat, the seat itself not being over eight inches deep. A chair of this kind will do more towards correcting the lounging habits of our youth than multitudes of parental lecturings, for then if they are seated at all they must sit erect, otherwise there is no seat-hold.

Importance of a Clean Skin.—Most of our invalids are such, and millions of more healthy people will become invalids, for the want of paying the most ordinary attention to the requirements of the skin. That membrane is too often regarded as a covering only, instead of a complicated piece of machinery, scarcely second in its texture and sensitiveness to the ear or the eye. Many treat it with as little reference to its proper functions as if it were nothing better than a bag for their bones. It is this inconsideration for the skin that is the cause of a very large proportion of the diseases in the world. If, as claimed by some scientists, four-fifths, in bulk, of all we eat and drink must either pass off through the skin or be turned back upon the system as a poison, and that life depends as much upon these exhalations through the skin as upon inhaling pure air through the lungs, it must be of the most vital importance to keep that channel free.

Health and Talent.—It is no exaggeration to say that health is a large ingredient in what the world calls talent. A man without it may be a giant in intellect, but his deeds will be the deeds of a dwarf. On the contrary, let him have a quick circulation, a good digestion, the bulk, thews and sinews of a man, and he will set failure at defiance. A man has good reason to think himself well off in the lottery of life if he draws the prize of a healthy stomach without a mind, rather than the prize of fine intellect with a crazy stomach. But of the two, a weak mind in a herculean frame is better than a giant mind with a crazy constitution. A lean pound of energy with an ounce of talent will achieve greater results than a pound of talent with an ounce of energy.—*Home Journal.*

Advantages of a Good Temper.—An equable temper is greatly to be admired. The man who always has himself well in hand, who is cool under all annoyances and circumstances, who has absolute control of his temper, we are always willing to trust in any emergency. But a person who flashes like powder touched by a lighted match, who loses control of himself upon the slightest provocation, we distrust, and have a right to do so. In the battle of life, he who would achieve victories must keep a cool head. And this matter is largely under our control.

A Beautiful Compliment to the Physician.—I dare not place any gift, however beautiful, or any success, however brilliant, above the talent or the skill which can relieve a single pang, and the self-devotion which lays them at the feet of the humblest fellow creature.—*Oliver Wendell Holmes.*

Cheerfulness at Meals.—The benefit derived from food taken, depends very much upon the condition of the body while eating. If taken in a moody, cross, or despairing condition of mind, digestion is slower and much less perfect than when taken with a cheerful disposition. The very rapid and silent eating too common among Americans, should be avoided, and some topic of interest introduced at meals, in which all may participate; and if a hearty laugh is occasionally indulged in, it will be all the better.

The Philosophy of Hot Bread.—A correspondent sends the *Journal of Chemistry* the following query: "Physicians often recommend for sick people oatmeal or graham pudding, made by stirring the meal into water and boiling a few minutes, as one of the first things to be eaten when the stomach will not bear hearty food. Why is the meal thus prepared any more easily digested than new bread or hot muffins, which are considered unhealthy? Is not the same chemical change necessary in the one as the other, which can only take place by standing for several hours after cooking?"

The two cases are by no means similar. The oatmeal or graham flour is made digestible by boiling, the starch granules being ruptured, so that their contents are more easily acted upon by the digestive fluids. In the making and baking of bread the same change is accomplished. The difference between hot new bread and that which is older is essentially the same as between "heavy" and "light" bread. It is its "lightness" or porosity which gives to bread its ready digestibility. When new, it is softer, from the steam of the water it contains; and this makes it difficult of mastication and liable to form a close and cloggy mass, which on passing into the stomach, is less easily penetrated and acted upon by the gastric juice. By cooling and drying it becomes firmer and more friable so that it is more thoroughly mixed with the saliva in the mouth, and goes into the stomach in better condition for the process to which it is to be subjected there.

If the bread is hot enough to melt the butter eaten with it, this makes the matter worse. The melted grease fills up the pores of the bread, and interferes with the action of the saliva and gastric juice. The fatty matters in pastry are objectionable for the same reason, and also on account of the chemical changes which they undergo in the oven.

Bread becomes more digestible by toasting, chiefly because is it made drier and firmer—that is, if the toasting is properly done. The slice should be rendered crisp throughout its entire thickness. If it be merely scorched on the surface, as often happens when the slices are thick and Biddy is stupid or in a hurry, the interior is merely softened and made like new bread, and consequently less digestible.

What English people call "bread jelly" is a light and nourishing article for weak stomachs, in some cases preferable to the oatmeal or wheat porridge. It is made by steeping stale bread in boiling water, and passing it through a fine sieve while still hot. It may be eaten alone, or after being mixed and boiled with milk.

How to Eat Oatmeal.—Oatmeal, cracked wheat, and similar boiled breakfast dishes often become more or less indigestible, says the *Journal of Chemistry*, from being "bolted" in the usual Yankee style. They are soft and "go down" easily, and are shoveled or spooned into the stomach, with no delay in the mouth *en route*. They need mastication as really as beefsteak does—not to save one from choking (which many people seem to suppose is the sole reason for chewing), but to mix them thoroughly with saliva, which is a *digestive* agent and not a mere lubricant to expedite the passage of dry food down the œsophagus. A friend of ours was lately complaining that oatmeal did not agree with him, and we found on inquiry that he was in the habit of eating it in this hurried way, without insalivation. He was much surprised when told that he ought to "chew" it, or at least to detain it for a moment in the mouth before swallowing it; but after a brief trial he admitted that he had no more trouble in digesting it. If the oatmeal or wheat is not thoroughly cooked it is all the more important that it should be masticated, as the half-softened grains offer considerable resistance to the digestive fluids.

Bean Soup.—A friend recommends this as the best: Soak the beans over night. Boil three hours, or until very soft. Strain them through a colander and, after placing the soup again over the fire (to heat, but not to boil more than a minute), season for one pint of beans as follows: One teaspoonful each of sugar and salt, half teaspoonful pepper, teacupful of milk, one tablespoonful of butter, and one beaten egg.

Correspondence.

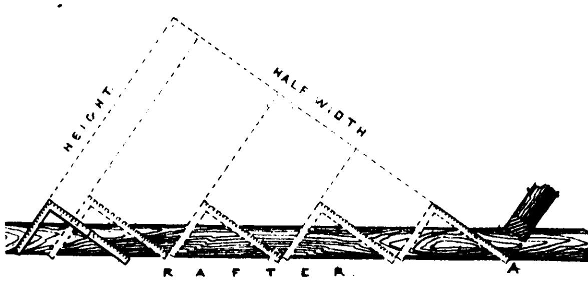
To the Editor of the Scientific Canadian and Mechanics' Magazine.

Mr. Editor,—Your notice to subscribers—page 346, November, 1878—reminds me that some time ago I wrote the *Scientific American* a query which remained unanswered, though the solution is of a very interesting nature. May be some of your scientific friends will feel equal to the task.

Some years ago an explosion took place at Archer's Mills, at Sillery, near Quebec. A fragment of the lateral shell of a cylindrical boiler some 5 feet diameter, ⅜ inch thick, of irregular shape, say 5 x 6 feet, or 30 feet are, retaining more or less of its original curvature, was projected to such a height that in falling it cut 14 inches deep into a 24 inch log of pine situated at a distance of about one hundred yards from the site of the explosion. The plate was found by me solidly imbedded in the log of timber, the cut being in a vertical plane and crossing the length or fibre of the timber at very nearly a right angle, say 85° to 90°. A building intervened between the boiler and the timber, so that the fragment of boiler plate, or rather of several plates rivited together in the ordinary way, was not projected direct from the boiler towards the timber, but must have risen nearly vertically to an immense height to have acquired the momentum necessary to produce the result above described. To what height approximately was this fragment—which I estimated at the time to weigh about 500 lbs.—hurled? The portion which had entered the log had been flattened out to a plane surface by the force of the explosion, the remainder being irregularly bent and twisted.

Chs. Baillairge, Chev.,
City Engineer, Quebec.

Dear Sir,—In response to your invitation, and stimulated by an article in the last number of the Magazine in reference to a method of getting bevels and lengths of rafters, I beg leave to give you the benefit of my experience in the use of the framing square, hoping it may be of some benefit to the mechanical class of your readers.



In determining the length and bevel of rafters, take any number of inches on the long and short arms of the square representing the proportion of half the width and the pitch of roof (which in a third pitch would be 24" and 16" or 12" and 8") and apply these divisions directly to the back of rafter (as shown below) the longer arm giving the cut of rafter at plate and the shorter the cut at ridge. Then, to get the length—if the calculation of width is from face of plates—first lay out the projection of rafter beyond the plates, using the figures on the framing square as a bevel, and then commencing at the line representing the face of plate (a); apply the diagonal length between the figures to back of rafter as often as the 34 inches (or the 12 inches) is contained in half the width, and if any fraction of the width occurs add on the fractional part by measuring at right angles to ridge cut and pass the bevel through this point for whole length.

You will notice that the square and pencil are the only instruments used in this operation, and it is perfect in its results.

This method, applied to braces, is very simple and accurate. If the run is 3 feet each way, take 18 inches on each arm of the square and apply twice to brace and the lengths and bevels are got at once. If the runs are 4 feet and 3 feet, take 24 inches and 18 inches and apply twice, because in both cases the figures used on the square are half the run. In the case of rough and fractional parts, divide both runs by any common division until the quotants are within the limits of the square, and then using these figures, apply the square as often as there are units in the division, thus, say runs are 7" 6" and 5" 6", divide both by 6, giving 15 inches and 11 inches. These figures being used on square applied 6 times will give the length and cut at both ends of braces; or using the figures of run as a scale of an inch to the foot, making 7½ and 5½ inches, these figures would be applied 12 times, but by doubling both and applying 6 times the same result is obtained as before. The above applications of the square is founded on the ordinary geometrical proportion that in similar triangles the sides are proportional to each other, therefore, if the figures used on the square are proportional to the base and perpendicular lines formed by "half the width" and "height" in case of the roof, and the "runs" in case of the braces, then the diagonal measurement between the figures on the square must be proportional to the whole length of rafter or brace, and if the figures on the square are contained any given number of times in half width or height of roof, or runs in braces, then the diagonal measurement between the figures on the square is contained the same number of times in the whole length of rafter or brace.

W. I. & S., Kingston.

Shoe for Interfering Horses.—"A Subscriber" sends a sketch (from which we have made the engraving, fig. 1) of a shoe which he has devised and tried successfully to prevent horses from interfering. It is made twice as wide and heavy on the outside as on the inside. To equalize the wear, the inner and lighter portion of the shoe is made of steel.

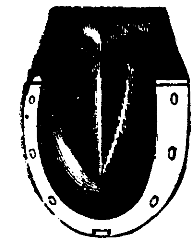


Fig. 1.

Errata.—On page 355 of the last (December) number, on the subject of "Clark & Standfield's Depositing Dock," our correspondent desires to correct an error which occurred in his manuscript, viz., that the "Imperial Government was about to construct a graving dock at Quebec." This was a mistake, and was entirely overlooked in reading the proof.

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AND
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