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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

A NEW elastic wheel is expected to turn out a rival to the pneumatic tire for cycles. Used on a hansom cab, it is reported to have given better results than the ordinary rubber tire, while it possesses three times its durability for wear. Bicyclists should look to this.

* *

The grouted concrete block system has been used in the construction of the new quay at Great Yarmouth, 2,103 ft. in length. The work has been carried out in one-third the time, and at less than half the cost that would have been incurred had the method of depositing concrete *in situ* been used.

* *

Sewing machines which will pierce half an inch of leather have been known for some time, but this performance is quite outrun by the claim made for a sewing machine brought out in Chicago, U.S.A., that it has pierced wood $\frac{3}{8}$ in. thick, and also $\frac{1}{8}$ in. thickness of brass placed between pieces of leather. Where does the application come in?

* *

A very large Swiss locomotive will be fitted with dynamos of a total of 1,500 horse-power, which could be increased up to 2,000 horse-power. The power will be transmitted to eight electro-motors, arranged on the same number of axles. This locomotive will attain a higher speed than is usual with steam locomotives, and trials of its capabilities are shortly to be made. We await results.

* *

The Birmingham Ear and Throat Hospital now adopt the electric light for illumination, and also for the laryngoscopic and other important surgical instruments in the consulting rooms. It has given great satisfaction to the medical officers and committee. This hospital is the first in the United Kingdom to utilise the electric light for its surgical purposes. London, hurry up.

* *

The American 125-ton steam hammer is used for forging ingots weighing from 30 tons to 70 tons into armour plates varying from 4 in. to 18 in. in thickness. They vary from 15 ft. to 22 ft. long, and are about 6 ft. 6 in. wide. The ingot usually takes three heatings; the first sixty hours. It is then hammered into plate form before it gets cold. The other heats are about five and three hours respectively, and the plates are finished cold.

* *

Carriage shaft-tips are coming to the fore. These are to lessen the seriousness of street accidents by which the shafts of vehicles injure people when crushing into them. The shaft-tips have rubber wheels standing forward from the end. A blow from one of these would be less harmful than from a metal tip. They serve a further purpose of preventing the ends of the shafts digging into the roadway and shattering the shafts when a horse falls.

* *

Mr. Crookes was very interesting at the recent Royal Society Conversazione. He showed some experiments with a modification of Tesla's apparatus, and obtained an alternating electric current showing 1,000,000 alternations per second. The electro-motive force was about 10,000 volts, and yet the spark discharges could be taken on the hand with only a slight pricking sensation. There is a wide field of research open for experimenting on static electricity.

* *

There is a feeling in Manchester that engineers would be foolish to send specimens of their work to the Chicago Exhibition, since Americans had already copied English work to too large an extent. The existing tariff prevented anything but the coarsest goods going into America, and it is felt to be unwise for manufacturers to assist in making rods to beat themselves by sending over the best work to be copied by unscrupulous competitors. Cannot the Chicago Commissioners do something to overcome this deterring element?

* *

A new portable steel bridge has been constructed for a Russian engineer corps. All the sections are made perfectly uniform, so that when it is required to build the bridge, the various pieces can be taken indiscriminately, no markings of the parts being necessary. All the sections, the heaviest of which only weighs 354·2 lb., are rectilinear, thus greatly facilitating transport. No rivets are used, but tenons with wedge-keys. The bridge can be put up in one hour and fifty minutes, is 100 ft. long, of a total weight of $22\frac{3}{4}$ tons, and of 8 tons capacity. The distance between the girders is 9 ft. 8 in.

* *

Plant warfare reads strange. To subsist, however, plants, when crowded in the ground, battle with each other and with more intensity when different species hold each other locked in a death-grip for mastery beneath the earth's surface. To comprehend this needs wide observation during a long period of time. The broad wild heaths and moorlands of England will furnish conclusive illustrations of plant warfare. The growths indigenous to heaths are, for light land, the furze, the broom, the fern, the bramble, the blackthorn, the ash, elm, and oak, to name only a few of the prevailing heath growths. The furze will, in root warfare, master the broom, the fern will vanquish the furze, the bramble will overcome both the furze and fern, the blackthorn will rise above the bramble, the ash will obliterate the blackthorn, and the oak will outlive the ash. The elm will, perhaps, be equally potent over the ash.

* *

The congested traffic of London is mainly attributable to the horses and carts of the carrying trade. The horses are estimated to number 25,000, worth £1,250,000. They work about seventy hours in each week. Their buying price is about £60, and after five years' use their selling price is about £10. 100,000 men and boys have to wait on this traffic and these horses. A novel rule prevails as to estimating food cost at 3d. per inch of height per week; a shilling a hand height means 16s. per week for a 16-hand horse. It costs more to carry goods across London by van than a hundred miles by rail. To carry the termini across London would relieve the congested streets, and be a national gain. To exclude all railway and general booking offices from main streets would facilitate London traffic of carriages to an incalculable extent. To bridge or subway main thoroughfares would be another gain. All will have to be done—the sooner the better. We say the London County Council might do worse than take up the London street traffic question.

HOW TO RENEW A PANE OF GLASS.

BY E. DICKER.

A LITTLE information on the above subject will, I feel sure, be gladly accepted by many, considering the great inconvenience which is often felt by the breaking of a window-pane, and having to wait a day or two, or sometimes longer, before you can get it put in.

In the first place, a proper hacking-knife and a putty-knife should be provided (cost, about 8d. each). After knocking out all the pieces of broken glass, you can, with a small hammer, carefully hack or cut out the old putty with the hacking-knife and small hammer, taking care that the knife does not cut the bars, or get damaged against that portion of the broken glass behind the putty.

If the putty is very hard, it can be softened by holding a red-hot iron against it, taking care not to burn the woodwork or crack the next square. A very good thing for this is an old poker, with the square part bent at a right angle to the handle or stem. You must make it red-hot at the junction of the square and round parts before attempting to bend it, and it can be bent back again after using it. Thoroughly clean out all the putty from the rebates. Now measure the size of your glass, being careful not to get it too large; any glass merchant will cut for you at the rate of about 4½d. per foot super. In measuring glass, you give the size in inches, not in *feet* and *inches*; also state what weight or thickness you require. I give a short table, showing what is meant by weight of glass—

Glass about	1-12th	of an inch thick	is called	15 oz.
"	1-10th	"	"	"	21 oz.
"	1-9th	"	"	"	26 oz.

That is to say, it weighs so many ounces to every superficial foot.

Now put a layer of very soft putty all round the inside rebate, and gently press the square of glass into its place, being careful to press it uniformly, and not more in one part than another, or you will be very apt to crack it. Secure it in its place with four small brads, driven in so that they only just clip the glass; next proceed to putty the outside all round with the putty-knife; and then, taking one side at a time, form a nice clean bevel on the putty by decisively drawing the knife along, resting it on the bar and on the glass, keeping the bevel so that you do not see it through the glass from the inside. It is rather a troublesome job for an amateur to finish off the mitres nicely, but it is very simple if you have patience.

Do not attempt to scrape off the fine strips of putty left on the glass, but brush them off with a dusting-brush. Very often a novice makes a clean bevel, and then spoils it in scraping off the superfluous putty. Now clean off the inside putty, carefully stopping-in any little places the bedding has not filled up. Sometimes it is found that it is very difficult to get at a square of glass by sitting on the window-sill—in fact, in many instances it is impossible to do so. If such is the case, you must take the sash out. To do this, take out one side sash bead, get hold of the sash cord, and pull the weight right up to the sash pulley, then gently drive a clout-headed nail through the cord into the pulley style just below the pulley, to keep the weight up; treat the other side in the same manner, and then undo the cords from the sash and take it out. You will then find you can glaze the square of glass so comfortably that it pays for the trouble of taking the sash out, even in cases where it is not absolutely necessary.

RUSTIC CARPENTRY: A ROSERY WALK.

BY ARTHUR YORKE.

PURPOSES OF THE DESIGN—MATERIALS—CONSTRUCTION—ROOFING—REFERENCE TO FORMER ARTICLES.

Purposes of the Design.—The rustic construction which forms the subject of the present set of illustrations is intended primarily as a trellis over which to train roses of those kinds which require such support, to form a shady and fragrant walk, and generally to contribute to the adornment of the flower garden. A secondary one may also be found for it where a covered path of ornamental character is desired, as it sometimes is in connection with suburban and other dwellings where there is no carriage approach to the door. It can readily be adapted so as to form a roofed-in track from a door to the public roadway; and the means of so adapting it will be explained further on.

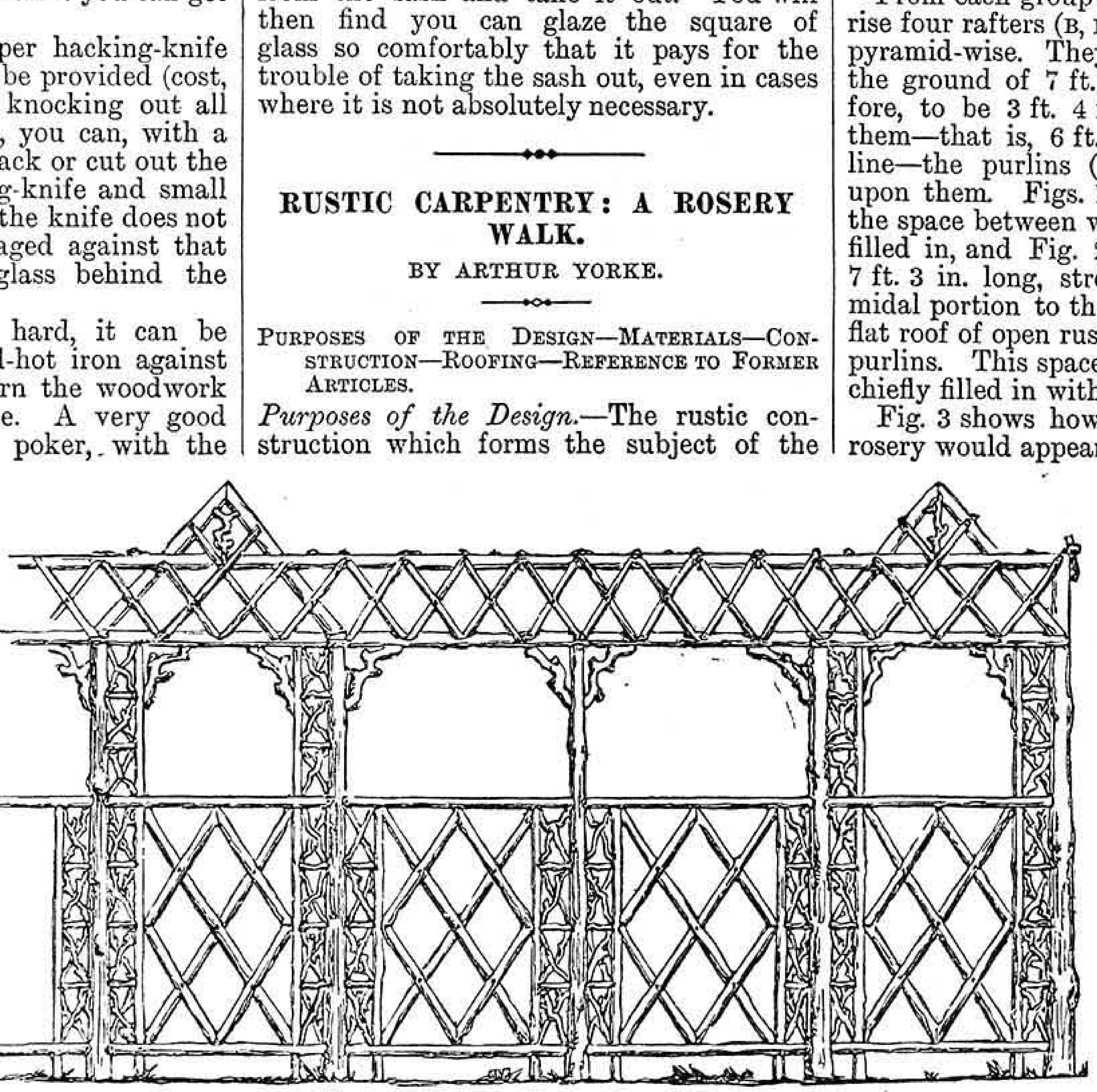


Fig. 1.—A Rosery Walk: Elevation.

Materials.—These will be entirely of rough wood in its natural bark. For the posts fir poles of some kind should be chosen, and larch is especially to be preferred both as regards durability and appearance. All the smaller pieces which show as straight stuff may well be of the same kind of wood as the posts, though for the finer rods hazel will not come amiss. It will be seen that in the mere filling-in much crooked stuff is used, and for this apple branches, or indeed almost anything that comes to hand, will suffice.

Construction.—Our rosery walk is 4 ft. wide, and the rustic erection is carried on two rows of pillars or collar-posts ranged at intervals of 3 ft. These posts should be let into the ground 2 ft., and well rammed in. They should have an average diameter of 3 in. or 3½ in., except in the case of each third one, as that which in Fig. 1 is seen standing in the middle of the portion with the lower roof; such pillars may be smaller as having little weight to bear, and will look better than they would do if equal in size to the others. Resting on the line of posts lies the wall-plate (A A, Fig. 2), the top of which is 5 ft. 6 in. from the ground line.

From each group of four large collar-posts rise four rafters (B, B, Fig. 2), meeting at top pyramid-wise. They rise to a height from the ground of 7 ft. 6 in., and have, therefore, to be 3 ft. 4 in. long. Half-way up them—that is, 6 ft. 6 in. from the ground line—the purlins (C, C, Fig. 2) are nailed upon them. Figs. 1 and 2 alike show how the space between wall-plate and purlin is filled in, and Fig. 2 shows how the space, 7 ft. 3 in. long, stretching from one pyramidal portion to the next, is covered with a flat roof of open rustic work lying upon the purlins. This space, it will be observed, is chiefly filled in with crooked stuff.

Fig. 3 shows how the upper part of the rosery would appear at one of its ends, and this figure may also explain how the roof would be in section—the shaded parts give the form of the roof in its lower portions; whilst if we imagine the cross-piece, D (which is on a level with the purlins), to be removed, we have with the dotted lines, B, B, a section through the middle of one of the higher pyramidal portions.

The object which appears over the middle of the entrance is supposed to be a rough knot or a piece of root.

The filling-in of the sides of our rosery is plainly shown in the elevation, Fig. 1. For its better preservation from damp, this work is kept 4 in. from the ground.

Roofing.—Let us now suppose that, as was suggested above, the design is to be utilised for a dry path with a covering of metal or other light material. We shall then do well to keep the whole roof to the level of the pyramidal portions—a ridge-piece will have to be used—and the rafters, instead of following the present arrangement, will meet in pairs opposite to the pillars. Instead of round stuff, also, we shall then do well to use halved stuff for our rafters and purlins, the sawn side being uppermost. The space between ridge-piece and purlin can then be filled in the same manner as that between purlin and wall-plate.

Reference to Former Articles.—Before proceeding further with the present group of papers on rustic carpentry for garden purposes, it will be well to direct the reader's attention to those which have already appeared on the same subject, since in them will be found much useful information on the proper kinds of wood, methods of construction, and other practical matters which it would be superfluous to repeat. These will be found in Vol. I., p. 247 (No. 16), Vol. II., pp. 65, 101, 149, 197 (Nos. 57, 59, 62, 65), and Vol. III., pp. 129, 161, 193, 225, 257, 289 (Nos. 113, 115, 117, 119, 121, 123). Attention is specially called to the first-named of these articles as containing necessary elementary information.

TIPS FOR FRENCH POLISHERS: REPOLISHING.

BY LIFEBOAT.

REPOLISHING — FADED POLISH — REMOVING THE UPPER SURFACE OF POLISH — TAKING THE WORK APART—SWEATING—BRUISES—COLOURING-UP AND MATCHING BY MEANS OF RED OIL—STAINS—DYED POLISH AND DRY COLOURS —FINISHING-OFF.

Repolishing, though essentially the same as French polishing, calls forth the higher qualities and tact of the workman; for, having once mastered the fundamental principle of polishing, it is a comparatively easy task to give to a plain piece of wood a level and lustrous surface; and by the aid of stains that can be bought ready prepared a reasonable imitation of any given wood can be obtained with a minimum of labour. But to the workman that would wish to hold his own against all comers, and call himself a practical or professional man, it is not enough that he should be able to stain and polish a plain piece of wood. No! far from it that his knowledge should end here.

Faded Polish.—The stains with which he is familiar to stain his common woods will be of no avail to him when restoring polish that has faded and turned sickly-looking from damp or exposure to the sun. He may be called upon to restore such a faded article, and his patron may not care to go to the expense of having the old polish removed by scraping, etc., and the article polished up again.

Removing the Upper Surface of Polish.—It may be more convenient to both parties that the upper surface only of the polish shall be removed, the faded portion coloured up to match its surroundings, and the whole repolished.

If the polish is not very bad, it is generally sufficient to well smooth down with a piece of worn glass-paper. Should it, however, be much scratched or faded, it is better to sprinkle it with methylated spirits, and well rub — with a circular movement—with No. 1 glass-paper, when it will be found that the upper surface only of the polish will be removed, instead of fetching it out of the grain, which would be the case if the scraper was used.

Before any repolishing is done, it is advisable that the article should be first washed with common washing soda and water (a cupful to a gallon of warm water) to remove any dirt, furniture paste, etc., using a little pumice powder or powdered bath brick to assist.

Taking the Work Apart.—It will simplify our work somewhat by taking apart as much as convenient. Thus it is a good plan to unhinge all doors, remove all carvings that may be screwed on from the back —not forgetting to put some tallying mark on—and remove all knobs, brass fittings, etc. The doors can be better handled on the bench, and the corners of panels worked up better; the carvings can be varnished better, and if it be a chiffonier we have in hand, and the carvings are planted on, as is often done, a much cleaner job is made if we first remove these; for, be as careful as you may, you will find it a difficult task to polish inside the intricacies of the open carvings equal to the flat surface.

Sweating. — The cracked, fretful, and greasy appearance of polished work after it has stood a few weeks or months is called, in polisher's parlance, "sweating." The why and wherefore of this appearance is difficult to determine without knowing something of the inner workings or conditions under which it was done. It may be that the workman was "sweated" in price, so had to scamp his work, either by putting on an insufficient body of polish, or the use of cheap, inferior, or adulterated materials; or it may be that the greater part, such as filling and bodying-in, was done by boy or girl labour, and they may have been *too* lavish in the use of oil; or it may be that the fault lies in the "filling-in" being of too oily or greasy a nature, such as Russian tallow, which is sometimes used. The glaze rubber may have been used too freely on a greasy foundation, thus giving a brilliancy at the expense of permanency. Not alone can the blame be all put upon the "poor shiners," as they are sometimes called. The cabinet-maker may have cleaned off his work *too* soon after laying on his veneer, so causing the veneer to crack, the blame for which may be, and, indeed, often *is*, put upon the polisher's shoulders.

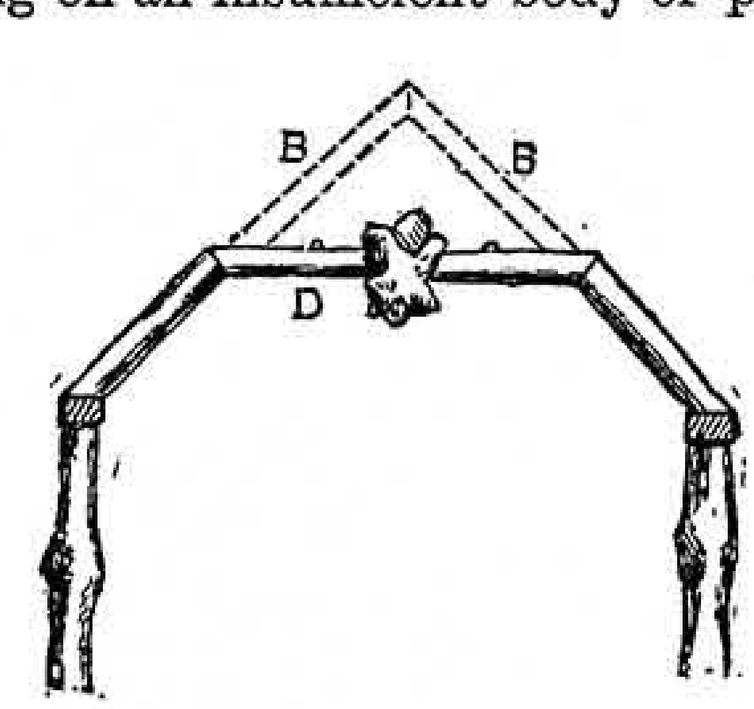


Fig. 3.—Entrance, showing Two Sections of Roof.

These are but a few of the causes for which we must look for "sweating." A whole chapter might easily be devoted to the subject. What concerns us most at present is its removal, and the restoring of the original polish.

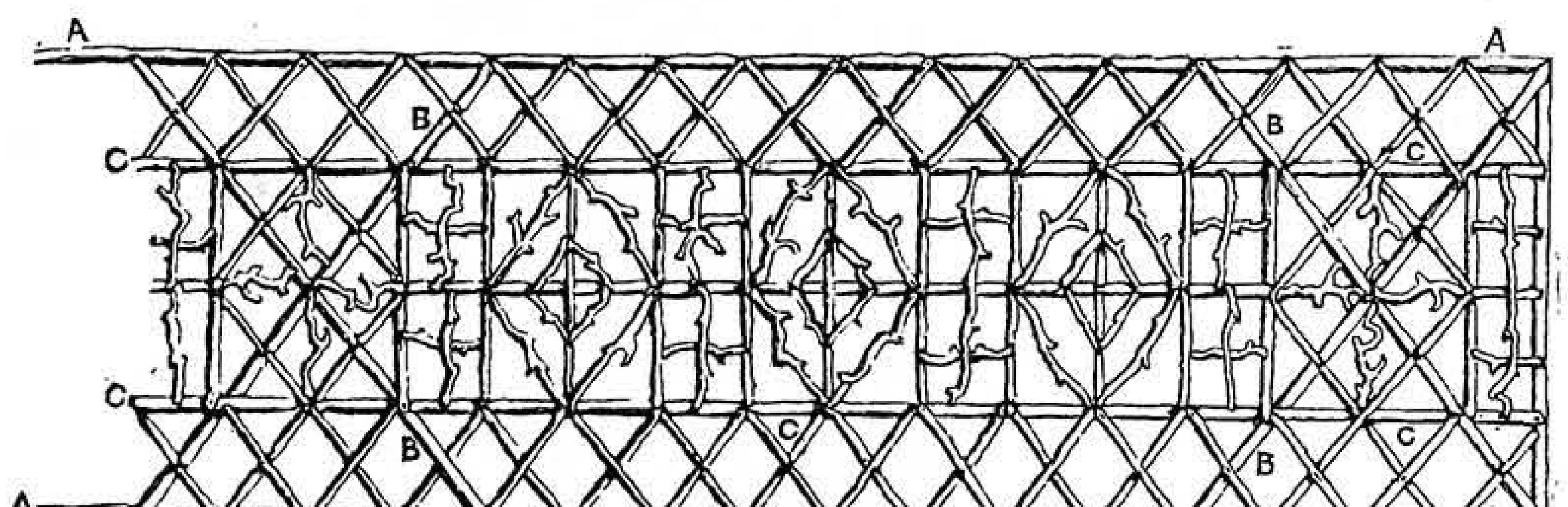


Fig. 2.—Plan of Roof.

Bruises.—The necessary cleaning-off of dirt, etc., having been accomplished, look to the bruises, either scraping out or bringing up level, by means of a hot iron and wet brown-paper, or by filling up with "Hard Stopping"—how to make and use which, refer to WORK, No. 150, Vol. III., page 726. This being done, and having made good all defective parts, wipe all over with an oily rag: it assists the new polish to take more kindly to the old. It will probably be found that in scraping out the bruises and in cleaning-off level any new piece, and the consequent cleaning-off the polish, that it leaves a light patch. More especially will this be the case if the damaged portion has been previously coloured-up by means of stains, dry colours, or dyed polish.

Colouring-up or Matching.—If the job in hand is of mahogany, it is generally sufficient to wipe over the damaged portion with red oil (alkanet root steeped in linseed-oil), working up with red polish. Should it, however, be of walnut, I have matched many a little place and scratches in soft resinous varnish by wiping over with asphaltum dissolved in turps (one pennyworth to ½ pint turps). Should the place, however, be a piece of sap or other light portion, having previously gone over the light portion several times with the polish rubber to prevent the grain from rising, take a small tuft of wadding, saturate it with 3 parts of methylated spirits to 1 part of polish; take up on this a small quantity of Vandyke brown or brown umber, press and mix well on the back of a worn piece of glass-paper, wipe carefully over the light portions, thinning out with spirits if too dark, picking up a little more colour with, perchance, a little black if not dark enough.

The wavy appearance may be given by a tremulous movement of the hand, and a mottled appearance by a little dabbing with a badger softener or clean, soft dusting-brush while the colour is still wet. Black and red veins may be given by picking up a little dry black or red stain on the corner of the tuft of wadding and applying it carefully, taking some surrounding portion as a pattern. If the job is of rosewood, use a little red stain and dry black in combination; if birch or oak, use yellow ochre. If the job in hand is a large one, and requires staining all over, and you feel it is not possible to gain the desired result by means of dyed polish applied with the rubber, mix the colours in a pot, 3 parts of spirit to 1 of polish, and apply with a camel's-hair brush. It is better to give two or more coats thus of weak stain than one strong one; you are not so liable to get it patchy.

Allow a few minutes to elapse for the stain to set, then smooth down with a piece of worn, fine glass-paper, and give a coat of thin brush polish or spirit varnish to set the colours previous to polishing, which can be proceeded with in about ten minutes. Mahogany, rosewood, and walnut goods, if not inlaid, are generally improved by working up with polish just tinged by the addition of a little red stain (made by dissolving two pennyworth of Bismarck brown in ½ pint of spirits); other colours may be mixed with polish to be applied with the rubber. But in using these dyed polishes, do not forget to leave off with that rubber when you have just the right tinge; it is better to take another rubber, and finish off with clear polish. Many a job has a patchwork appearance for want of this precaution.

Finishing-off.—In repolishing, the foundation being already laid, the polish is not required quite so thick as in polishing from the bare wood; and in the final stage, or finishing-off, any trace of greasiness may be effectually removed by well rubbing with a swab of clean, soft rag, fairly damp (not wet) with spirits, on the face of which has been sprinkled a few drops of glaze.

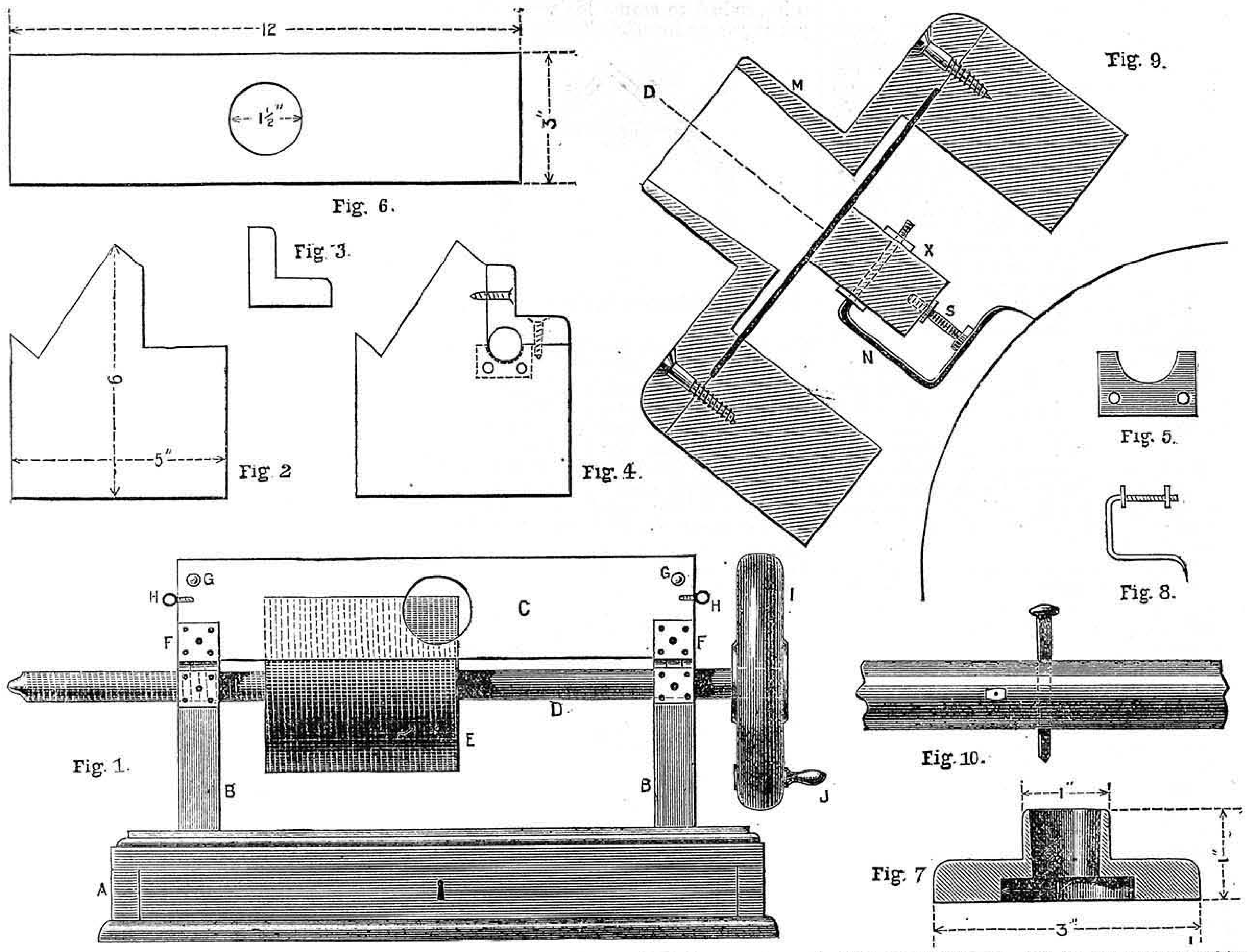
HOW TO MAKE A PHONOGRAPH.

BY WILLIAM DUFF.

Introduction — Prophecies regarding certain Inventions — Their Fulfilments — The Telephone—The Electric Light—Accumulators—The Perfected Phonograph—The Phonograph as a Scientific Toy—The Principle of the Phonograph.

During the last few years a great many very wonderful things have happened. All the great forces of Nature seem to have suddenly become more obedient to the will of at the same time without the least danger of them becoming jumbled or mixed up.

Sometimes, however, the shadow which the coming event has cast before it is greater than the reality. For instance, when the telephone was first talked about we were almost afraid to speak its name; for it was going to reveal all secrets—every word that we uttered was going to be heard, not only by our next-door neighbour, but by those living at the extremes of the earth. If a wire was simply passed through the keyhole of our door we were to be at the mercy in this direction we invariably look out for the proverbial grain of salt. That it is making rapid strides towards becoming the best of artificial lights I will not deny; but it is far from holding the position which has been prophesied for it. For instance, in the beginning of the year 1879 one of the London dailies stated that Mr. Edison could at that time supply this light for practical domestic purposes at less than half the price of gas. About the same time the whole scientific world was startled with the intelligence that a Frenchman had discovered a method



A Phonograph. Fig. 1.—Front Elevation of Phonograph with Mouthpiece and Diaphragm removed—A, Base with Drawer; B, B, Standards or Uprights; C, Top hinged to Uprights; D, Iron or Steel Shaft, one end screwed; E, Cylinder; F, F, Hinges; G, G, Brass Knobs; H, H, Brass Eyes to take a Hook not shown in the Figure; I, Heavy Fly-wheel; J, Handle. Figs. 2, 3, and 4.—Details of Standards or Uprights. Fig. 5.—Brass Plate in which the Screw Thread of the Shaft works, shown by Dotted Lines in Fig. 4. Fig. 6.—Top with Hole in Centre. Fig. 7.—Section of Mouthpiece. Fig. 8.—Stylus or Needle. Fig. 9.—Section of Mouthpiece, Top, etc.—M, Mouthpiece; D, Diaphragm of the Thin Ferrotype Plate; N, Stylus or Needle; S, Adjusting Screw; X, Block of Wood or Cork holding the Needle and attached to Diaphragm; the Curved Line shows the Cylinder. Fig. 10.—Portion of Shaft showing the Nails to keep the Cylinder from turning on Shaft.

man than hitherto. It is not only that new inventions are being brought to light day after day, but time-honoured institutions, such as the steam-engine, are being roused to greater energy. We can travel faster both by land and sea now than we could do a few years ago. We used to think the "needle telegraph" of Professor Wheatstone a marvellous invention, and the operating clerk who could transmit twenty or thirty words per minute a paragon of expertness; but this is very much altered now, for with the present systems as many as 400 words per minute can be sent along a single wire, and five or six messages conveyed over one wire of the unprincipled gossip or scandalmonger. But, fortunately, it has fallen short of this, and we know that even with the best of instruments, fitted in the most approved manner, general conversation is by no means a possibility—in fact, we must speak very deliberately and listen very attentively if we want to use it at all. Still, we have the telephone, and, although it has not fulfilled the dream of its inventors, it serves a very useful purpose in our everyday business life.

We have become so well used to puffs about the electric light, that when we hear of anything very wonderful going to happen of storing electricity; and immediately there arose the cry that this wonderful power was going to do everything for us. It would, of course, displace steam and all other motive-powers, gas and all other illuminants. The accumulator or "secondary battery, charged with electricity, would be delivered to the consumer like other goods, and returned empty to be charged again"; but this prophecy has not yet been fulfilled. Accumulators have their sphere of action, but just now it is limited.

Let not the reader imagine that I write these things in a carping, peevish spirit. Far be it from me. I am just as ready to hail a new thing and puff its merits as any-one; but an invention in the hands of its originator is not quite the same as it is before the public, and we must excuse him if he does over-estimate its usefulness.

You will be quite ready now for the statement that I am going to make regarding the "perfected phonograph." It is simply this: I have no hesitation in saying that it will be a long time before this instrument does all that has been prophesied regarding it—in fact, I do not believe that it ever will. There has been too much claimed for it. It is going to be the business correspondent of the future, the shorthand-writer of the future—to take entirely the place of the pen—and those who have been foolish enough to spend their time in learning to write may fall back, and Gillot and Heath may shut up their factories. In fact, the newspaper offices may shut up, and beat their type into foil, for we need not bother reading any more. We can have the news talked to us while we chip the top of our egg and munch our toast at the breakfast-table. All the great speeches will be delivered, not only in the words, but in the accents of the speaker.

In the evenings we can draw in our chair to the fire, and sit comfortably there while our favourite soprano or tenor is turned on. The great singers are not going to sing any more in public; they will sing their songs in the quiet of their own rooms to the phonograph, and retail the phonograms at a price within the reach of all.

These are but a few of the things that have been foretold of the phonograph. That it will accomplish all this I am sure it never will, and I am just as sure it will be a long time before it finds itself at home on the merchant's desk, which seems the most sensible part of the prophecy.

As a scientific toy, the phonograph has enjoyed a somewhat lengthened popularity, and attempts have been made again and again to raise it from that position. As a scientific toy the writer of the present articles has known it for many years, and as such he now presents it to the readers of WORK, with the assurance that many a pleasant evening may be spent in its company.

The instrument which I am going to describe is very simple in design, requiring no special tools or machinery to construct it, the only part presenting any difficulty being the stylus or needle. The perfected phonograph is, on the other hand, a very complicated machine, the chief part of which lies in the motor which is employed to give that regularity of motion which its inventor considers a *sine quâ non.*

The phonograph is an instrument which can reproduce articulate sounds spoken into it. The voice of the speaker is directed into a funnel which converges the sonorous waves upon a diaphragm carrying a style. The vibrations of the diaphragm are impressed by means of this style upon a sheet of tin-foil, which is fixed on the outside of a cylinder to which a spiral motion is given—*i.e.*, when turning the handle the cylinder travels endwise. After this has been done the cylinder with the tinfoil on it is shifted back to its original position, the style is brought into contact with the foil as at first, and the cylinder is then turned as before. The indented record is thus passed beneath the style, and forces it and the attached diaphragm to execute movements resembling their original movements. The diaphragm accordingly emits sounds which are imitations of those previously spoken or sung into it. In my next paper I will enter fully into the particulars of construction.

MICRO-PHOTOGRAPHY WORK.

BY ARTHUR RENAUD (B.A. OXON.).

MANUFACTURE OF NEGATIVES REQUIRED FOR LANTERN SLIDES — DIFFERENT DEVELOPERS SUITABLE FOR THE WORK.

THE actual manufacture of lantern-slide negatives from the object under the microscope can be achieved by any method in which the operator is most expert. It will be found that a great deal of the character of the result depends on the subject to be taken. The preparations should be perfectly clean, with the object sufficiently flat to allow of being focussed sharply all over. Certain objects, in which yellow or yellowish-brown colours exist, will not transmit light, or so imperfectly as to be hardly available for photography. When mounting objects, if they are intended to be photographed, it will be found a good plan to bleach many of them—such as insects and their parts by long maceration in turpentine, and sections of dark-coloured wood by nitric acid, etc.

The negative should not be over-exposed; at the same time under-exposure for lantern slides is complete ruin, as all the finest details of the object are wanted. A long exposure and a development with a strongly restrained developer is perhaps a good plan, as the details are thus secured, and yet a thin, misty image from over-exposure is avoided. Plates exposed to gas or lamp-light will be found to take longer to *commence* developing than those exposed to sunlight; once begun, however, it goes on easily enough, and quite as perfect pictures as those produced by sunlight may readily be obtained. The time of exposure is not easily judged, as it is so dependent on the nature of each object. Practical experiment will be your only guide. A negative with good strong contrasts is to be aimed at, as if required for making lantern slides, the slide will be certain to follow the lead of the negative from which it is produced, and, if that is thin and wanting in contrast, the lantern slide will almost inevitably be the same, and give a washed-out picture in the lantern.

The ferrous oxalate developer is well known, and can be found in any of the innumerable text-books of photography published. It has great advantages of its own, but, unfortunately, it also has disadvantages, one of which is that it is not so easy to compensate for under- or over-exposure with this developer. For those who prefer the old pyrogallic acid developer there is a method of development with sodic sulphite, which gives black tones instead of yellow ones—an important consideration when developing the negative, and absolutely necessary in the case of the lantern slide. The formula I prefer is known as Berkeley's—A: Pyrogallic acid, 1 oz.; sodic sulphite, 4 oz.; ammonium bromide, 600 grs.; citric acid, 60 grs.; water, up to 12 oz. B: Strongest liquor ammonia (·880), 2 parts; distilled water, 1 part.

A is mixed by dissolving the sodic sulphite and bromide of ammonia in hot water, adding the citric acid. When these are dissolved the solution is poured over the pyrogallic acid, and the mixture is then made up to 12 fluid oz. with more water. When about to develop, 1 dr. of A is diluted to 2 oz. with water, and successive small portions of B, beginning with about 5 drops, are added to it in another vessel until the picture appears. Development will be much slower than without the sulphite, etc., but the result will be a dense black negative, which will give an equally black lantern slide, all the details being very sharply drawn, and therefore very suitable for enlarging.

The hydroquinone developer is considered by many to be *the* developer *par excellence* for lantern slides. I give a formula used with Thomas' plates, which gives extremely good results—No. 1: hydroquinone, 160 grs.; sodium sulphite, 2 oz.; citric acid, 60 grs.; potassium bromide, 40 grs.; water, up to 20 oz. No. 2: sodium hydrate, 760 grs.; water up to 20 oz.

In cold weather equal parts of Nos. 1 and 2 are used, but in hot weather many workers have found this too strong, and it is preferable to dilute it with an equal quantity of water, adding an extra 3 or 4 grs. of bromide of potassium for every 1 oz. of developer. If the plate is over-exposed, the high lights can be brought up with this diluted developer; and the detail afterwards brought out by using the normal developer—*i.e.*, equal parts of each.

I am supposing that the actual details of development are known to the reader, as plenty of information has been given in former numbers of this paper. Guides also abound, priced from sixpence upwards. One of the best and about the latest published is that by Mr. J. Eaton Fearn. This is a shilling book, and in it you will find a chapter on lantern-slide making, which will supplement my instructions. Of the older guides, Burton's "Modern Photography" gives you the most for your shilling, and there is a "Beginner's Guide," at sixpence, published by Messrs. Perken & Rayment. Another admirable and much larger work is Marion & Co.'s "Practical Guide to Photography"; this costs half-a-crown.

It is possible to produce stereoscopic photographs of microscopic objects, but the apparatus required is rather elaborate; and, as it is not strictly available for lantern slides, I will refer my readers to page 256 of Dr. Lionel Beale's book on "How to Work with the Microscope," where various methods will be found. The simplest is certainly that of Mr. Heisch, who recommended an adapter for the object-glass, carrying a tube which can be turned half round by a lever outside. In this tube is another which has a stop to cut off half the pencil of light proceeding from the object-glass; when this sliding tube is placed in proximity to the back lens of the objective, the field on the ground glass of the camera is equally illuminated in all positions of the stop. Now the first picture is taken on half the prepared plate, and the stop is turned round until it is in a position directly opposite where it was during the first exposure. The other half of the plate is now placed in position, and a second exposure takes place. The two pictures combined give a stereoscopic effect. In the case of thick objects the near surface should be focussed for one picture and the farther surface for the other.

AN EASILY-CONSTRUCTED AIR COMPRESSOR.

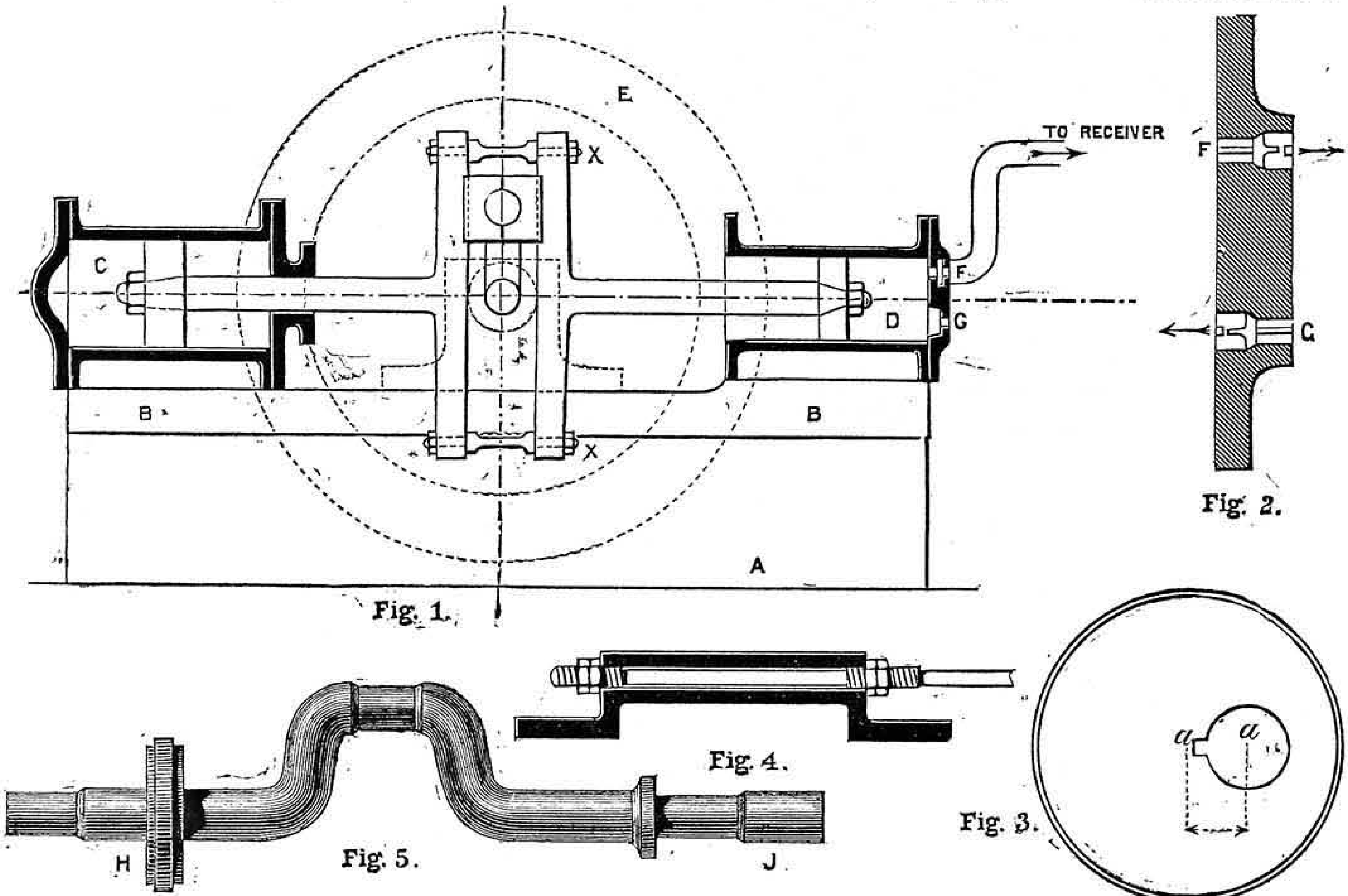
BY T. R. BLACKETT.

INTRODUCTION—CLASS OF COMPRESSOR—CAST-IRON WORK—STEAM CYLINDER—PARTICULARS OF DITTO — AIR CYLINDER — PARTICULARS OF DITTO—BED-PLATE—PISTON, FLY-WHEEL, ETC. —WROUGHT-IRON WORK—AIR RECEIVER.

IT is my intention in this article to give the proper working detail of an air compressor and receiver, these details having been taken from one in every day use in a manufactory. To convey my meaning clearly to my readers, so that one and all may grasp the design, etc., I have selected what may be termed a "single acting air compressor."

It will be seen by the general view, that by adopting this design we shall be able to do away with both connecting-rod and horizontal motion bars, the compressor resembling the form of donkey pump that one sees on board ship in the engine-room, but in the present instance we have it horizontal instead of vertical.

We will commence in the first instance with the cast-iron work, assuming that we have the services of a pattern-maker handy. Fig. 1 will give us sufficient idea of the form of steam cylinder we require, which, when finished, should be of the following dimensions:—Diameter, 8 in.; thickness of metal to be $\frac{5}{8}$ in.; length of cylinder (that is, from face to face) to be 1 ft. $3\frac{1}{2}$ in.; so that the pistons having a stroke of 1 ft., and the spigot of the cylinder cover being let into the cylinder $\frac{3}{8}$ in., there will be a clearance of $\frac{3}{8}$ in. at each end of the stroke for the piston. We must remember that the piston is 2 in. thick.



Air Compressor. Fig. 1.—General View of Air Compressor—A, Foundation to be of Stone or Concrete; B, Bed-plate; C, Steam Cylinder; D, Air Cylinder; E, Fly-wheel; F, Delivery Valve; G, Suction Valve. Fig. 2.—Showing Suction and Delivery Valves—F, Delivery Valve; G, Suction Valve. Fig. 3.—Giving Throw of Eccentric Sheave from *a* to *a*. Fig. 4.—Giving Sectional View of Slide Valve. Fig. 5.—Crank Shaft for Air Compressor—H, Eccentric Sheave; J, Fly-wheel End.

Having so far determined that our cylinder shall be one of 8 in. diameter and 12 in. stroke, we will now attend to the dimensions of steam and exhaust ports. Let us say for the area of steam port that area of cylinders in square inches ÷ 12 will be a very good proportion, which will be $4\frac{1}{8}$ in. nearly, say $4\frac{1}{8}$ in. area. Now for the length of steam port, let us say, diameter of cylinder in inches × ·7, which will be 5·6 in., say $5\frac{1}{2}$ in., which will be near enough for all practical purposes. Then for the width of the steam port, which is found by dividing the area of the port—that is, $4\frac{1}{8}$ in.—by its length, which is $5\frac{1}{2}$ in.; this will give us, roughly speaking, $\frac{3}{4}$ in.

This system of getting out the sizes for cylinders I have found from practice to answer very well indeed, but many engineers have, of course, their likes and prejudices on such matters. Let us now make the width of our exhaust port $1\frac{5}{8}$ in., which will also be a good proportion. The width of bar from the edge of steam port to the edge of the exhaust port is to be $\frac{7}{8}$ in.

The cylinder covers for this cylinder to be as per sketch, which, I think, will convey sufficient information that any practical pattern-maker will grasp at a glance.

Let us now turn our attention to the air cylinder. It is to be 6 in. in diameter, and the same stroke as the steam cylinder; the thickness of metal to be $\frac{5}{8}$ in., and thickness of its flange at the back end to be $\frac{3}{4}$ in. It will be seen in this case that the one cylinder cover of the air cylinder is minus the usual spigot, and contains also the necessary suction and delivery valves (Fig. 2). With regard to the bed-plate, it must be of $\frac{3}{4}$ in. section at its weakest part, and have what are known as chipping pieces on each end, so that the two cylinders when planed can be firmly bolted down to it.

For the remainder of our cast-iron work we must look to the eccentric sheave, slide valve, and the steam and air pistons, not forgetting the fly-wheel.

Now, if we were to allow no "lap" on the slide, the *travel* of the valve would be only twice the width of the steam port, which would be $1\frac{1}{2}$ in. But as we must cut off steam before the end of the stroke, we will give the valve $\frac{1}{4}$ in. "lap"; this will make the *travel* of the valve equal to 2 in., therefore we must give the eccentric sheave 1 in. throw—*i.e.*, the distance from *a* to *a*, Fig. 3. The eccentric sheave in this case to be a plain disc of metal, as shown in the figure. Next take the slide valve as per sketch (Fig. 4), so as to be connected up by a through slide spindle, which scarcely needs explanation.

We will next make the steam piston. It is to be 8 in. diameter, and to have two grooves turned in it to receive the piston rings, the grooves to be $\frac{5}{16}$ in. deep and $\frac{1}{2}$ in. broad.

Then the air piston is to be 6 in. diameter, and to have two grooves turned in it also, $\frac{3}{8}$ in. broad and $\frac{5}{16}$ in. deep; these, of course, are the finished sizes, and care must be taken that proper allowances are made for shrinkage when the patterns are first made. The piston rings in both these cases to be made of cast-iron, their diameter to be, when turned, $8\frac{5}{16}$ in. for the steam piston and $6\frac{1}{4}$ in. for the air piston; this is, of course, before they are cut and fitted to their respective cylinders.

A very good style for piston rings is to bore out the inside first to the required size, and then shift the job in the chuck, so that we have one side of the ring, say, $\frac{3}{32}$ in. thinner than the other ($\frac{3}{32}$ in. would answer very well in the present instance); this is the part that we would have to cut and fit the ring to the cylinder. It will be seen that by adopting this method the thickest part of the ring opposite the cut would have a tendency to spring open the ring, more so than if we had turned the whole ring of equal section. The fly-wheel should be about 3 ft. 3 in. diameter, and about 3 cwt. in weight.

The wrought-iron work will be our next consideration. The crank shaft, which can be bought at any forging company's works ready made, to be as per sketch (Fig. 5). Then the two piston-rods to unite in one common crosshead (as shown in Fig. 1), secured by bolts through distant pieces at X X, and having a nice split crank-pin brass for the crank-pin to work in. This means of changing a reciprocating motion into a circular one answers our purpose at the present time fairly well.

Here we have the principal instructions necessary for constructing an ordinary single-acting air-compressing engine which will give a continuous supply of air at a pressure of 35 lbs. per square inch through a 1 in. delivery pipe, the engine to run at the rate of 100 revolutions per minute.

These air engines, as they are sometimes called, are used extensively in our large chemical industries for drilling rock, and for other purposes too numerous to think of. Now with regard to our air receiver. It is a well-known fact that the best shape of receiver is that of an egg—that is, for standing any great pressure. Well, the next best will be a cylinder, so we must just have a receiver cast in the form of a cylinder closed at each end, and of the same thickness as the air cylinder of the engine. This receiver must be fitted with a pressure gauge, a blow-off cock, and a spring-loaded safety valve, as well as any other necessary stop valves connected to the system that the air compressor and receiver has to work.

HOW TO MAKE A CHEAP SPIRIT LAMP, BUNSEN BURNER, BLOWPIPES, ETC.

BY H. B. STOCKS.

Usual Form of Glass Spirit Lamp—Cheap Form—Materials Required—Method of Making—Cost—Bunsen Burner—Utility of the Burner — Construction — Materials Required—Method of Making—Method of Adjusting Gas and Air—Useful Blowpipe Adjunct.

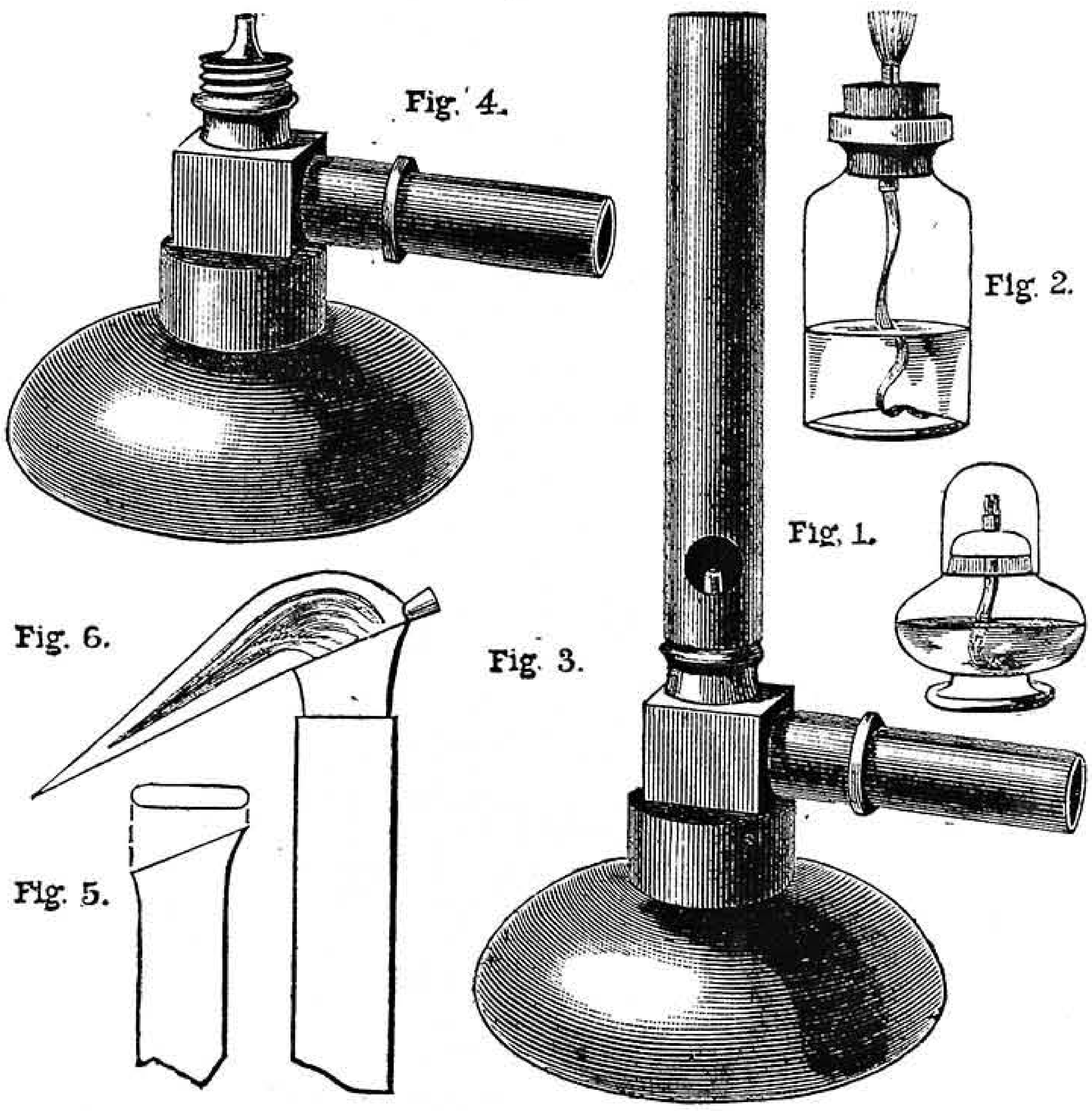
I have noticed in Work a growing interest in heat-giving appliances. Certainly no one could have a greater name, so far as gas-heating appliances are concerned, than Fletcher of Warrington; but it is within the reach of all to make their own appliances, even if they do not at the same time make a great name.

I have spent some little time in elaborating the simplest forms of spirit lamp, Bunsen burner, and blowpipes, and intend in the following lines to describe them. The description will, I hope, be useful to those studying chemistry, and to those in trade who need such appliances.

Spirit Lamp.—The spirit lamp which we see usually in chemical laboratories consists of a glass vessel to hold the spirit, with an earthenware or brass tube in the mouth of it through which the wick passes, and over this is a glass cap ground to fit on the lower vessel so as to prevent evaporation when the lamp is not in use (Fig. 1). There are other forms of spirit lamps used by plumbers, differing in the material of which they are made. There is described the making of one on p. 696, Vol. II. of Work.

What I wish to describe is a cheap form of the glass spirit lamp. Provide yourself with a two-ounce wide-mouthed bottle and cork to fit it, the holder portion of a penholder, some unwoven cotton wick, and methylated spirit. By means of pliers break off the portion of the holder which grips the pen, and you then have a steel tube. Make a hole in the centre of the cork to fit the tube—with a little pressure and moistening the tube itself will make the hole—and push the tube half-way through the cork. Make a smaller hole in the cork by means of red-hot wire; this will allow air to enter as the spirit escapes. Pull the wick through the tube, leaving plenty of it out. Put some spirit in the bottle, cork up tight, and light, and you will find you have got a very fair spirit lamp for 3d. or 4d. (Fig. 2). The Bunsen burner—known to some as the atmospheric burner—was invented by the chemist of that name. It is a most useful appliance. It burns with a blue flame when properly adjusted, gives out great heat, but practically no light; and when a cold body is brought into the flame it does not deposit soot, which distinguishes it from any other burner except the spirit lamp. Since the original burner was made numberless others have been invented, besides gas stoves, gas furnaces, and gas cooking and heating appliances, all of which depend upon the same phenomena as presented by the simple burner.

In Fig. 3 you see the ordinary Bunsen burner. It will be seen that there are holes at the base of the upright tube, through which air is drawn by the gas itself as it ascends the tube. Fig. 4 shows the base of the burner with the tube unscrewed, to show the small jet through which the gas issues.



Chemical Appliances. Fig. 1.—Spirit Lamp. Fig. 2.—Cheaply-made Spirit Lamp. Fig. 3.—Bunsen Burner. Fig. 4.—Bunsen Burner with Tube unscrewed. Fig. 5.—Brass Tube cut. Fig. 6.—Directed Flame of Burner.

To make a Bunsen burner the following materials will be necessary:—A piece of brass tube 3½ in. long, ½ in. diameter (external); a piece of tube ⅜ in. in diameter, 1½ in. long; a brass boss similar to those on an ordinary bracket, but without a tap; a brass elbow tube; also a piece of tubing with very fine bore (small bit of tube from an old oil-can will do).

Commence by soldering the elbow-piece on to the brass boss, and notice that the tube, with a screw cut for gallery, must be uppermost. If the large tube is not of very thick brass, it will be a little too large for our purpose. Cut out a piece of very thin sheet brass, ½ in. by 1¼ in.; turn it up into a cylinder and solder *inside* the large tube; then tap the tube inside so that it will screw on the male thread of the elbow-piece. At the same end of the large tube on which you have tapped a thread, drill two holes of about ⅜ in. diameter, exactly opposite to each other, and centres ⅝ in. from the end of the tube.

The tube with fine bore must be about ¾ in. to 1 in. long, and requires to be soldered inside the vertical tube of the elbow-piece, and allowed to project about half an inch. If it is too small, plug around it with a little sheet lead, but keeping the small tube perfectly vertical and also in the centre of the outer tube, then solder. If you now screw on the larger outer tube, and also screw the 1½ in. tube into the side opening, the burner is theoretically complete. Fix the indiarubber tube from the gas supply on to the side tube, and let us see if the burner is practically complete. If, after lighting, the flame burns with a purplish-blue colour, the air and gas are being delivered to the burner in the right proportion. If the flame is yellow at the tip there is too much gas supplied, so plug up the hole in the small tube to a slight extent. If the gas burns with a green flame and hissing noise, then the air-holes are too large. To remedy this, cut out a piece of sheet brass about ¾ in. wide and 1¾ in. long, and drill in it two holes, each ⅜ in. in diameter, and at a distance of ½ in.—centres $\frac{3}{16}$ in. further—from each end of sheet; turn it up into the form of a tube, and push it on to the large tube of burner until it covers the air-holes. By turning until the two sets of holes do not quite correspond, the proper amount of air may be delivered to the burner.

If the Bunsen burner is needed for blowpipe work, the following arrangement will be found very useful for supporting the blowpipe, and will allow of the flame being blown downwards upon a charcoal or other support. Get a piece of brass tube 4 in. long, ⅜ in. in diameter. Cut obliquely at one end (Fig. 5); soften this end by heating in the flame of the burner you have made, and quench it in water, then flatten it out carefully until the opening is a mere narrow slit. By dropping this inside the Bunsen burner, and closing the air-holes, a wide flame will result, which, by resting the nozzle of the blowpipe on the edge of the tube, may be blown downwards or upwards if required (Fig. 6). For spirit lamps, see pp. 696, 763, Vol. II.; pp. 16 and 269, Vol. III. For Bunsen burner, see p. 615, Vol. II.; also p. 368, Vol. II., and p. 181, Vol. III., for uses to which they may be applied, etc.

I quite agree with "F. B. C." (see p. 615) that the cost of a Bunsen burner is slight, but it is my impression that those who learn to make their own apparatus will know best how to use them, and therefore there will be a material gain.

In my next paper I propose to deal with the subject of "How to Make Cheap Blowpipes." I understand that the Editor of Work intends to give much attention to the subject of Chemistry and Chemical Appliances in Work, and, such being the case, my readers cannot do better than bring this, and subsequent articles, under the notice of schoolboys and the thousands of students who take an interest in chemistry.

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WATCH TRADE DRUDGERY.—While the whole country is being stirred up for the reduction of hours of labour, some of our best mechanics are wearing their lives away in protracted hours of business, running to twelve and fourteen hours a day. This is very noticeable in the watch trade, where it is not unusual to find an assistant at the bench who also serves at the counter. It is not easy to pick up a good watch hand, and therefore some masters, if they have one who interests himself in his employer's welfare, work him to the failing point, and give him assistants who are frequently worse than useless—for surely this applies to men whose work is returned as faulty, to be re-dealt with by other juniors, or, perhaps, the principal. We think that a man who is placed in charge of a watchmaker and jewellers' shop to serve customers should not be required to also work at his bench on a Saturday evening, which is usually a busy one in small provincial towns. The masters would not lose in the long run by a relaxation in this direction, as their assistants would then be more inclined to stop with them than to leave and start in business on their own accounts, and add to the long list of those who trade on credit, and from sheer necessity reduce the prices for repairing jobs. How, too, with such excessive hours can an assistant be supposed to have his wits about him to cope with fraudulent customers and swindlers?

SHEFFIELD FILE INDUSTRY.—There seems little doubt that this industry is in jeopardy at home—this arising partly from the activity of American and German trading houses, and the lethargic state of the home makers. The following letter, which has reached a Sheffield firm, speaks for itself:—"We are obliged to you for your letter of the 17th instant giving us the names of machine-cut file makers in Sheffield. We shall most likely be in Sheffield this week, so shall call on the firms you name. We have hitherto been using some very finely cut files made in America, but we think that Sheffield ought to be able to make files with anywhere, although up to the present we have not been able to get what we require." Sheffield will do well to take this hint, and abandon all old-fashioned prejudices. Manufacturers might also take a wrinkle with advantage to themselves from the Americans, whose custom is to "vacation" their superintendents, with whom they generally associate some long-headed practical workman, who, as a reward for signal service, and with their salaries going on and a liberal allowance for expenses, they send to England or other countries to combine business with pleasure, and in the pursuit of which they find means to visit the various workshops and manufactories connected with their crafts, taking notes of all interesting processes. This is frequently done by American firms, and answers a double purpose, giving the men a thorough rest and renewed health, and means for acquiring information, which is made use of as opportunity serves. If we are to hold our own with foreign competitors, English makers ought to be availing themselves of similar opportunities where they exist. The suggestion of "Workers' Holidays," made a few weeks since in a leaderette in WORK, would be one step in the right direction. It does take some time, however, to prove to the home trader that his position is not so secure as he feels it to be.

WINDOW CLEANING DEATHS.—Another lamentable accident to a domestic servant at Holloway, who lost her balance while cleaning a second floor window, and fell mortally crushed, recalls the miserable practice of employing girls to stand on a window-ledge at a great height for the purpose of cleaning windows. Most London windows can, or might be, easily displaced and pulled into the room. There are many very good patents for this purpose, costing but little more than the ordinary sash and frame, and many of the patents can be adapted to the existing frames; and even with new sashes, etc., £2 a window would cover the cost of most of them. Seeing the cost is, comparatively speaking, so trifling, it is surprising there are not more reversible sashes, that can easily be cleaned from the inside, in use than there are. £2 for a human life! An invention for suspending or hanging sashes has just been patented. Instead of employing for each sash two balance weights as hitherto, one only is used, the sash cords attached to one sash passing over pulleys at the top of the frame, and over pulleys secured to a balance weight, and returning over pulleys in the top of the frame and passing down to the other sash, to which they are secured. The frame, with the sashes, is then hung to an outer frame, and opens into the room like a casement or door, with the weight on the hanging side. The fact of opening this casement with the sliding sashes in not only renders the cleaning an easy matter, but at once exposes the lines, etc., in case of a breakage, and when it is shut and secured it is both air- and water-tight, and nobody could tell it from an ordinary sash and frame, especially from the outside. This method is equally applicable to ordinary windows having fixed frames, and if the patentee can supply the whole thing complete ready for fixing at the same rate as the ordinary sash and frame in common use, then one of the most diabolical of death traps for servants should be compulsorily made to disappear. There is no reason, too, why other inventions in the same direction should not be forthcoming.

DESIGN AND DECORATION OF ALL AGES.

BY M. H. C. L.

ASSYRIAN.

INTRINSICALLY, Assyria gives less ground than Egypt for interesting research in the field of decorative art; but it is important in the history of design because of the effect it has had on the art of modern nations, through its influence on Greece.

We have no tomb sculptures and paintings like those of Egypt, no objects buried with the dead such as we find in many pagan countries, notably in the tombs of Etruria and in those of ancient Scandinavia. It is to the sculptures from the old palaces, which the excavations of Sir Henry Layard and Sir Henry Rawlinson have brought to light, and the strange carvings found on the rocks, that we turn for a knowledge of their pictorial, which was also their decorative, art, to these, and to the copper bowls and dishes, the painted tiles, and the fragments of pottery, and to the delicately cut seals and cylinders discovered by the excavators among the *débris* collected about ruins.

The sculptured walls of the Assyrian palaces give pictorial histories of the doings of the kings; their marches with their armies over rocky country, through marshes, and by rivers; their conflicts with the enemy, the burning of towns and battering down of fortresses; their triumphant returns with troops of captives, the peculiarities of whose dress and method of wearing the hair prove to modern research from what countries they were taken. Often these captives are represented with bound hands or carrying burdens; sometimes taking part in labours such as the removal of one

Assyrian Ornaments. Fig. 1.—Sacred Tree. Fig. 2.—From Obelisk of Assur-Nasir-Pal. Fig. 3.—From Bronze Gates of Shalmaneser II. Figs. 4 and 5.—Trees. Fig. 6.—Palm-Tree. Fig. 7.—Lilies carved in Stone. Fig. 8.—From Border of Bronze Dish. Fig. 9.—Border of Dish. Fig. 10.—Libation poured by Assur-Banan-Pal. Fig. 11.—Cylinder from Cyprus. Fig. 12.—Chalcedony Cylinder (Assyrian). Figs. 13 and 14.—Figures carved on Stone, giving privileges to Ritti Marduk. Fig. 15.—Bronze Bowl, Palace at Nimroud. Fig. 16.—Terra-cotta from Kalch. Fig. 17.—Guilloche Border. Fig. 18.—Top of Babylonian Boundary Stone, B.C. 870. Fig. 19.—Assyrian Palmetta or Honeysuckle.

of the colossal bulls, which are the first facts in the history of Assyria to make an impression on the mind of childhood. Sometimes they are shown being subjected to the horrible tortures which are such an odious witness to Eastern cruelty. There is much less of the religious element in Assyrian representation than in the Egyptian; but the king was the great high priest of his people, and he is depicted in the sacred chambers, and on the cylinders, engaged in offering sacrifice. We also find representations of the Assyrian gods, both in gigantic sculptures and in bas-relief: Assur and the Fish-god, with whom the account of Dagon in Samuel has made us familiar; the Assyrian Hercules, contending with a lion; the Assyrian Venus—a lady of small pretensions to beauty. There are also mythical figures and strange devices, one of the most frequent of which is the Sacred Tree, which always bears the form given in Fig. 1. In the cylinders this form is reduced to great simplicity; but we always find some suggestion of the interlacing side boughs and the independent branch at the top of the stem. The Sacred Tree is a very old and widely spread symbol, and is generally guarded by two figures of strange beasts, or is an adjunct in a scene of religious ceremonial.

Mention has been made of a sacred chamber, a hall set apart in the palace for religious decoration as a votive offering to the gods who had given victory—the "palm-room," as it has been called. The chief worship of the Assyrians seems, however, to have been offered to their kings, to whom—as in Egypt also—a divine quality was ascribed. He stood between man and the unseen powers, and, while offering to the gods, was himself a demi-god.

A portion of a bas-relief representing the chase is given in Fig. 2. Hunting scenes were of very frequent occurrence, as, when not engaged in slaying their enemies, the chief delight of the Assyrian monarchs was in destroying the lower creation. Lion hunts were a favourite pastime with them, and the delineations of the fierce animals and of their hunters in the bas-reliefs are extraordinarily spirited. The Assyrians, like the Egyptians, knew nothing of perspective, and, when drawing a river with trees beside it, gave a bird's-eye view of the water and laid the trees down flat on each side of it, with their trunks facing towards the stream! A device for showing a chariot drawn by four horses was to place the horses on top of one another, showing the whole of each. Troops of men dragging a weight were treated in the same way, as though walking along ledges in a steep rock. The attitudes of their figures, however, were varied and true to life, and their animals were admirable. The methods of conventionalisation of the Assyrians are worthy of study; for, however impossible the grouping and anti-naturalistic the representation of objects, each scene of the bas-reliefs explains itself at a glance, and the history contained in them is nearly as clear as in the written inscriptions which accompany them, and are often written straight over the pictures. Four methods of conventionalising trees are given in Figs. 3, 4, 5, and 6. They are, in their way, as true to nature as Hardy's tree sketches, and are not wanting in a certain beauty—especially the palm-trees with their fan-like and feathery branches. The Sacred Tree is unlike anything in nature—doubtless designedly so, like the monstrous animals with human heads, bulls' bodies, and eagles' wings which stood for sacred animals. The vine was a subject too difficult for Assyrian art, and in its crude ugliness the Assyrian vine resembles the ivy-sprays and rose-branches we are too familiar with in the decoration of cheap tea-trays; but in one of the bas-reliefs now in the British Museum there are two lilies treated with such simplicity and grace that they would be a joy to the nineteenth century æsthete (Fig. 7). The lotus occurs in Assyrian decoration but sparingly; their chief flower-form was that to which Sir H. Layard gives the name of the poppy, and which in Greek art developed into what is called the honeysuckle.

Of actual pattern-drawing the Assyrians did little. The garments of some of the figures in the bas-reliefs are embroidered, but there is nothing striking about the designs. The cone was much used. The star also was a favourite form, probably because astrology had a large part in the Assyrian religion. The king, in the mystic scenes in which he figures, is sometimes surrounded by the sun, moon, and stars.

The most characteristic decorative design of the Assyrians is the guilloche. This border was very extensively used, and from them has come down to us, retaining to this day its popularity. Ruskin contemns the guilloche, chiefly upon the ground that it has no counterpart in nature except in an obscure chemical combination. Surely he has forgotten the wild honeysuckle of our hedges, two or three stems of which often cling together for mutual support, forming in their twisting round and round each other a natural guilloche. What was the origin of the design? Sir Henry Layard thinks it may have had some astrological significance. But among the bas-reliefs in the British Museum there is portrayed the figure of a king pouring a libation from a cup held out in his hand. The stream of water gives the curl round that water is always seen to do in falling in a solid jet from a height, and the curl is represented by a guilloche (Fig. 10). This has suggested to the writer that the guilloche may be one of the many varying conventionalisations of water. The form, when once devised, forms such a natural and simple bordering that it was almost certain to be adopted for decorative purposes. Its value is known to every decorator. It can be worked in wood or metal, and might well be used for embroidery; it is often painted as a border, but where it has been most successfully brought out is in the tessellated pavements of the Roman Empire. The adaptation of such forms belongs to the subject of original design rather than to that of the present series of papers. But the evolution of the guilloche has been of the simplest. Its first inevitable step was the insertion of a small form, such as a star or a blossom, in the space naturally left between the intertwinings of the two strands. This first step was its last, and to this day it remains to us in its naked simplicity, just as it appears on the Assyrian monuments.

The metal bowls and plates, of which mention has been made before, are some of the most beautiful of the Assyrian remains, and those which best represent their purely decorative art, though fragments of earthenware, with designs painted on them, and glazed bricks have also been discovered bearing analogous designs. The handles of the bronze vessels were often formed in the shape of the heads and fore-parts of animals. The subjects of the designs embossed or incised on the surface were animals in conventional pairs, or forming a band, representing such scenes as a lion springing upon a bull, two vultures devouring a hare, or stags feeding gracefully among reeds and trees. Occasionally the scarabæus appears, with other traces of Egyptian influence; guilloches, stars, and tulip-bands are largely used. It is interesting to know that the method employed for the repoussé work was the same as that in vogue nowadays. The copper was laid on a bed of mixed clay and bitumen, and punched with a blunt instrument, a few strokes of which, in the rougher work, served to produce the image of an animal. Fig. 15 is a portion of the design on a bronze bowl from the N.-W. Palace at Nimroud; Fig. 8 from a bronze dish found in the same palace. The curious head-dress worn by the hawk-headed lion like the Egyptian "pshent" had a divine import. We find it on the human-headed bulls and on the kings as represented in their most sacred moments. The mystic animal lays its foot on the head of a worshipper by way of protection and blessing—not, as might appear to the casual observer, as a means of extermination. The winged scarabæus appears on the same bowl, the design of which is exquisitely preserved.

Among the most curious discoveries in the way of Assyrian relics are the cylinders—probably amulets—made of lapis-lazuli, amethyst, agate, onyx, and the like, from a quarter of an inch to two inches in size, and engraved with religious or historical subjects. Fig. 12 is the impression of an Assyrian cylinder of chalcedony. The subject is the Sacred Tree, with two adorers, one on either side—in the air a winged disc, emblematic of the god Assur. Cylinders made by the Phœnicians—those early masters of the arts, the great workers in metal of antiquity—have also been found. Fig. 11 represents part of a quaint cylinder from Cyprus. Babylonian cylinders are also numerous. Of the decorative art of Babylon we have little left in comparison with the vast treasures bequeathed to us by Assyria. The Assyrian bas-reliefs, with which the outside and inside of their palace walls were adorned, were chiefly cut in alabaster, and have thus survived the lapse of centuries; but the Babylonians had no such durable material in any large quantity to their hand, and their sculptures, cut, for the most part, in rock of perishable quality, have long ago crumbled away. What remains shows that great resemblance existed between the arts of the two countries. The wings of the sacred bulls of the Babylonians were shorter, and there were other slight distinguishing peculiarities; but their worship in essential points was very similar, and there are no marked contrasts in their system of decoration. Fig. 18 represents some of the very quaint figures the Babylonians were wont to carve on their boundary stones; Figs. 13 and 14 are from another stone monument—a grant of privileges granted to Ritti Marduk by Nebuchadnezzar about B.C. 1120. The embroideries of Babylon were early famous. It was, doubtless, the beauty of the embroidery on the "goodly Babylonish garment" he had secreted that cost Achan his life. The Babylonians were also great weavers in wool and silk, and the producers of renowned carpets. They buried their dead, and earthenware coffins containing bodies were found covered with decoration, but these perished almost as soon as found.

In my next paper of this series I shall hope to treat of Greek design and ornament, which rose to great perfection in the social life of this great people. Influencing, as it has done, modern ornament, the subject appeals with especial interest to every art worker.

SCIENCE TO DATE.

Electricity in War.—The United States navy has provided one of its ironclads with electric fans to blow away the smoke from the guns.

Good Gum.—Melt at a gentle heat 100 parts of gilders' glue in 200 parts of water, then add 2 parts of lac previously dissolved in 10 parts of alcohol. Next, prepare in the cold a solution of 50 parts of dextrin in an equal quantity of water, and add it to the first liquid with constant stirring. Filter the still liquid solution through linen, and put it in bottles, where it solidifies on cooling and preserves well. To employ this substance, a sufficient quantity is taken, melted, and diluted more or less, according to the use for which it is destined. If it is wished to stick thin paper, the pure dextrin may be advantageously replaced by a solution of the same substance in 5 parts of water, 1 of alcohol, and 1 of acetic acid.

Preservative Fluid for Biological Specimens.—According to Mr. Haly, of Colombo, carbolised oil is an excellent preservative of the natural colours of fish, snakes, or frogs. It is not suitable for marine invertebrates.

Silica in Wheat.—MM. Berthelot and André have determined the amount of silica, soluble as well as insoluble, contained in the various parts and at various stages in the growth of a culture of corn on a soil in which the amount of silica was previously determined. The grain sown contained a minute quantity of soluble silica. At the commencement of growth the stalk contained a notable quantity of insoluble silica, but at the beginning of the flowering the greatest proportion of the total silica appeared in the leaves. Of the total quantity of silica in the plant, the greater part was in the insoluble state; soluble silica exists for the most part in the roots. During the ripening of the grain, the silica accumulates more and more in the leaves; the stalk and roots only contain soluble silica. At the time of desiccation, on the contrary, the roots contain little silica, the stalks more, partly in the insoluble state.

Mistletoe.—It is generally supposed that the mistletoe is injurious to the apple or other tree on which it grows. Dr. Bonnier, of Paris, has recently put forward arguments, based on experiment, to show that this supposition is not correct, but that, in reality, the mistletoe is beneficial to its host. Thus, by observations on the increase in the weight of the dried leaves, he finds that whilst in summer the mistletoe receives the greater part of its nutriment from its host, yet in winter the increase in weight of the mistletoe is less than the amount of carbon which it has obtained from the atmosphere, showing that it has given up to its host a portion of its assimilated material.

New Acid.—A short time ago M. Recoura discovered a remarkable isomeric form of chromium sulphate, a solution of which yielded no precipitate of barium sulphate with barium chloride. When a solution of zinc sulphate is mixed with one of the isomeric chromium sulphates, a substance of the composition $ZnCr_2(So_4)_4$ is formed. This substance gives none of the reactions of sulphuric acid or of chromic acid, but at the same time it exhibits the usual reactions of zinc salts. Hence it must be the zinc salt of a new acid—chromosulphuric acid. The free acid has been obtained as a green powder, very deliquescent in moist air, but permanent in a dry atmosphere. Its solution is bright green in colour when freshly prepared, but gradually changes to blue, and finally to violet, when the solution consists only of ordinary chromium sulphate mixed with free sulphuric acid. Other salts of this interesting acid have been studied.

Nitrojute.—Nitrojute is a new explosive. By treatment of one part by weight of jute fibre with fifteen times its weight of a mixture of nitric and sulphuric acids it is obtained as a brownish-yellow substance, insoluble in water, alcohol, ether, or benzine, but, like other nitrated carbohydrates, soluble in acetic ether and nitrobenzine. It explodes, on percussion, like gun-cotton.

An Electrolytic Method of Preparing Boron.—Fused boric acid becomes a good conductor of electricity when mixed with 20 per cent. of its weight of borax. On passing a current of 35 ampères through such a fused mixture, a little sodium is liberated at the negative pole, while amorphous boron and oxygen are produced at the positive pole. Owing to the high temperature, some of the boron re-combines with the oxygen with brilliant incandescence, but the remainder may be isolated as a chestnut coloured powder.

NOTES FOR WORKERS.

Russia has the longest electric railway in the world, and the government is now considering the construction of a line from St. Petersburg to Archangel, a distance of 500 miles. The longest British line now in operation is between Portrush and Bushmills, in the north of Ireland, and is only 6 miles long.

Methylated spirit is a mixture of 90 per cent. of spirit of wine (alcohol) and 10 per cent. of partially purified wood spirit. The latter is put in to make it undrinkable, and therefore free from the very high duty levied on pure spirit of wine.

Polished surfaces of steel and iron, if varnished with a mixture of lime and oil, will keep their brightness and not rust when exposed to water.

Fifty telephone wires are being erected between Chicago and New York, a distance of 980 miles. This will be the longest line in the world, and as there are two wires in each line, 98,000 miles, or 8,528 tons, of copper wire will be used.

If an alternating current is sent round the laminated field-magnets of an alternator whose armature is stationary, an alternating current is generated in the latter, just as if the field-magnets revolved under the excitation of a steady current.

The effect of revolving the armature as well as exciting the field-magnets with an alternating current is the same as if the field-magnets were revolved at one speed (under steady excitation) and the armature revolved independently at some other speed.

The result of this double rotation is to produce an alternating current whose frequency corresponds with the sum or difference of the speeds according as these are in opposite or the same direction.

WORKERS' QUESTIONS: EIGHT HOURS.

BY ECONOMICUS.

Apart from their own private and individual affairs, there is, perhaps, nothing occupying so large a share of the attention of workmen as the question of limiting the number of hours they shall be permitted to work per day. This question crops up in the workshop, at the dinner-hour, at the meetings of unions—in short, wherever two or three workmen are gathered together, there, it may be said, you will find "eight hours" the subject of conversation, each speculating as to what the effect of the system upon himself and his peculiar trade would be. It is this widespread and living interest in the topic that has forced it into the pages of Work, which has no blind political leanings, and which is, therefore, all the more suitable to offer some general observations to enable workmen to arrive at clear views upon the subject.

In the first place, there should be no difficulty in coming to a conclusion upon the question of a compulsory universal eight-hours day—*i.e.*, an eight-hours day applicable to all employments. In the case of one employed like myself, the closest scrutiny could never discover the number of hours worked, and I am only one among thousands similarly occupied. When Sir Isaac Newton was lying on his back in the orchard and saw the apple drop that led to a revolution in our conceptions of the universe, the Government inspector would have jotted him down as not working then. All the same, he must have been struggling very severely. To everyone's mind will readily occur numerous other sorts of work in which no kind of inspection would avail.

These considerations reduce the applicability of a universal eight-hours law only to those employed in workshops and such places as are known to be places where workmen go for the sole purpose of working. No doubt, if a sufficient number of active inspectors were appointed, breaches of the law in such places might be detected as often as they were made. But the workers employed in these places comprise only a small part of the total population, and it would be obviously unfair that the small part—especially those in it that objected—should be under the operation of a law from which all other workers, from the nature of the conditions under which they worked, were free. Moreover, those workers upon whom the law would operate most precisely are generally paid piece-work wages, and such would be very apt to resent a regulation that resulted in reducing the money they had to draw at the week's end.

These are pointed out as difficulties, apparently insuperable. Let us hope they are not insuperable, however, and that a way may yet be found whereby, to the disadvantage of none, our workmen may enjoy greater leisure than they now do without any reduction of income.

Dismissing, then, as impracticable a compulsory universal eight-hours day, we will now speak of a compulsory eight-hours day for a certain trade or group of trades. The high-water mark in this movement has been reached by the miners, whose case has so far developed as to have become the subject of a Bill brought before Parliament and strongly supported. The reason that the miner has been singled out for special treatment is because his work is very arduous and very dangerous, and because the conditions under which he carries on his work are very disagreeable. All are agreed on these points, and it has consequently been proposed to mitigate the harshness of his lot by forbidding his being employed more than eight hours per day. The miner himself, however, has not made up his mind so clearly upon this point as his friends seem to have done. You see, he is paid so much for every ton of coal he turns out, and he is apprehensive lest, his hours being reduced, the number of tons he turns out will be similarly reduced, and his takings at the week's end affected to his detriment. The advocates of the miners' eight-hours day say to this: "No; the output will not be reduced. The miner with eight hours only will work so much harder during that time than he now does, that he will turn out just as much coal as before." This may be true, and it may not. It may be true of the stronger miners, but what of the weaker? If they are unwilling or unable to live on less wages than they are now earning, it would manifestly be cruel to compel them to do so. Besides, even for the stronger miners, the extra exertion to keep up the output in the shorter hours might be more trying than their present exertion. Many a man can catch his train in five minutes by running all the way from his house to the station. He does it far more easily, however, and is far less tried by allowing himself fifteen minutes. Thus there are many doubts to clear up yet ere an eight-hours day, even for miners, can with certainty be recommended as an amelioration of his lot.

We shall take one step just a little deeper into this question before leaving it. For some it may, perhaps, be a difficult step; for all, however, it will be interesting, as it concerns wages—important, well worth mastering. What really would be the effect of an eight-hours day upon miners' wages, supposing the output of coal to be reduced? If, after the miners worked only eight hours a day, the quantity of coal turned out were not sufficient to meet our requirements, clearly more miners would be employed. Now, if employers found any difficulty in getting these additional miners, the rate of miners' wages would be increased—more would be given per ton turned out. This increased rate would not last long, and the greater the increase, the briefer would be the period it was maintained. The high wages would attract workmen to the pits, and the higher they were the more workmen would they attract. The consequence would be that, instead of employers finding it difficult to get miners—the difficulty that raised wages—miners would find it difficult to get employment—the difficulty that reduces wages. Thus, then, the wages of miners would fall back to their old rates, perhaps below them if the labour attracted by the temporary high wages was much in excess of what was required.

These are points well worth the consideration of all classes of workmen at the present time. The man that has a thorough grasp of the causes that fluctuation in rates of wages is due to is not likely to be led away by delusive hopes. Let every man by all means strive to get the highest return for his labour that he can, but, in so striving, let him be careful not to act so foolishly as the avaricious man who killed the goose that laid him golden eggs.

One other aspect of this question. While a workman is engaged with his tools, he is in no danger of having to spend any money. It is in his leisure that very often the necessity arises, or temptation comes in the way, urging him to seek amusement. Time hangs heavy, and to kill time is frequently costly; and the more time one has to kill, the more costly is the performance liable to be. Many who are not hobbyists will have this difficulty to face. With shorter hours of work, they will have longer hours of play; and as play means expense—in large towns, at any rate—even though wages may be the same and not reduced at all, they will find their power to save in many cases considerably curtailed.

TRADE: PRESENT AND FUTURE.

*** Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

Shipbuilding Trade.—The Aberdeen shipbuilding and engineering trades are dull. One of the largest orders in hand is for a large passenger steamer for the Aberdeen Steam Navigation Company. The *Resolute*—the first of two new battle-ships—is ready for launching. The second ship—the *Revenge*—is in a forward state, wanting principally such superstructural parts as "conning towers," casemates, etc.

Silver and Electro Trades.—A slight improvement is noted in the Sheffield silver, electro-plate, and Britannia metal trades; in the latter branch orders coming to hand from France.

Cotton Trade.—In the Lancashire cotton trade there is a feeling of dissatisfaction at the comparative insignificance of the concessions obtained. It is contended that compensation for bad work is an "admitted principle" in Oldham and elsewhere, and the only point which the operatives have gained is the general extension of the arrangement to the other districts. With regard to the employment of non-unionist labour, the position remains practically unaltered. The Stalybridge Company's spinning mill continues to be the centre of a disturbed area.

Jewellery Trade.—The London jewellery trade is still dull, and there is but slight sign of improvement. The case is the same in the country and in Paris.

Timber Trade.—Some twenty or thirty vessels have been unloading a very fine cargo of deals and battens, KAB and NAS mark, in the centre yard of the Surrey Commercial Docks. The cargo also consisted of some 3 × 2 scantling. Piled under the sheds was the first cargo to arrive from Sweden. There was also a fine parcel of BSSC, BC, and BBB 3 × 9 yellow and B—Co. white, Canada sheds—these goods being remarkably bright and clean. There is also unloading a cargo from Freemantle of Jarrah wood.

Sheet Metal Trades.—In the Wolverhampton district most makers are fairly busy just now in stamped hollow ware and japanned goods. The trade in manufactured iron is dull, some makers being unable to find full employment for their men. In the tin-plate industry, makers in the South Wales and Monmouthshire district are firm.

Engineering Trade.—There is little change to chronicle in the condition of the Lancashire engineering and iron trades, and it is considered that an exceedingly depressed period may be anticipated, so far as this district is concerned. A few machine tool makers have booked some orders for new work, but otherwise this branch, like that of stationary engine building, is in a very stagnant condition. Locomotive builders are somewhat better circumstanced. Boiler makers are also reporting a decided lull in their business. The shipbuilding and marine engineering trades are exceedingly short of work, except in the Barrow district, where a fair amount of briskness prevails in both branches.

Boot and Shoe Trade.—The West-end London boot and shoe trade has improved, and gives great promise.

Building Trade.—In Rochdale and district the stonemasons are still out on strike. The demand of the joiners for an advance in July has not yet been conceded, and there is every probability of a strike. The Arbroath joiners have resolved to strike work immediately unless the masters grant an increase of ½d. per hour, making their wages 7½d. an hour. The Sheffield bricklayers' strike still continues. Thirty-four of the masters have signed the men's working rules, but the contractors for the municipal buildings here having refused, no bricklayers are on the works.

Iron Trade.—In the Middlesbro' iron market No. 3 Cleveland pig was quoted at 40s. per ton for prompt delivery, but few firms are in a position to deliver. Merchants ask 38s. 3d. to 38s. 6d., which is 1s. 6d. less than at the previous close. Warrants have dropped to 38s. cash. The stock of forge pigs is almost exhausted, there being only two or three makers who can supply it. The production and demand for finished iron is somewhat heavier, and prices are stiffer. Steel ship plates are £5 15s.; angles, £5 12s. 6d.; iron ship plates, £5 10s.; angles, £5 7s. 6d.; common iron bars, £5 12s. 6d.: all less 2½ discount and F.O.T. for delivery after close of the strike. Heavy steel rails are £4 net at works. In Sheffield the scarcity of hematite iron threatens to limit the output of steel. Armour plate establishments are still working full time in order to complete the heavy work for the Admiralty programme. The file trade has improved.

Printing Trade.—The printers of Liverpool have been considering the terms offered by the employers, and have accepted them by a very large majority; they are briefly as follows:—Daily papers, night hands, 50 hours per week, £2 5s., with 1s. 2d. per hour overtime; casual hands, 11d. per hour. Day hands, 51 hours per week, at 35s. 6d., and 11d. per hour overtime. Jobbing work and weekly newspaper hands, 51 hours per week, 35s. 6d., and 10d. up to 1s. 1½d. per hour overtime, according to length of time overworked.

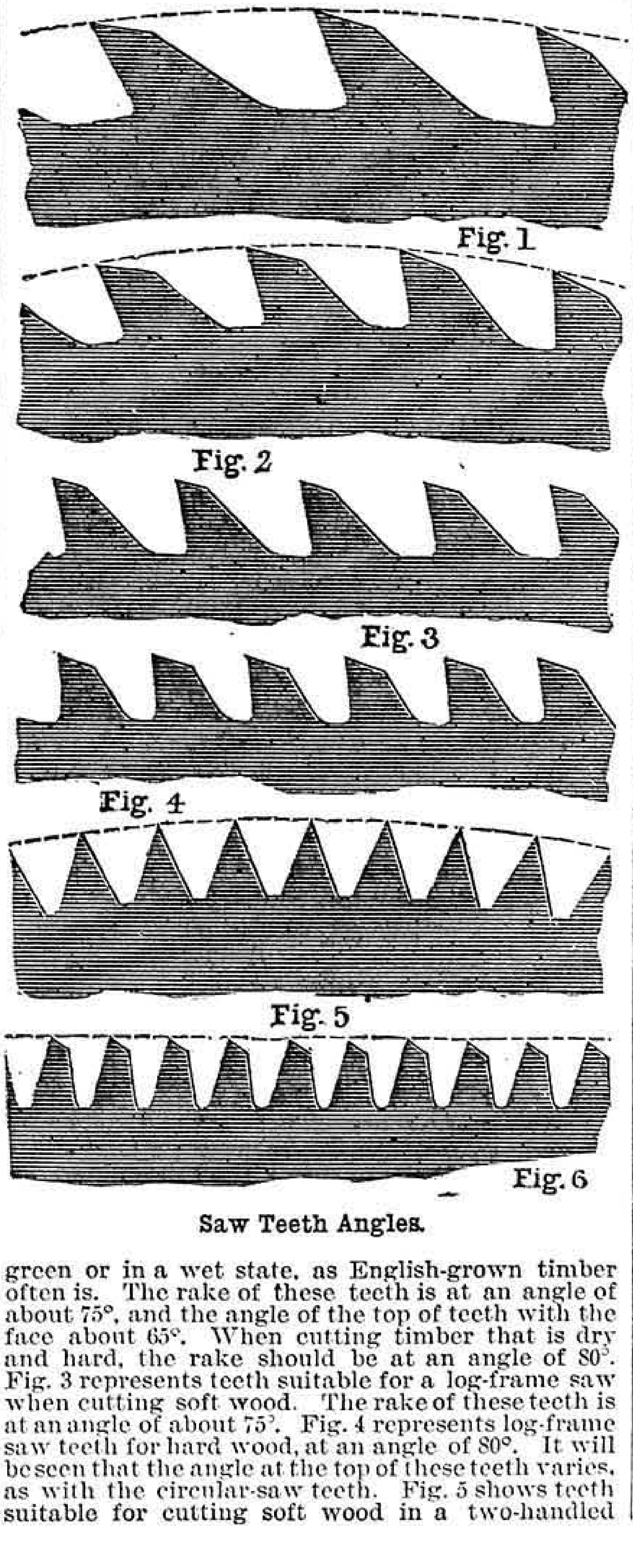
SHOP:

A Corner for Those who Want to Talk It.

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—Letters from Correspondents.

Saw Teeth.—A. R. writes:—"Some time ago I promised to write more on saw teeth. The annexed sketches of saw teeth are what I have proved, by long experience in saw sharpening, to be the best form and rake for cutting soft and hard wood generally. Fig. 1 represents circular-saw teeth, for cutting soft wood. The rake of the teeth is at an angle of about 65°, and the top of teeth with the face of teeth at an angle of about 50°. Teeth of this form and rake, from 65° to 70°, will cut soft wood very satisfactorily. Fig. 2 represents circular-saw teeth for cutting hard wood—that is to say, wood that is cut



Saw Teeth Angles.

green or in a wet state, as English-grown timber often is. The rake of these teeth is at an angle of about 75°, and the angle of the top of teeth with the face about 65°. When cutting timber that is dry and hard, the rake should be at an angle of 80°. Fig. 3 represents teeth suitable for a log-frame saw when cutting soft wood. The rake of these teeth is at an angle of about 75°. Fig. 4 represents log-frame saw teeth for hard wood, at an angle of 80°. It will be seen that the angle at the top of these teeth varies, as with the circular-saw teeth. Fig. 5 shows teeth suitable for cutting soft wood in a two-handled cross-cut saw. These teeth should be sharpened to an acute angle, so as to cut across the fibres of the wood easily. Fig. 6 represents teeth not generally used in cross-cutting hard wood, because, I suppose, they are not generally known, and a little more experience is needed to work such a saw tooth. But with a little practice it will be found to cut almost as fast again as does the fleam or peg-tooth (Fig. 5) when cutting hard wood. The teeth of Fig. 6 cut only one way, and instead of there being a rake in the teeth, they lay back. Should these teeth be given rake or lead, the saw could not be worked by the strongest of men, even if such had a deal of experience in cross-cutting timber. A strong man will sometimes force a saw through a piece of timber when a weaker man could not. If the teeth of the last-named saw were upright even, it would be a difficult matter to work it. The teeth of Fig. 6 are parallel, therefore the saw should be shot and pulled perfectly straight. If the arms are moved in an arch, as they may be when cutting with teeth shown in Fig. 5, there also being what is termed a belly in the saw, the saw would not work well, nor do the duty that it would if shot straight, and not forced. It must be understood that when a saw is properly sharpened it is folly to force it."

Workmen's Trains.—T. R. B. (*Newcastle-on-Tyne*) writes:—"With reference to your remarks on workmen's trains (see No. 161, page 72), it may be interesting to your readers in the South to know that workmen in the North have a similar set of trains set apart for them, but certainly at a rather heavy rate of charge. For instance, the rate of charge from Newcastle to Blaydon (4¼ miles) comes to 3d. per day return. How would a South-country workman like that? Moreover, a full set of twelve tickets has to be bought; these are supposed to last one week. The trains are not punctual, landing the workers very often fifteen minutes late."

Eight Hours.—W. B. (*Higher Broughton*) writes *à propos* of our remarks in No. 169, as to the Sunderland engineers who tried the Eight Hours system with so much success:—"Five hours a week more play: that is five hours more for reading, walking, house improving—in fact, really and truly living. Five hours more between work and bed; which means better spirits, better health, more comfort for each working man, and by reason of this the same for his wife, and also his family, is, I think, what you would call being better off."

Gravitation.—F. B. C. writes to H. R. (*Colne*):—"*Errata*, p. 29.—In the first column, line 6, for '3·014,159,265 . . . . etc.,' read '3·14,159,265 . . . , etc.' In the second column, line 3, for '$2\pi r \times \pi 2 r$' read '$2\pi r \times 2r$'; and line 50, for 'A P,' read 'A B.'"

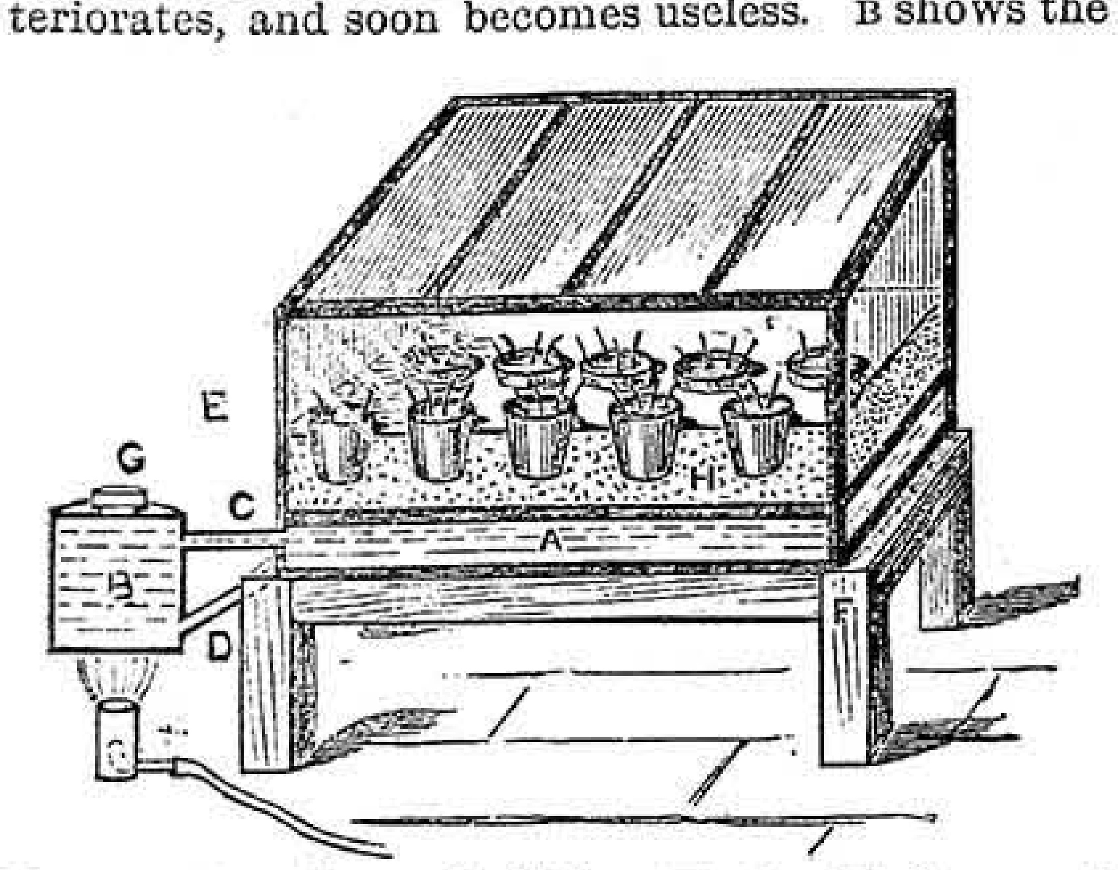
Work Back Numbers.—R. R. T. (*Frome*) writes:—"I am one of the unfortunate amateurs who did not hear of Work till it was near the end of its third year, and now cannot get all the back numbers—a great loss to one who looks forward to the arrival of each issue as I do."—[If you were to advertise in our Sale and Exchange column for back numbers, you would probably be successful.—Ed.]

II.—Questions Answered by Editor and Staff.

Model Marine Engine and Boiler.—P. B. (*Oldham*).—I think your boiler is not quite large enough, and would make cylinder ½ in. bore; then you will drive at a higher pressure and faster speed, and get the same power but with less weight. It is not well to have flat sides to your boiler, they would require to be tied together inside with stays to make it strong; also, though you have plenty of room for water and steam, you have not room enough for the fire, and the chimney is much too small, and would only carry away the burnt air from one of your wicks. Remember it is useless having a number of wicks if they can't burn properly for want of air. I don't like that bend in the flue. I would have it straight, and about 1¼ in. in diameter; then I would make the top of the furnace arched, and have the top of the arch as high as the top of the bend in the flue, or nearly. Take chimney straight up from the middle of the furnace through the top of boiler, which should also be arched. In fact, I would make the boiler saddle shape, and have the furnace open at both ends, using three wicks at each side of the chimney. If you have the top of boiler high enough, it will not need a dome, which saves expense and trouble. I would not have those eight water tubes. You might round the bottom of lamp to suit the boat. Fly-wheel is all right; make it as big as you can, as also the screw propeller. Methylated spirit is the right thing for the lamp, which should be kept as cool as possible, or the spirit will boil and the wicks flare up. Why have the lamp under the boiler at all when you can lead the wicks where you want them by tubes, and interpose a little cock in the tube to regulate the spirit burnt? Spirit will boil away about four times its weight of water; if, therefore, you wish to know how much to put in the lamp, fill boiler up to cover the furnace; then weigh how much it takes to fill it full enough for starting, and put quarter of that weight of spirit in the lamp. Thus you may be sure the lamp will go out before the water is low enough to allow the boiler to be unsoldered. You can let air into the lamp by partly unscrewing the filler, or by boring a little air-hole through it.—F. A. M.

Liquefying Horn.—Probyn.—So far as I am aware, the only known solvents for horn are concentrated alkali solutions, as caustic potash or soda.—S. W.

Plant Propagator.—E. H. M. (*Bideford*).—For a propagator 3 ft. × 2 ft., such as you desire, it would be necessary to have a water-heater, as a flue only would make some parts of the frame inside very hot, and inefficiently warm the others; whereas, with ever so small a circulating water-heater covering the bottom, the heat would be uniform. The annexed sketch shows a very successful arrangement of the kind, which acted admirably with very little attention. The frame may be made of any material—preferably bar zinc. At the bottom a tank about 2 in. deep is fixed; this should be made of copper if it is intended to last many years; the next best material is tin-plate; but on no account use zinc, as with heat it rapidly deteriorates, and soon becomes useless. B shows the



Propagating Case—A, Water Tank; H, Cocoanut Fibre.

heater proper, which is connected to the tank by a flow-pipe, C, and a return pipe, D, the former leading to the top of the tank, the latter, or D, leading from the bottom of the tank. A filling-plug, G, is provided on top of heater; the heat of the lamp or gas flame causes the water to completely circulate in the tank, and the whole surface gets a uniform heat. Above this tank a bed of cocoanut fibre is placed, into which the pots with seeds or plants are placed. A very short experience will enable you to maintain a fairly uniform degree of heat with either a paraffin lamp or gas—a very small flame sufficing. Of course, an ornamental case can be made upon similar lines, but the above is intended as a practical hothouse on a small scale.—C. M. W.

Grindstone.—Young Joiner.—You don't say the size of the stone, but if about 3 ft. diameter, make the frame of 4½ in. by 3 in., or 6½ in. by 2½ in. stuff. The frame will be about 9 in. wide inside, depending on the thickness of the stone. The cross-pieces are notched ½ in. into the sides. The legs are notched at the top, and splayed end and sideways. The stays between the legs are mortised, and a long bolt, with nut and washer, put through, and screwed up tight; also put similar bolts through the top of the legs and across the frame. The top of legs should be cut to a templet, and nailed (see Fig. 1). The axle and crank are shown in Fig. 2. Make the centre 1½ in. diameter, or the size of the hole in the stone. Reduce this at each end to 1¼ in. to the inside of the bearings, and make the outer end 1 in. diameter, leaving a shoulder to work

Fig. 3

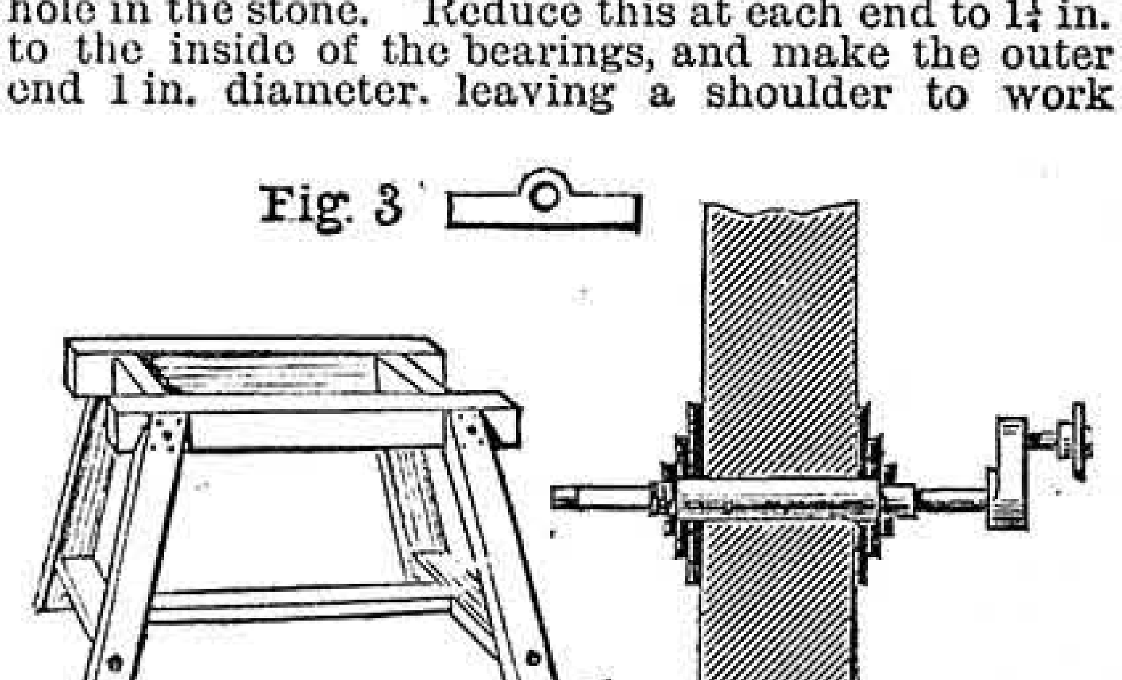


Fig. 1 Fig. 2

Grindstone. Fig. 1.—Wooden Frame for Grindstone. Fig. 2.—Section of Grindstone with Axle and Crank. Fig. 3.—Cast-iron Bearing.

against the inside of the bearings. A collar is welded on at one end, and two plates, 4 in. diameter and ⅜ in. thick, are fitted on. The other end is screwed, and has a nut fitted to it. Also make two discs of willow or plane tree, 7 in. diameter and ⅜ in. thick. Put a plate and wooden disc on, then the stone and a disc and plate, and screw up tight, or you may make the centre of the axle square. Lay the stone on a level bed of sand. Put the axle in and run with lead, but this is not such a good plan as the other. Sometimes wood and iron wedges are used, but these are very liable to break the stone. Make the crank of cast or wrought iron. Cut a key-way and key it on the axle, making it 2 in. or 2½ in. throw. The bearings are cast-iron, as shown in Fig. 3. If you put a core point in, the hole can be cast in, and will only need riming out. Fix the bearings on the frame with screws; also drill a hole in the top of each for lubrication. The crank pin is keyed in, and has a pin and washer on the end. The treadle may be fixed to one of the legs; it may be iron 1 in. by ⅜ in., set edgeways. The outer end is flattened for the foot to rest on. The connecting-rod will have a double end, fixed to the treadle by a pin or bolt. The top end has an eye to fit the crank-pin, and is fixed by the pin and washer. The treadle will work at one side of the frame, or the end may be cranked and come out at the middle of the frame. Fix the treadle so as to clear the floor, and don't give it too much rise.—M.

Draught Screen.—D. C. (*Kinross*).—The difficulty caused by your pictures being 18 in. too short for the panels we should overcome by making up the deficiency with Japanese leather-paper—one with as much gold as could be introduced without "killing" your pictures: there should be a 6 in. border at top and a 12 in. at bottom. The best place to get Japanese pictures, leather-paper, etc., for screens would, we imagine, be Rothmann, Strome & Co., St. Mary Axe, London, E.C.—that is, if you are buying wholesale for trade purposes; but, perhaps, for mere retail purchases you would do better to go to Liberty's, Regent Street, London, W. Prices would, of course, vary widely. For proper brass hinges try Jas. Cartland & Sons, Constitution Hill, Birmingham; you can order through any good ironmonger. Prices will depend on size and weight of metal.—S. W.

Exhibition Stand for Cut Flowers.—D. C. (*Kinross*).—You ask for an idea for a stand to hold, say, six cut roses or other flowers. We should suggest a hexagonal wooden box, large enough to hold one of the shallow round Australian meat tins (for water); this will be mounted on a turn-table. It would have a lid fitting so far into the box as would allow the sides to rise nearly 1 in. above it. Through the lid, and opposite to the middles of the sides, holes would be pierced to admit the stalks of flowers, and in the middle might be a hole for some tall ornamental grasses. The sides of the box would be ornamented with rustic work or cork. The lid would be covered with green moss, which should be kept in place by the rim formed by the sides; or a pretty effect might be gained by making the lid of looking-glass, and drilling the holes through it. A great point in connection with such a case as this would be that, at a touch, it would move round and bring any required specimen to the front.—S. W.

Book-keeping.—A. C. (*Leeds*).—We fear that to attempt to sketch out for you a system of book-keeping in "Shop" would scarcely be practicable. Your really best plan would be to get the evening services of a clerk to set your books going, and to put you into the way of carrying them on; in large business towns like yours there are always numbers of men who would be glad of such an engagement for a trifling consideration. Or get a work which treats of the subject—say "Cassell's Popular Educator." This will give all you want to know; and, if we remember rightly, Cassell's have published a "Guide to Book-keeping," taken from, or based on, the Educator lessons. Write for their catalogue. Or, again, W. & R. Chambers, Edinburgh, publish exercise books in book-keeping for schools; you might get them, and fill them up according to the sample page given in each.—S. W.

Wood-Carver's Strops.—T. W. (*Kendal*).—Melt a tallow dip in a saucepan over a fire, then spread it on to a strip of buff leather about 4 in. wide and 9 in. long, and before the tallow cools, sprinkle the emery-powder on to it; then mix together well. Put as much emery as will make the tallow a dark puce colour, and until you get a firm paste like butter. Spread the paste equally all over the leather to the depth of about $\frac{1}{32}$ of an inch. Care must be taken to keep the leather flat during the process, as if the tallow is very hot it sometimes makes it curl up. Do not melt the tallow on to the leather instead of in the saucepan first, as that is a fatal mistake. The strop is improved by use as the paste in time gets well beaten into the leather.—M. E. R.

Medical Electric Belts.—Perpetuum Mobile.—Directions for making a medical electric belt were given in "Shop," on page 827, Vol. II., and further instructions on the same subject were given on pp. 174, 203, 251, 315, 396, and 427, Vol. III., in reply to correspondents. It would take up too much space here to give fully illustrated descriptions of electric belts.—G. E. B.

Books on Painting.—W. H. (*Hastings*).—Messrs. Brodie & Middleton, Long Acre, London, W., publish a cheap and useful handbook, dealing with all kinds of work. It is, however, more suited to amateur requirements. I cannot refer you to a "best book," dealing *collectively* with painting, house decorating, and sign writing. Vol. I. of Work contains very useful series on House Painting and Sign Writing. Vol. II. contains a good series on Graining. With these you get practical lessons by reputed workers and writers at the "lowest possible cost." If you want the best modern works, irrespective of *cheapness*, write for particulars to the Decorative Art Journals Company, Mosley Street, Manchester.—F. P.

Moulding in Plaster.—Amateur Modeller.—Yes, there are other substances in which moulds for plaster casts can be made, such as wax and gelatine, but plaster is most in use, and is, for general purposes, by far the best. You will find such articles as you ask for in Vol. II. of Work, and these will give you full information on the points in question: on Clay Modelling, pp. 3, 50, 123, 189, 255, 303 (Nos. 53, 56, 60, 64, 68, 71); and on Plaster Casting, pp. 319, 398, 500, 578, 659 (Nos. 74, 77, 83, 88, 93).—M. M.

Rearer.—P. S. (*London*).—Winchcombe's address is Leonard Stanley, Gloucestershire. These rearers can be obtained of Mr. Stevens, who advertises in Work.—Leghorn.

Work (Cover for).—A. H. (*Cork*).—Thanks for your suggestion.

Mahogany Chair.—C. H. B. (*Jewin Street, E.C.*).—I think the best way to make the chair is to let the back legs run up to form the back rest, instead of having them separate, as it makes a stronger job than the latter. You can get the front legs at a turner's, and, having shaped the backs to taste, tenon together as shown in Fig. 1. This could be made more secure by driving in oak dowels right through the leg and the tenons. The top rail of the back can be dowelled to the upright as in Fig. 2, but a better method is to have a round tenon on the upright, and glue it into the socket in the back

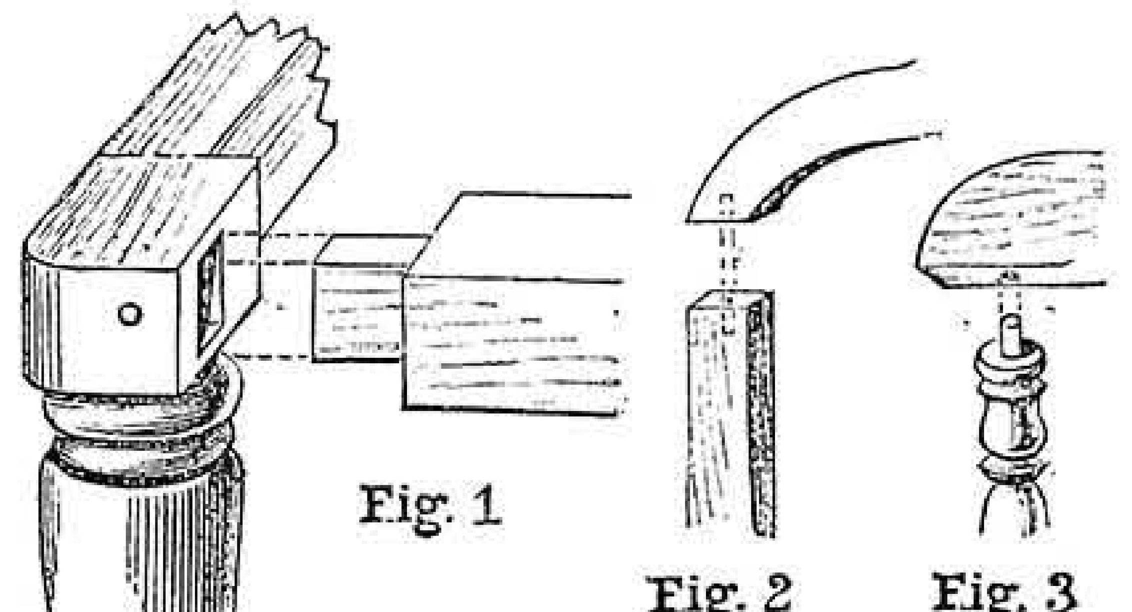


Fig. 1 Fig. 2 Fig. 3

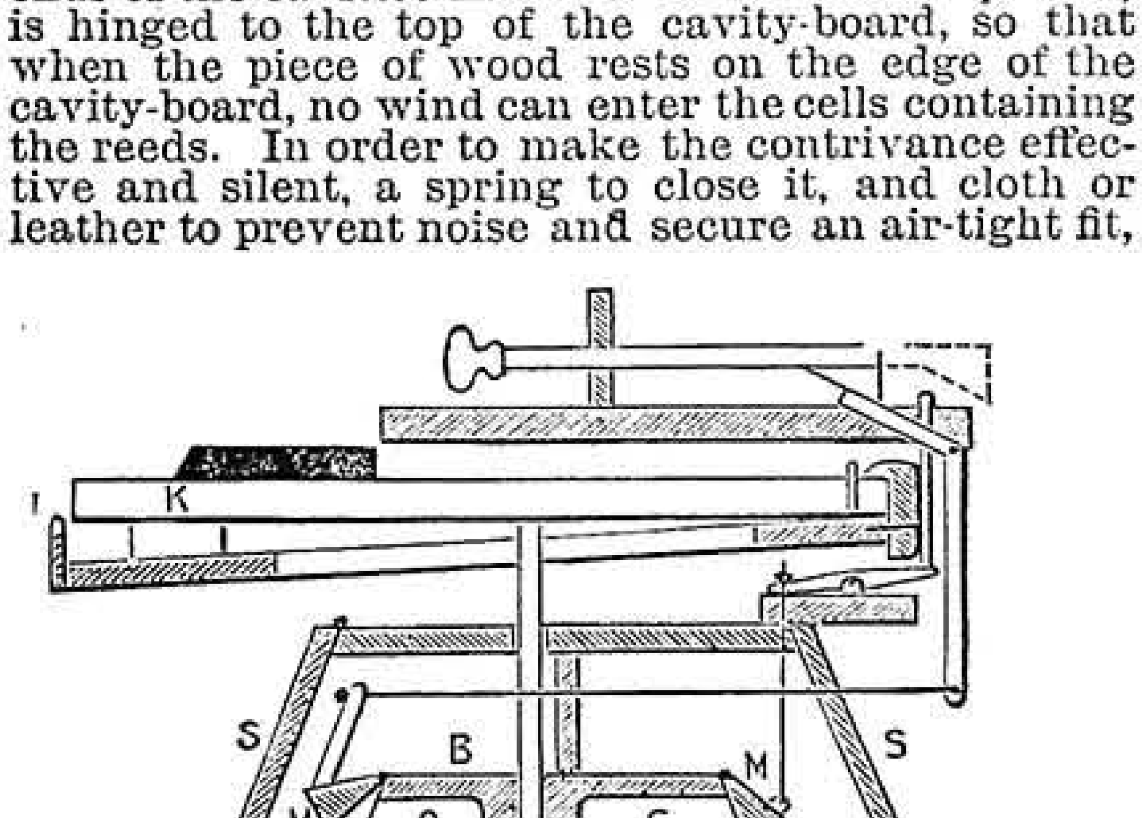
Mahogany Chair. Fig. 1.—Tenoning of Frame into Legs of Chair. Fig. 2.—Dowelling of Back Rail. Fig. 3.—Tenon to Back Rail.

rail (see Fig. 3). The rail below this is also tenoned into the standards. I suppose by an "ordinary wooden chair," you mean one suitable for rough usage in the kitchen, etc. The construction in such a case would be much more simple than that just described, and the different parts are more easily put together by an amateur. All the rails and the frame can be balanced into the legs instead of being tenoned in. Stiffening rails would most likely be needed between the legs. A plain wood seat screwed to the frame is sufficient. I am afraid I have no space here to give a list of tools, as most of the ordinary cabinet-maker's tools would be necessary to make a good job.—F. J.

Plumbing and Gas-fitting.—W. J. D. (*Montgomery*).—These subjects have not been dealt with in Work. When a thoroughly competent writer and practical worker can be found, arrangements will be made for papers on both subjects.

Work and Contents.—J. H. S. (*London, S.E.*).—Thanks for your letter. Some more ornamental wood turning shall be given as soon as convenient.

American Organ.—C. W. T. (*Leytonstone*).—(1) The stops are not "fixed to the reeds," but a piece of well-seasoned wood, of suitable size to cover the ends of the cavities in which the reeds are placed, is hinged to the top of the cavity-board, so that when the piece of wood rests on the edge of the cavity-board, no wind can enter the cells containing the reeds. In order to make the contrivance effective and silent, a spring to close it, and cloth or leather to prevent noise and secure an air-tight fit,



American Organ Stop Action—C B, Cavity-Board; C, Reed Chambers; M, Mutes; K, Keys; S, Swell-Shades.

are added. The draw-stops are connected with these so as to open them at pleasure. There are many ways to unite the draw-stops with the "mutes" just described. Probably C. W. T. can arrange a wire to each, so that the drawing of the wire will open the mute, and relaxing the tension will allow the spring to close it again. (2) The swell is managed in a similar manner to the stop action; but the swell may enclose several sets of reeds, and is generally arranged so that the swell-cover may be lifted by the player's knee. There may, of course, be a stop knob, marked *forte*, to open swell-cover, in which case the knee action is, for the time, superseded. By an arrangement of levers the mutes may be raised by the player's knee, when the stops not in use because the draw-stop is pushed in become available as long as the knee pressure continues; as soon as the knee is withdrawn the stops, drawn again, govern the reeds as usual. The sketch sent is a suggestion.—B. A. B.

Motor.—First Start.—I am sorry to hear that the little motor you have made from the paper in Work, Vol. III., No. 154, p. 785, will not go. In the first place, you have put far too much power into it. I should not like to put a battery of twelve cells on to the one I made to write the paper upon; two or three single-fluid bichromate cells are quite enough to make it go well. Are you sure you have got it connected up properly? Try it with two cells independently—that is, one cell on to the binding screws from the magnet, and the other cell on to the binding screws from the armature; then see that your brushes are in the right place: you will find you will have to bend and adjust them; don't let them press too hard, but see that they make contact all round. If the armature touches the magnet, it will be held tight; to prevent this, unscrew the button on top of the magnet and set it back a little, then screw it up tight again; I think it ought to go then. If you think your winding is faulty, you can test it with a galvanometer; I should not do it with a bell. If you have not got a galvanometer, look in the index to Vol. III. of Work, and you will find how to make one that will do very well for testing purposes of any kind.—J. B.

Motor.—R. W. Wright, Jr.—If you use about 30 yards of wire on the magnet for the model in Work, Vol. III., No. 154, p. 785, and about 20 yards on the armature, you will find it will work properly. There is a paper already in hand as to making your own batteries, carbons, etc., which doubtless will appear in due course.—J. B.

Staining and Matching.—J. M. (*Manchester*).—A similar query to yours is answered under the same initials and address in our issue of December 26th, p. 652, No. 145, Vol. III., which, if you will read, will give you the information you require without fully repeating it here, except that I may further add that the desired result may also be gained by wiping over with a solution of common washing soda; or by wiping over with a weak brown stain, made by mixing a little vandyke brown into a thin paste with liquid ammonia or a solution of pearlash, then thinned down with water till the required shade is obtained, and using a little coloured polish.—Lifeboat.

Ebony Stain. — Vulcan.—The French black stain is sold by most veneer merchants, including Mr. Kingston, veneer merchant, Pershore Street, Birmingham, and most druggists and gum merchants at 1s. per pint. Stephens and S. Jackson & Sons can supply you with ebony stain either in liquid or powder. I am sorry I cannot recommend you to any place nearer home, unless you try the Yorkshire Varnish Co., Limited, Ripon, and Mr. H. O. Milnes, Bradford. The ebony stains in general use are suitable for most woods, including yellow pine. Should you prefer to make your own, you will find full particulars in "Shop," under Ebony Stains, p. 332, No. 125, Vol. III., August 8th, 1891 issue.—Lifeboat.

Heating Greenhouse. — Novice. — The water will not circulate if you carry the pipes below the level of the boiler, and I do not see how you can avoid doing so without carrying the pipes round the kitchen; in which case the loss of heat from radiation in the kitchen would prevent the greenhouse from getting warm. It is far better to have an independent boiler for the greenhouse, as the kitchen fire is generally out, and the pipes cold, at the time when warmth is most required—*i.e.*, the early hours of the morning. Any ironmonger will supply you with a gas heating boiler for small greenhouse, which you can connect for yourself. You do not give the size of greenhouse, but, judging from the sketch, I should say the size of pipes you propose would do very well.—T. W.

Incubator.—H. S. (*Dalston Lane, N.E.*).—Articles on "How to make an Incubator" appeared in Work, Nos. 89 and 143.

Induction Coils. — Anti-Procrastination.—These articles are appearing in the fourth volume of Work.

Designing for Furnishers.—E. C. M. (*Portadown*).—Your designs indicate no talent whatever. You have evidently never learnt drawing. Work hard at this in your spare time, and you may some day be able to submit good original designs.—Ed.

Cottage Specifications.—Theo d'Olite. — (1) "Is it usual to use pressed bricks for cutting and rubbing?" No, it is not usual; but it is better for pressed bricks to be used, as the bricks generally used for rubbing and cutting are usually composed of about 75 per cent. of sand, which makes the bricks absorb more water, and when they come in contact with frost—which they cannot help doing—the frost, when it thaws, enters the pores of the bricks, and thus splits or, rather, cracks them, rendering them utterly useless for their work. I have seen myself where they have been used for arches, and within twelve months after they have had to be removed, and pressed bricks inserted in their place. Pressed bricks have an advantage in being hard and durable, and they can resist more pressure or strain upon them than "rubbers." (2) If Theo d'Olite will kindly look at the drawings, he will see plainly that I have shown in my design all that he mentions in his letter. What I have not mentioned in the specification is plainly described in the drawings. If I had to write a full specification of works required in their erection, it would occupy at least two numbers of Work. As a rule, architects never mention every little detail in their specification; they say, as shown in drawing No. so-and-so. When Bills of Quantities are taken out, then every item is entered in detail, mentioning their length, height, and width. (3) "Is water required to mix the mortar, and who is to provide it?" Of course, water is used to make proper mortar; and as regards who is to provide it is a question of detail. As a rule, the contractor has to, and it is charged along with wear and tear of tools and scaffolding. (4) "Would a 9 in. wall be absolutely damp-proof?" If you will kindly note, I have mentioned, "Lay a damp course of pitch and tar, well boiled, or a layer of roofing-felt well soaked in pitch and tar, throughout the length and thickness of the walls." A 9 in. wall, faced with pressed bricks and a damp course, as above, is perfectly damp-proof. (5) "Could two contractors be fairly expected to tender from the specification in the matter of joiners' work?" Yes, if they had the same drawings and specification, and knew their business.—W. B.

Gold and Stone Tests.—Learner.—The articles on ear-rings appeared in Nos. 106, 111, 115, in Vol. III. of Work. Look out for an article on Gold Tests. Your other query as to testing precious stones and pearls will be answered in a future number.—H. S. G.

Electricity.—A. M. (*Glasgow*).—Messrs. Cathcart Peto's address is Hatton Garden, London.

Working Drawings for Violin Making.—E. E. W. (*Abergavenny*).—The writer of instructions for violin making will furnish you with a set of full-sized working drawings for 2s. 6d. The address is in the advertisement columns of Work.—B.

III.—Questions Submitted to Readers.

*** *The attention and co-operation of readers of* Work *are invited for this section of "Shop."*

Lathe Attachment.—Learner writes:—"Can any reader kindly give instructions for making a fret-saw attachment to a 4½ in. centre lathe?"

Oil.—Learner writes:—"What is the best way to cleanse a bottle which has contained oil?"

Ice Safe.—Butcher writes:—"Will some reader kindly advise as to the filling of the interstices, 4 in. wide, of an ice safe that my carpenter is building for me, 6 ft. by 4 ft. by 7 ft. high. Sawdust is objectionable, it gets damp, then smells badly, and charcoal is too expensive. Also which is the best method of placing the ice to produce the coldest and driest air?"

"Woodite."—C. (*Londonderry*) writes:—"This substance is used upon or behind armour plates, and by its expansive properties closes shot-holes automatically. What is its composition? How is it applied and kept *in situ?* Where can it be obtained?"

Camp Cot.—F. K. (*Staveley*) writes:—"Would any kind reader of Work give me instructions how to make a camp cot—one to fold up? I want to make it of wood, to rest on legs."

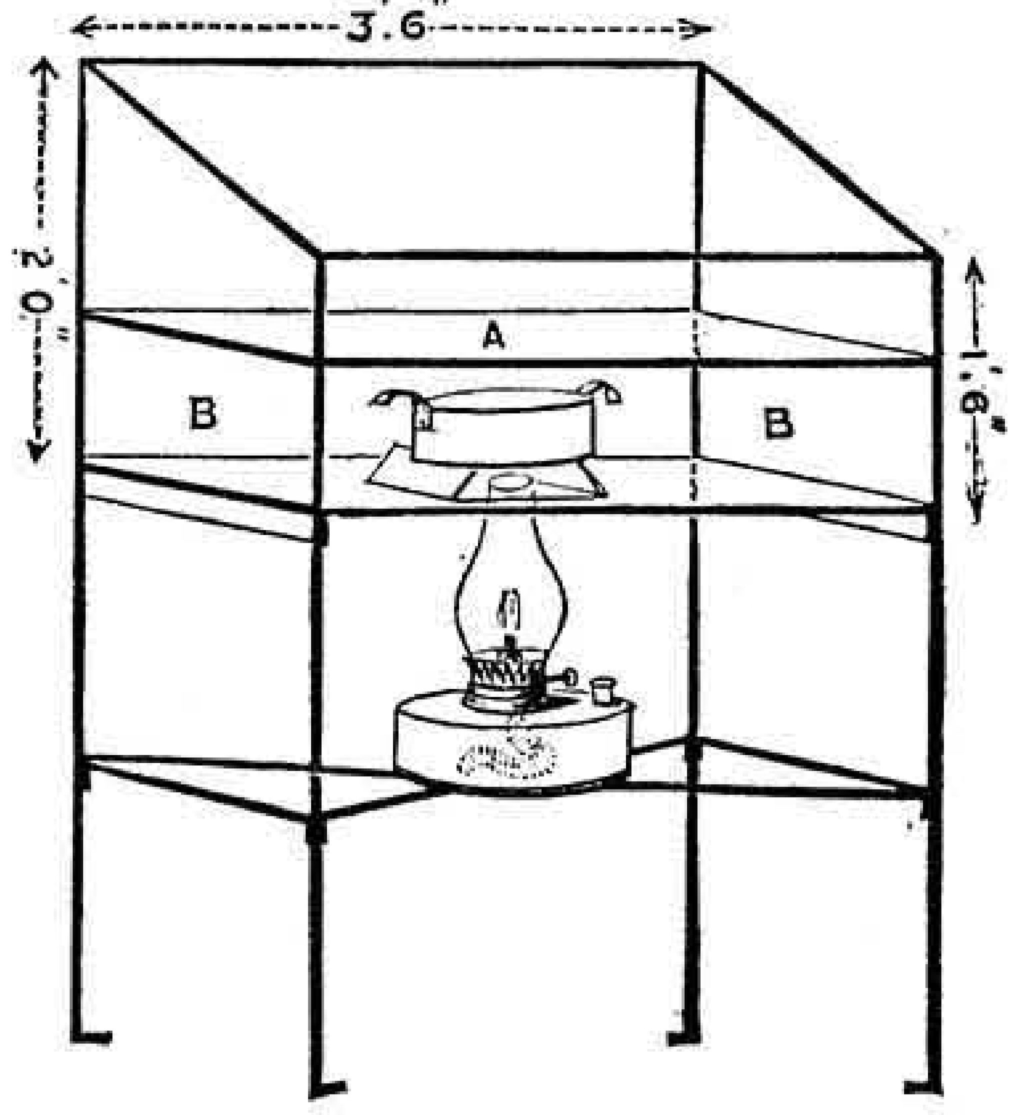
Razors.—J. P. (*Claydon*) writes:—"Can any reader tell me the stone to use, and the best method of setting a German hollow-ground razor, and whether oil or water should be used?"

Lubricating Oil.—Spot writes:—"Will any reader say what is the best oil for lubricating with, or how to make a lubricating oil that will not corrode?"

Puzzle Money-Box.—R. S. H. W. (*High Wycombe*) writes:—"Would some kind reader of Work give me a design for the above in fretwork? Also for a monogram for R. S. in the same."

IV.—Questions Answered by Correspondents.

Plant Propagator.—Cawd Hud writes to Barra (see No. 161, page 78):—"Construct an or-



Plant Propagator—A, False Bottom; B B, Vapour Chamber.

dinary box frame of 1 in. boards, say 3 ft. 6 in. by 2 ft. Let it be 2 ft. deep at the back and 18 in. in front. Nail strips of 1 in. wood all round the inside about 9 in. from the bottom, and fix two cross-bearers, 2½ in. in width, on a level with the strips. The bearers must be placed edgewise for strength. On these fit accurately a piece of galvanised sheet iron, which must be thoroughly perforated with fine holes. Now nail boards closely all over the bottom of the frame, and cut a circular hole 3 in. in diameter in the centre of the bottom. The lower board at the back must be made movable, by sliding or otherwise, to afford access to the lower chamber, wherein is placed a shallow metal vessel about 18 in. square, which must be kept nearly full of water, supported on two bricks, laid flat. Lay three inches of cocoa-fibre or sphagnum moss on the false bottom of galvanised iron, and place the whole on four stout legs. Take a paraffin oil lamp, having a 3 in. wick—to be used for obtaining heat—and stand it so that the lamp chimney protrudes through the circular hole, and within two inches of the metal vessel. Have your seeds, etc., in boxes, and place them on the fibre or moss, which must always be kept moist. Put on your sash, and having lighted your lamp, you should have no difficulty in maintaining a heat of 70° or 80°. If your propagator is to stand outside, you will require to nail boards round the legs to screen the lamp, or it will be blown out by the wind. Mind the ventilation."

Photo. Frame.—A. S. (*London, W.*) writes:—"Seeing W. W. (*Wokingham*) inquiring for a photo. frame that appeared in No. 152 of Work, he may like to know that I got E. W. Wise, of Chiswick, to make one for me. He enlarged the design."

V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—S. & Co. (*Blackpool*); H. F. M. (*Ramsbury*); L. M. (*Roscrea*); C. C. (*Norwich*); L. W. (*Kettering*); F. C. B. (*Blandford*); W. P. (*Dartford, Kent*); A Kerry Lad; M. E. (*Renfrew*); R. A. de P. (*South Kensington*); Corkscrew; W. J. P. (*Lines*); J. W. H. (*London*); H. W. H. (*Heathfield*); D. W. (*King's Cross*); R. B. P. (*Dartmouth Park Road*); W. B. (*Wirksworth*); Faraday; Dynamo; A. B. D. (*South Shields*); In Dubiis; A. T. (*Bollington*); Walnut; H. T. W. (*Cardiff*); A. L. (*Dewsbury*); F. C. B. (*Deptford*); H. (*Sunningdale*); S. W. (*Glasgow*); S. W. (*Cardiff*); Saint Mungo; W. N. (*Lincoln*); E. D. (*London, W.*); Mechanic; Amateur Screen; H. J. (*Liverpool*); G. H. (*Sheffield*); Drill; Royal College; Horologist; H. B. (*St. Peter's Park*); Padiham; An Old Subscriber; Donovan; D. A. L. (*Bacup*); W. S. (*Havant*); D. J. E. (*Bryhmaur*); J. G. S. (*Barbados*); D. W. H. (*Tredegar*); A. G. (*Sheffield*); D. J. C. (*Ipswich*); Bookcase; W. S. P. (*Bilston*); B. B. (*Hillsborough*); A. P. M. A. (*Stretton*); J. T. M. (*Burnley*); Jules; J. E. (*Deptford*); J. B. (*Moss Side*); A. B. (*Middlesborough*); A. J. H. (*Brixton*); F. H. W. (*Southampton*); G. S. L. (*Strangeways*); T. C. (*Dewsbury*); S. T. (*Londonderry*); P. B. (*Bolton*); Constant Current; Stager; Dynamo; J. R. (*New Brompton*); E. F. B. (*Darlington*); Barnet; J. P. (*Chester-le-Street*); D. McD. (*Glasgow*); D. B. (*Glasgow*); W. T. (*Houghton-le-Spring*); O. B. (*Hanley*); One in a Fix; A Reader.

"WORK" PRIZE SCHEME.

Next Week's Work (*No.* 168) *will contain full particulars, rules, etc., of the* First of a Series of Competitions *in connection with the* Work Prize Competition Scheme. *The Editor will be obliged if his Readers will assist in making these Competitions known amongst their friends, with a view to their becoming permanent.*