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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

THE best cement to use for floors is made of three parts coke breeze, three parts sharp sand, and one part best Portland cement. Why not more clean and warm cement and fewer dirty wooden floorings?

* *

A furnace at Halauzy, one of the great French pig-iron centres, yields seventy tons of foundry pig-iron of good quality in twenty-four hours. This furnace is constructed on a new model, and its yield is excellent. Our English furnace engineers should examine this model.

* *

A Welsh firm of tin-plate manufacturers have acquired several acres of land in New Jersey, U.S.A., where they intend putting down a tin-plate plant. The plates will be made in Wales, and taken to the States to be tinned. This is one of the results of the heavy duties levied on tinned plates.

* *

At the Scotia Works, Sunderland, the proprietor, who was one of the first to test the eight hours' working day amongst his *employés*, finds that the scheme has been attended with so much success that he is returning to his men the five per cent. in wages which was deducted from them on the inauguration of the shortened hours plan. Will this be the case everywhere?

* *

An electrical instrument has been invented for avoiding the pain incident to the extraction of teeth. It consists of adjustable prongs, carrying buttons and connected with an electrical battery. The buttons are placed on the face over the nerves leading from the teeth to the brain, and a circuit is established the moment the extracting instrument touches the tooth. Thanks!

* *

The Neunkirchen method for consolidating sand in water-bearing strata consists in ejecting powdered cement by means of compressed air, steam, or water under pressure, into the ground to be consolidated. The cement is screened, and other measures taken for the success of the operation. The system was used in England fifteen years back, but this is "made in Germany."

A Glasgow engineer has, after nineteen years' labour and experiments, succeeded in an engine-fitting by which he returns all the steam back to the boiler after doing its work in the cylinder. The arrangement is being adopted, and is giving extraordinary results. In one case, at a textile factory, an engine fitted with the invention is doing as much work with one ton of coal as was formerly done with ten tons.

* *

In the United States they have been testing the holding powers of lead, sulphur, and Portland cement, for retaining bolts. Of four bolts set in sulphur (42 in. deep, $\frac{3}{4}$ in. diameter) one was drawn out by a pull of 12,000 lb.; with the others the iron yielded before the sulphur gave way. Three of the bolts "caulked" with the lead broke in place, and one pulled out; of those set in cement, one yielded slightly, and one broke.

* *

The uses of mica are extending. For insulation in the armatures of dynamos and electro-motors, this material is in great demand. It is, therefore, satisfactory to learn that the supply in Idaho is practically inexhaustible. In the Idaho building, at the Chicago Exhibition, mica is to be used as a substitute for window glass. We have never seen mica in this country sufficiently transparent or cheap enough for this application.

* *

An appliance for ascertaining the muzzle velocity of shot has been introduced by the Elswick firm. It consists of a plug, twelve of which are inserted at regular intervals from the muzzle end of the shot chamber to near the muzzle. The shot passing down the bore, and its conical end coming in contact with a small ball $\frac{5}{8}$ in. in diameter, drives this ball, together with a small piston, in an upward direction inside the plugs. The piston in its turn cuts an electrical communication. Each of the disconnectors cuts the communication immediately after each other, and so mean time is recorded and the muzzle velocity is obtained.

* *

It is a remarkable fact that many engineers and others in charge of engines and boilers, who carefully heat their boiler-feed water by means of live steam in feed-heaters, forget to keep the water hot after it has gone from the heater to the boiler. In many cases the water loses as much as 9° or 10° of heat by the feed-pipe being exposed to a cold current of air. This may only mean, perhaps, 1 per cent. lost, but if taken for the year round represents tons of coal. It is, therefore, necessary that all feed-pipes from the heater to the boiler should be well cleaded with a good non-conducting material in order that there will be no loss of heat, by radiation, that has been so carefully sought after.

* *

There is a kind of jewellery which depends for part of its beautiful appearance on the reflection of one part in another. This style was fashionable some thirty years ago, but, although much used then, it was not carried to anything like the full extent of its possible development. Rarely was anything more elaborate attempted than a fluted gold bead or a plain coral bead in a coloured gold cup. Yet even with these simple means great richness of effect was obtained. An effect so easily got, and which enhanced the appearance of the article out of all proportion to the work put in it, would, we think, now repay any study with regard to its re-introduction. It would come in as a welcome contrast to the narrow wire ornaments that have nearly played their innings out.

* *

Among the wonderful clocks for the Chicago Exhibition will be the invention of a native of Warsaw, who has worked for six years in the construction of an ingenious model representing a railway station. It includes railway line, signals, telegraphs, station buildings, with the usual waiting rooms, offices, etc. Every fifteen minutes the miniature station becomes a scene of activity; doors open, officials appear on the platform, signalmen in the boxes, and ticket clerks in the booking office. Then a long row of passengers appear, luggage is wheeled about, a bell is rung, and a train runs into the station; and while a man taps all the wheels with a hammer, another pumps water into the locomotive tank. After another signal with the station bell, the engine whistles, the train starts, and disappears in a tunnel, the porters leave the platform, and the doors are again closed.

SIMPLE UTENSILS FOR THE GARDEN.

BY C. MAYNARD WALKER.

Wheelbarrow and Rake.

In the cultivation of a garden, whether of small or large dimensions, a handy wheelbarrow becomes an important and very desirable labour-saving apparatus. To say nothing of the necessity of moving soil, rubbish, transplanting, etc., a barrow comes in most handy to hold all necessary tools, pots, plants, etc., when performing the ordinary operations of gardening, and prevents a lot of fetching, finding, and carrying on occasions when time can ill be spared.

To buy a wheelbarrow is a somewhat expensive matter, and may not be convenient to many to obtain; but, as I shall presently show, a serviceable article can be turned out easily and cheaply by anyone who is familiar with the practice of rough carpentry, or, in other words, who can use a saw and hammer and nails.

Fig. 9 represents such an article. The question of size must be left to individual requirements, having regard to the purposes to which it is to be applied. I may say, however, that I find mine a useful size—viz., length of barrow body, 22 in.; width, 16 in.; depth (back), 12 in., front, 7 in. The advantage of making it shallow in front and deep at back is that the top is brought to a level plane, and can be readily used, with a wide boarding, as a movable table for potting, etc. For the timber, any tough kind may be used for the frame, and ordinary rough or planed deal will do for the barrow-body. The handles, frame, and wheel bearing are made in one (see Fig. 10); and in the frame I have made an addition at the end, in the form of a cross-piece beyond the wheel, not usually seen in barrows. This not only greatly strengthens the woodwork, but will be found to be very useful in tipping.

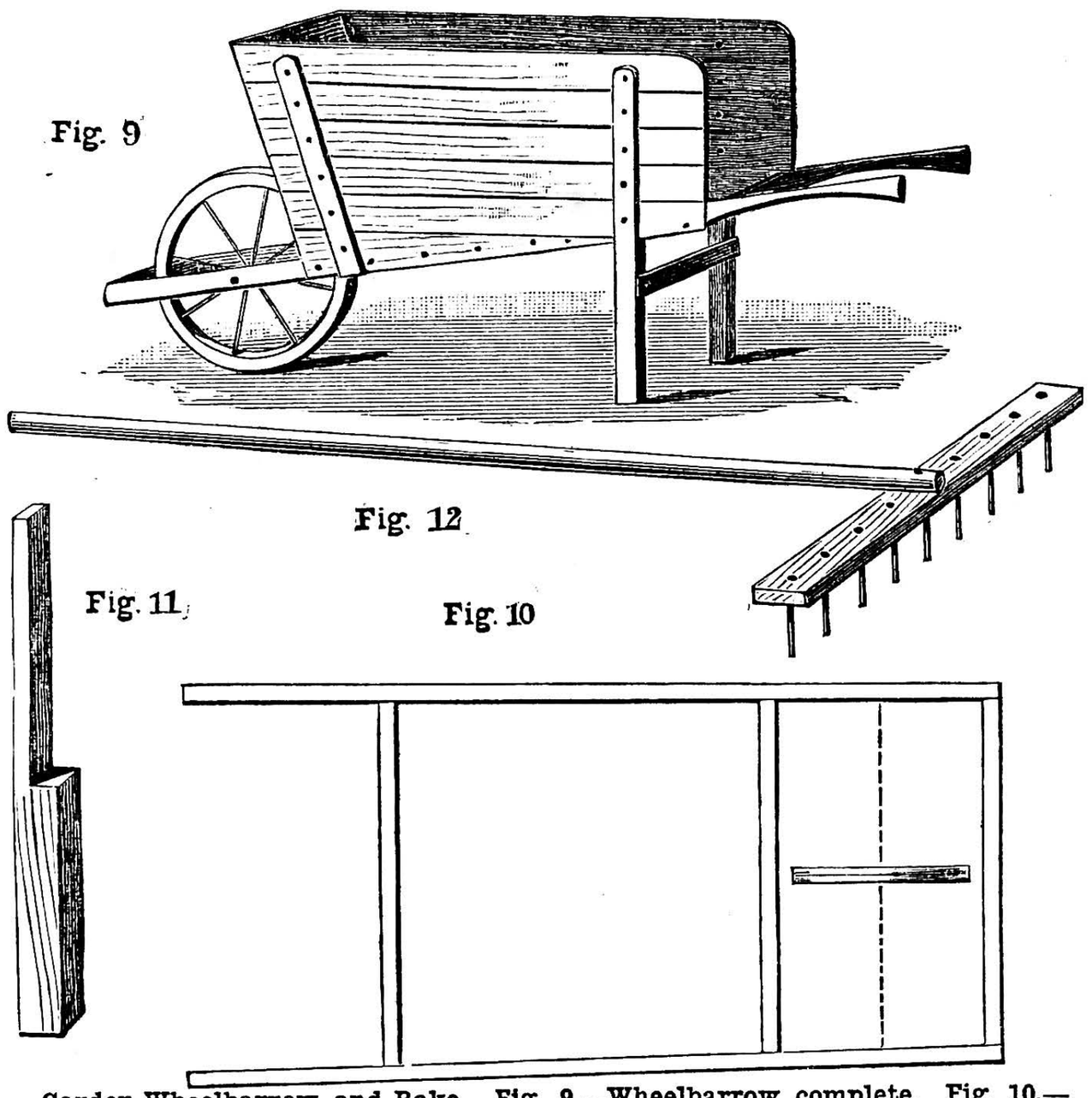


Fig. 9

Fig. 12

Fig. 11

Fig. 10

Garden Wheelbarrow and Rake. Fig. 9.—Wheelbarrow complete. Fig. 10.—Frame. Fig. 11.—Batten and Leg. Fig. 12.—Rake.

It frequently happens, in tipping soil on to a bed, that the load shoots out at a spot which was not intended, owing to the awkward manner in which an ordinary barrow has to be turned over to empty; while it is almost impossible to tip it over in front or over the wheel. The cross-piece entirely remedies this; and to tip the contents of the barrow neatly, you have only to lift up the barrow sufficiently high for the cross-piece to touch the ground, when the wheel is raised off the ground, and, as the barrow remains on end, the stuff is easily tipped with the least possible trouble.

In fitting the legs, strength and neatness are gained by using the upper portion as battens to the sides of the body, cutting a portion away (as in Fig. 11). The handles are readily shaped with a spokeshave. An iron wheel, suitable for the purpose, if one be not at hand, can be obtained through any ironmonger or from the Carron Iron Foundry, retail price for one being about 3s. 6d. These measure 12 in. in extreme length of axle, by 2 in. wide; but even this is not indispensable, and a serviceable makeshift can be made by using a wooden wheel, made of two discs of wood fastened together the cross-way of the grain, fitted with an iron rod in the centre, with this advantage: that the rim of the wheel can be made to any thickness, and be less likely to cut up the paths when in use.

I would also remind the worker that no projecting parts should be left on the inside of the barrow, as they would interfere with the use of the spade in taking out mould or other loose material. All battening should be on the outside.

The wheel is fitted in a manner which, I have no doubt, a wheelwright would object to. All I can say in defence of it is that it answers its purpose well. An ordinary gas-barrel socket is let into the woodwork, and the axle of the wheel, which fits loosely therein, is put into its place when the frame is made, the only objection to this plan being, as far as I can see, that the wheel cannot be got out except by taking the barrow to pieces; but as this event is not likely to happen until the barrow is worn out, that is a small matter. The whole of the work should be painted with two or more coats of good paint.

A Cheap Rake.—Although an ordinary iron rake is not by any means an expensive article, a handy and serviceable substitute can be made for about twopence. Take an ordinary broom-handle and a piece of wood for the head, 9 in. long, 1½ in. wide, by 1 in. thick; into this put nine or more 3 in. French nails for the teeth; then fasten the handle across the head (Fig. 12). A ferrule of tin-plate, put on the wood handle previously to fastening, will very greatly add to the wear of the rake. The writer has had one in use for six years, and it answers its purpose admirably.

In my next paper, dealing with these simple utensils for the garden, I shall hope to describe how to make a garden roller—one of those very necessary adjuncts to every well-ordered garden.

HOW TO MAKE A PHONOGRAPH.

BY WILLIAM DUFF.

Easy Method of cutting Groove upon Face of Cylinders—Mounting the Diaphragm and Stylus—Adjusting the Stylus—Tinfoil—Reproducing Funnel—Necessity of having all parts well made—Fastening the Foil to Cylinders—First Experiments performed alone—The Capacity of the Instrument—Showing it to Friends—Joy and Pleasure to be derived from Home-made Things.

After the face of the cylinder has been turned perfectly true, a continuous spiral groove must be cut upon it, or, in other words, it must have a screw of the same pitch as the screw of the shaft. This is not a difficult matter, although it may look so at first sight. Remove the chisel from the hole, and in its place fix a small bodkin whose point has been filed V-shape, fasten the cover by the hooks and eyes (the eyes are shown at H in Fig. 1, page 164; the hooks are on the standards, but not shown), and rotate the cylinder as before directed. This will have to be done carefully, for the top of the screw thread is provokingly easy to chip. Do not allow the bodkin to cut deep; have a little patience, and there is no fear of the result. To lessen the chances of chipping during the above processes, the cylinder may be saturated with paraffin wax. To do this, place it before the fire or in a hot oven for some time, until it gets thoroughly heated; melt some paraffin wax, and baste it well; the wax will soak in and fill up the pores of the plaster, and render it more workable.

The next point will be to fix the diaphragm and needle in position, and screw the mouthpiece to the top. Proceed in this manner: cut out six rings of blotting-paper the size of the diaphragm; place three on the top (C) round the hole; pass the needle through the hole, and allow the diaphragm to rest on the blotting-paper; lay the other three rings on the top; place the mouthpiece on the top of these again, and screw up tightly. The blotting-paper makes a better bed for the diaphragm than the hard wood, and ensures it being clamped tightly all round. It will be better to have six screw nails round the mouthpiece. The diaphragm must be as tight as a drum, and there must be nothing to interfere with its vibrations. Fig. 9 is a section of the mouthpiece, needle, etc., and as I have drawn it full size, each part will be seen readily, and the necessary arrangement easily understood. The large curved line represents the cylinder.

Before putting on the tinfoil, adjust the needle; it must enter the groove on the face of the cylinder, and must not touch the cylinder at any part. If the instrument has been carefully made, when the needle has been once adjusted it will not require to be touched again. The point should be slightly chisel-shaped, so as not to cut the foil. The foil itself must be carefully chosen. The dull leady stuff is no use. The more like

tin it is the better. It is sold in sheets 11 in. by 14 in., and costs 1s. 6d. per lb.

When reproducing the sound record from the surface of the indented foil, it is necessary to have a large funnel placed in the mouthpiece, and we had best get it made before we commence our experiments. It is simply a large paper funnel about 8 in. long. One end must fit tightly into the mouthpiece of the instrument, and the other end should not be less than 6 in. wide. This is called the "phonet." The inner surface must be smooth, so as not to interfere with the sonorous waves set up by the vibrations of the diaphragm caused by the stylus passing over the indentations on the surface of the foil, and the bottom edge must not touch the diaphragm.

The construction of the phonograph should now be complete. I have not given any directions for varnishing or polishing the wood or brass work. I trust, however, you have attended to this, and that you can sit down and look with pride at your workmanship. You should always strive to do things well; although you may be an amateur, that is no reason why your work should be carelessly done. "A thing that is worth doing at all is worth doing well."

The next step is a very important one: in fact, *the* most important of all. Having made your phonograph, you want to hear it speak. Take a sheet of tinfoil and cut it into lengths; its breadth must correspond with the breadth of the cylinder: viz., $4\frac{1}{2}$ in.; its length must be just sufficient to meet round the circumference of the cylinder. Have beside you a little flour paste and a few narrow strips of tissue-paper for joining the ends of the tinfoil or blank phonogram. The join must be on the under side of the foil; to do this, paste a strip of tissue and lay one half of it along one edge of the foil; lift the foil, and place it on the cylinder with the paste side of the tissue-paper uppermost; bring the other end of the foil round, and place it upon the other half of the tissue, and allow it to dry in this position. When doing this, the top with the mouthpiece must be let down, so that both hands can be used in manipulating the foil. There must be no creases or wrinkles in the foil. To smooth it out before putting it in the cylinder, lay it on a piece of glass, and rub it from left to right with a piece of cotton-wool. When the cylinder has been covered, place the top in position, and see that the needle merely touches the foil; it must be regulated not to tear or otherwise injure the foil, for the slightest mark in it produces a sound when the cylinder revolves.

As it draws near the critical moment I can imagine you becoming a little excited; so I would advise you, if you can, to perform your first experiments alone. You will not be able to make your phonograph speak perfectly plain all at once; the needle will require a little adjustment now and again, until the best result has been obtained. People who come to see and hear things expect so much, and if the object of interest does not come up to their expectations all at once, they are rather fond of smiling; and he must be a very good-natured man who can take that smile with perfect equanimity.

If you are alone, you will have to perform two things at once. Take hold of the handle and turn the cylinder at the rate of about forty turns to the minute, and speak very deliberately into the mouthpiece. If the needle is working properly, you will be able to see distinctly little indentations in the foil, not cuts or strokes, but clear sharp markings following closely upon each other. After you have spoken a few words, lift the top, and reverse the cylinder until it reaches the point from which it started; having replaced the top, put the phonet or large funnel into the mouthpiece, and turn the cylinder at the same speed as before, when you will hear your own voice most wonderfully reproduced, providing every point has been carefully attended to. If there seems to be too much sound, the needle must be raised a little; if the reverse, it must be lowered. You must keep on experimenting until your instrument has become a success. There is a certain tone of voice which it will reproduce most faithfully, and this can only be found out by experiment. It is extremely fond of nursery rhymes, and can laugh splendidly. Speaking the alphabet into it will be reproduced with remarkable distinctness, as will also simple figures. Singing or musical sounds are not very successful, because the regularity of motion is not sufficient to ensure the exact pitch.

Of course, there is really no limit to the capacity of the instrument; it will reproduce any sound made in its vicinity, providing it is loud enough, and directed upon the diaphragm through the funnel or mouthpiece. After you have acquired the necessary swing of the handle to produce the desired speed of the cylinder, and accustomed yourself to speak into the funnel, you can trot out your instrument, and invite your friends and neighbours to a worthy entertainment, and if they do not pronounce you a genius, put it down to their want of soul; but do not speak your mind to the phonograph, lest the after consequences might be undesirable.

And now I must bid you adieu for the present; and if there is anything requiring further explanation, I will have pleasure in attending to you in "Shop." But as I always strive to write plainly and to give my instructions explicitly, I think I may use the adage, as far as this paper is concerned, "that he who runs may read."

TESTING PRECIOUS STONES.

BY H. S. GOLDSMITH.

Of rough tests, the simplest is that of applying a file to the stone. The reason of this is based on the fact that real gems are hard enough in most cases to resist a file, while the common imitations will not remain unaltered, but will scratch and crumble away under the action of a file or knife. The imitation gems now spoken of are those usually called "paste." They are a fine, bright quality of glass, and very often are softer than the ordinary glass. These pastes are made of all colours, to imitate all the gems, but they do not, of course, keep their brilliancy if subjected to rough wear; they are too soft.

The next most common imitation stone is one made up partly of paste and partly of some real stone—say a garnet, crystal, or sapphire.

Figs. 1 and 2 will explain the construction of these articles; for the hard stone parts are left white in the sketch, while the paste is shaded. Fig. 1 is composed of two parts, and is called a doublet; Fig. 2 is made up of three pieces, and bears the name of a triplet.

Now, these pieces have to be joined together, and in most cases a doublet or triplet can be detected by the air bubbles in the cement which joins them. If they are not perceptible, then put the stone in a little clean water; then, as it is turned about, the layers which go to make up the deceitful article will clearly show up. Or it might be put in chloroform or boiled in water, when the pieces would separate.

A file, if applied to the front of either of these, would have no effect, the crown being of garnet or sapphire, or some other hard stone. It is then necessary to try what the back will stand. If it is a doublet, the file will scratch it anywhere, but a triplet will not be affected, except on the layer of paste just under the girdle of the stone, which is a part generally hidden by the setting.

The water test is a good one for these, and the appearance of minute bubbles in the cement is fairly decisive; but there are real stones which have bubbles in them, so take care how a stone is condemned on that account. A cinnamon stone or essonite often has the little bubble-like specks; and there are others.

An imitation gem need not have glass in its composition, for sometimes a real stone is so cut that it is really an imitation of a more valuable one. For example, a jargoon or a chrysolite can be made to very fairly represent a diamond. To these it is useless to apply a file, for they are hard enough to resist it. The appearance of the sharpness of the facets is some guidance, but if the tests of hardness by Mohs' scale and of specific gravity are not going to be applied, then a lapidary will easily judge for you; or, if you have had a fair experience, your own eye should be sufficient to discriminate between them. A file will indicate the relative hardness of the two stones by the sound it makes, although it has no effect on the stone; but the ear must be an educated one before it is able to discriminate in this way.

Concerning turquoise—real turquoise can be filed, but not so easily as glass. The surface of a real turquoise is more waxy than glass. A minute or two's practice with a file or scraper on paste turquoise and on the real article will teach a valuable lesson. As to other imitations of turquoise, there is a real stone called "callainite," whose hardness is below that of glass; but it is rarely met with.

Odontolite is another natural production, and is yet not a true stone, much as it resembles a turquoise. It is coloured like it, but, being a fossil bone or ivory, the bony structure can be traced.

With turquoise the test of the file or scraper is useful, but in this, and in the other stones too, do not apply your test to the prominent parts of the stone under examination.

Coral.—This natural production has a good many imitations; but many are so coarsely done that a moment's inspection will expose their falseness. I mean the things formed in coraline, xylonite, and celluloid, or dyed ivory or bone.

A more tricky imitation is one that is shown in packets. It is a beautiful pink colour, ready cut for mounting and setting, and is very soft, being, I am told, made from rice.

There are others, but if their own appearance does not give judgment against them the file can be used; and by comparing the way a known piece of coral "talks," and the difference of feel and sound that imitation coral has, a just opinion can easily be formed. Coral is also well imitated in glass.

Of opals little need be said. A passable counterfeit of a good opal I have never seen, and do not think it exists. If it is a bad

one, then the value will be so little that the trouble of testing it is not worth doing.

Of lapis lazuli the file is again a good means of discriminating. Its imitations may be either harder or softer—*i.e.*, stained agate will be harder, so will enamel on metal. This last makes a splendid imitation, but the polish is generally too perfect for lapis; while the Xylonite Company's lapis is first-class for appearance, but it is much softer to the file than the real thing.

Xylonite can also be cut with a knife like cheese. Now, we have no gem which will stand having pieces cut off with a knife; in fact, one of the necessary conditions of a precious stone would be absent—that of sufficient hardness to be durable.

To judge whether a pearl is real or not is nowadays not always an easy thing to do at a glance, the imitations are so excellently got up. Doubtless, a pearl of the highest class is matchless in its orient; but of the general run of pearls one finds that the best imitations are nearly, if not quite, as good as the real in appearance.

First, let us clearly understand the formation of a real pearl. It is simply a series of concentric spheres, one enclosed in another sphere; or, to put it the other way, layers or shells completely enveloping each other, beginning with a very small one, and gradually increasing in size as they have to enclose larger and larger kernels, as it were.

Being formed in this way, it follows that if a round pearl (Fig. 3, A) is cut across in any direction, then the appearance of the interior, when it is exposed, must be something like Fig. 3, B—that is, a series of concentric circles.

If the pearl is an oval or a drop shape, the lines will still appear concentric—*i.e.*, one within the other, but of the shape of the pearl; not circles, that is, but ovals or pear-shape, as the case may be. These are formed by deposition of the nacreous or pearly material in stages, and it is only when it is deposited *round a nucleus* that it forms a real pearl.

The same pearly material is also deposited on the shell itself. Now, even if it is possible to cut off raised portions of the shell, and even if such portion is just as bright as a pearl, as it often is, still, the piece is classed differently, being called a blister pearl, and its value is much less.

Its structure will be often approaching parallel lines, the particular concentric formation being either absent altogether or else much modified as shown in Fig. 3, C and D.

These blister pearls, being formed as shown by the dotted lines, the shape cannot be so good or so regular, but will be more or less on the twist. But this question of shape is rather a complicated one; so it had better be left out of further consideration in this reply, which already is taking up too much space.

We cannot always observe the structure, particularly in the case of an undrilled, or only partly drilled, pearl; but then we have the shape to guide us. If it is entirely undrilled, then it will be a pearl; and if partly drilled, the glassy formation can easily be recognised if present, and some of the waxy stuff that is used to fill them is generally to be got at.

These mock pearls have many names—Roman pearls is one of them. They are thin glass beads, filled with certain matters, or lined with them to counterfeit the real article. The exposure of the edge of the hole is usually sufficient to decide the question. Church's description of imitation pearls is as follows:—

"They are small spheres blown on tubes of slightly opalescent glass, and coated internally with a preparation made from the scales of a certain fish (as the bleak) and called *essence d'orient*. The little opalescent glass globe first receives, while still soft, a few very slight dents; then a coating of parchment size is introduced, and then a film of the pearl essence. Lastly, when the essence is dry, the bead is filled with wax."

Another substitution of a genuine article for one of greater value is the case where hematite (the iron ore) is cut and polished to represent black pearls. The weight and hardness of this are sufficient to distinguish

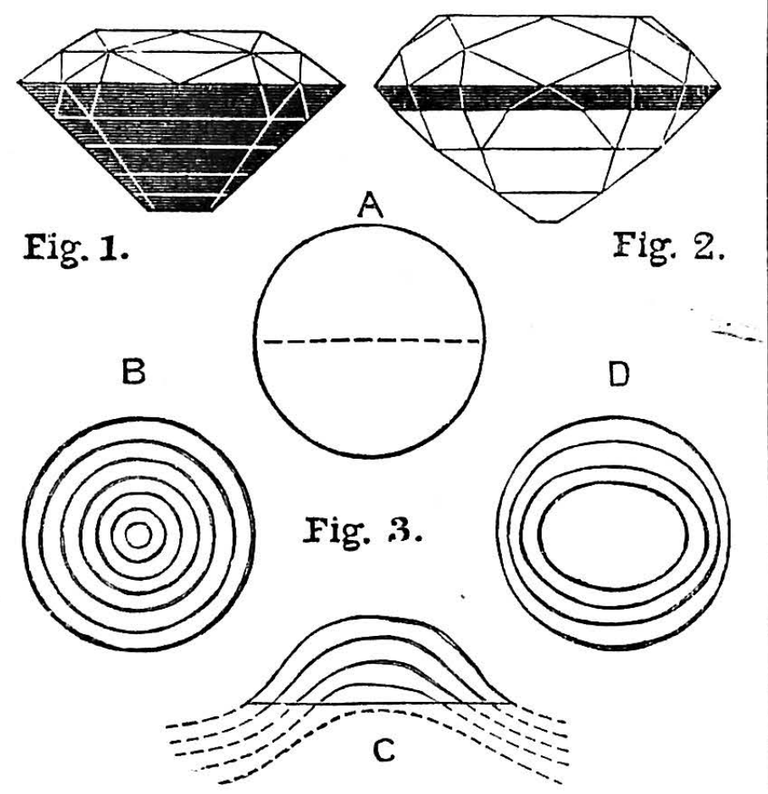


Fig. 1. Fig. 2. Fig. 3.

Precious Stones. Fig. 1.—A Doublet, two pieces, the Crown of Garnet or Crystal, etc., the Base of Paste, shaded in Sketch. Fig. 2.—A Triplet, three pieces, Crown of a real Stone as far as the Girdle, then a layer of Paste, shown shaded in Sketch, the lower part of base being composed of a real Stone. Fig. 3.—A, Whole Pearl; B, the same. If cut across and turned to show the flat Surface, it shows the Concentric Structure of a real Pearl; C, Sectional Elevation of a Blister Pearl as it would be cut from a Shell; D, the same, to show the appearance of the cut Surface.

it from the real thing. Pearls are also dyed sometimes to represent black pearls. They are real pearls, but still not genuine articles.

In this paper I have purposely left out acid tests, and any but passing allusions to other tests. I will go into the matter more fully later on, but the papers will have to be restricted to one class of gems at a time.

In conclusion, let me warn all young jewellers against applying any test to a customer's stone in such a way as to damage it; and a little practice on the lines suggested will be the best course to follow. Rough stones are interesting too, but will want a page to themselves. Indeed, there are many branches of the jeweller's art which young workmen would do well to read and learn about, and I have the Editor's authority for saying that the matter shall have full attention in WORK.

HOW TO MAKE A MAHOGANY MAGIC LANTERN.

BY O. BECKERLEGGE.

As is made evident by numerous inquiries which have appeared in WORK from time to time on the construction and working of the lantern, there must be many of its readers interested in the subject, therefore I purpose giving practical instructions for the making of the same.

The three essentials of a lantern are: the body, illumination, and optical arrangement. The body is of the least importance, so we put it first. But there are bodies and bodies, and my advice is to pay all needful attention to it. Do not go in for the essentially cheap. I have heard of a lantern being constructed out of a biscuit-tin. Without doubt it could be done, but why do it? Is neatness or elegance nothing? I knew a man who lived in a hut made of discarded soap-boxes. No doubt, that was a trifle better than having no shelter, but it must have been neither elegant nor comfortable. So for our lantern: in some cases it may be better to have one with a biscuit-box for its body than having no lantern at all; but if there is no necessity for such an arrangement, then let us construct that which, when completed, shall give us pleasure in looking at and using. The writer's experimenting goes back to the time when WORK was an undreamt-of quantity, and when practical men were far too conservative to give outsiders any information. Then not only did old tins work in, but even cardboard, for some purposes, was brought into requisition; but I know this: that no sooner was the novelty worn off than the clumsiness and unsightliness of the construction would assert itself, and a craving for something better would master one. At present there is a great variety of types of lantern. For some reasons, the modern one with the circular head to turn over is admirable, but its construction requires more than the average ability possessed by the readers of WORK, whilst the ordinary japanned tin body is hardly up, perhaps, to their standard. I therefore propose to construct a mahogany body; this will not be difficult to make, and presents a handsome appearance. A full-size lantern has the following proportions: inside measurement: height, 13 in.—this does not include the chimney; from front to back, $8\frac{1}{2}$ in., and $6\frac{1}{2}$ in. wide. Old lanterns will be found much larger than the dimensions given, but there is no advantage obtained. Before commencing, it will be necessary to decide on the size of the condenser, which we will assume to be a 4 in. compound. This is the most convenient size if we intend using the lantern in any public entertainment. If it is a matter of cost, then we must decide accordingly.

A set of 4 in. condensers will cost, with front lenses, 17s. 6d.; $3\frac{1}{2}$ in. do., 12s. 6d.; and 3 in. do., 8s. 6d. We shall, however, make all our measurements for the larger size.

For our work we must procure a few feet of well-seasoned mahogany, straight in the grain; when finished up, it should be $\frac{1}{2}$ in. thick. A piece may sometimes be picked up at a reasonable price at an old furniture shop, when it will certainly be well seasoned. For sides, two pieces $13\frac{1}{2}$ in. by $9\frac{1}{2}$ in.;

A Mahogany Magic Lantern. Fig. 1.—Section of the Lantern—A, Body; B, Tin Lining; C, Screw to fasten Lining to Body; D, the Plate carrying the Tube for the Condenser Cell; E, the Presser Plate actuated by the Spiral Springs; F, Plate carrying the Front; G, Sliding Tube over the Front; H, Sleeve carrying the Pinion; I, Tube carrying the Front Lens; J, Stop in front of Lens. Fig. 2.—Plan of Lantern—A, A, Blocks at the

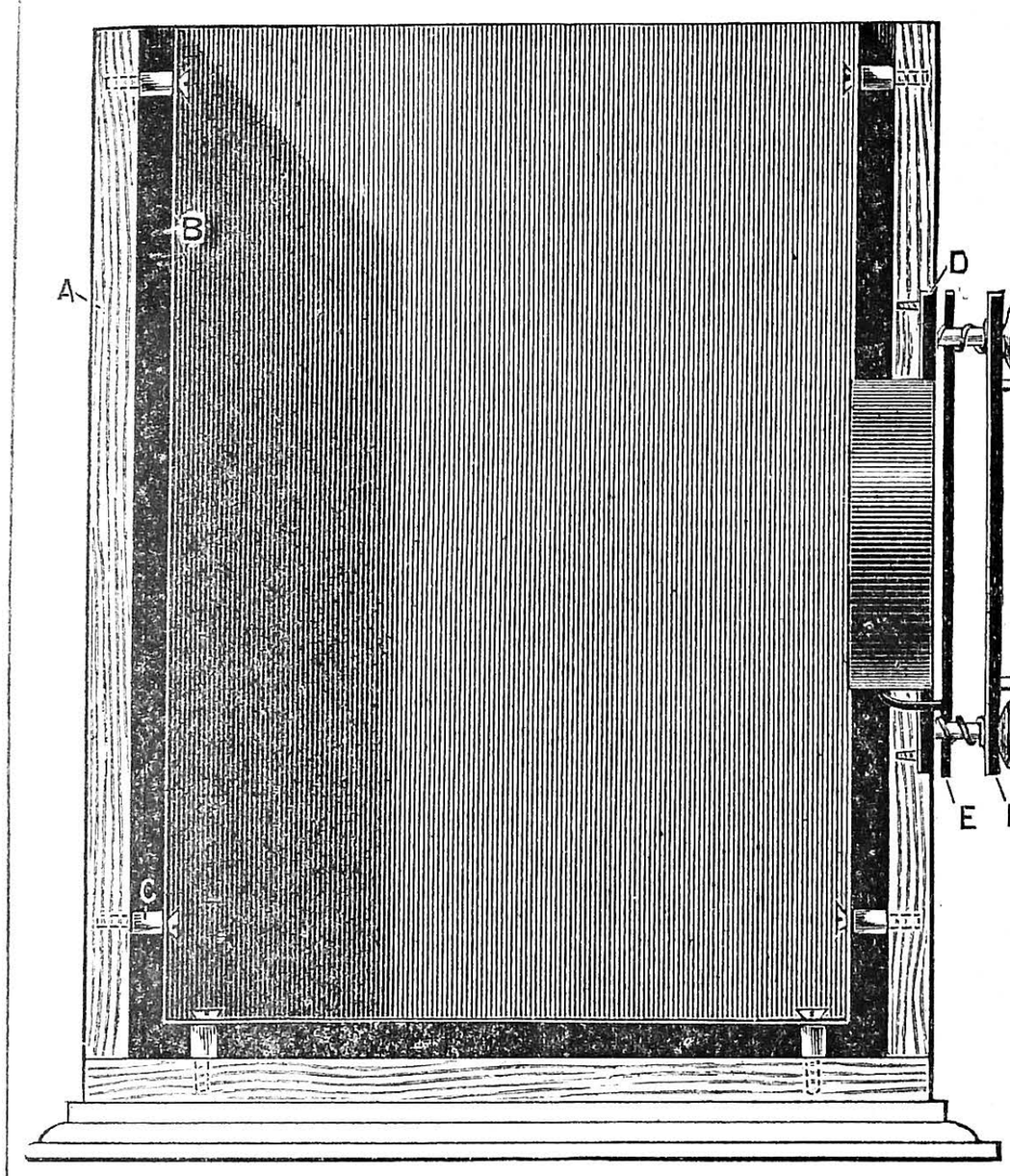


Fig. 1

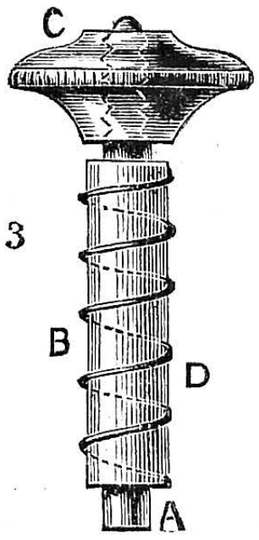


Fig. 3

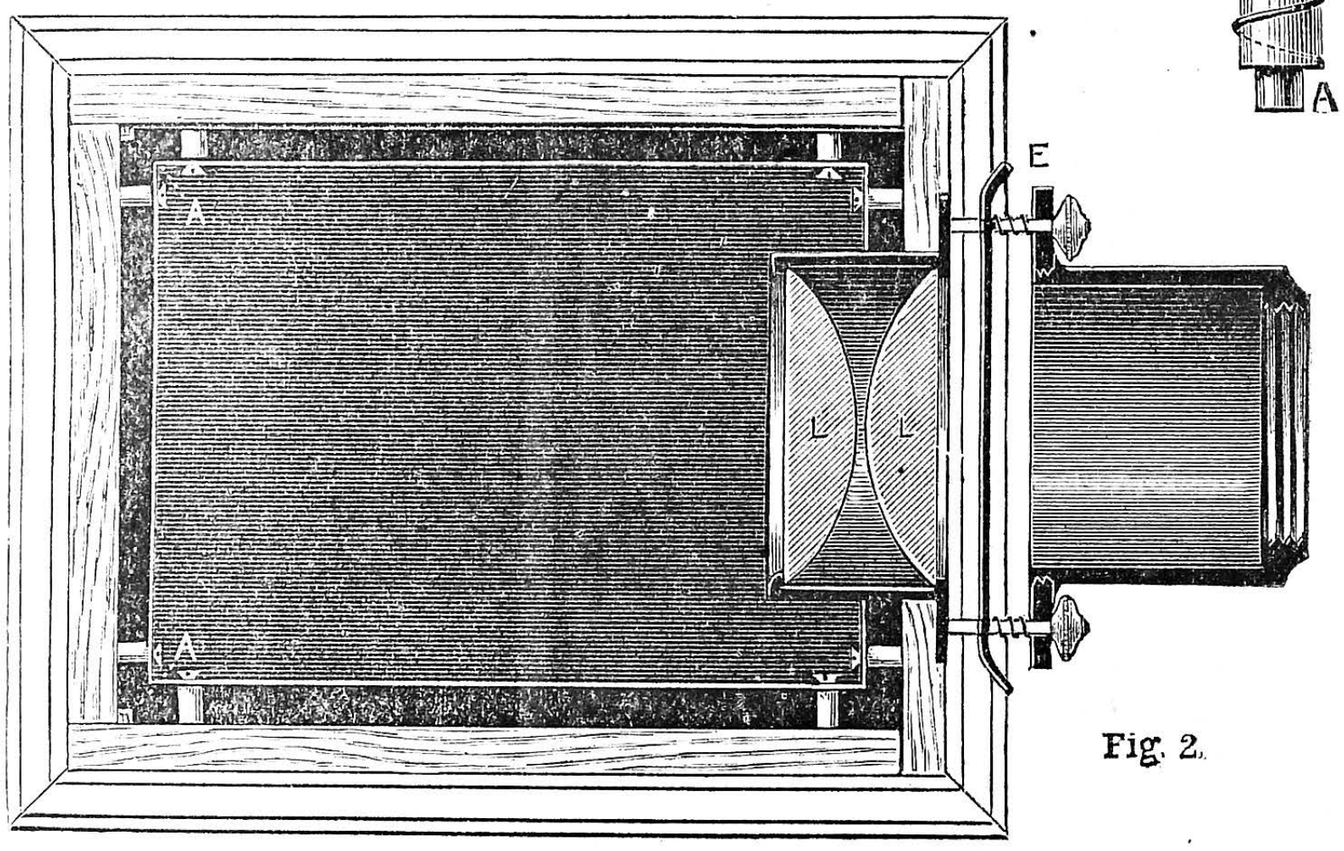


Fig. 2.

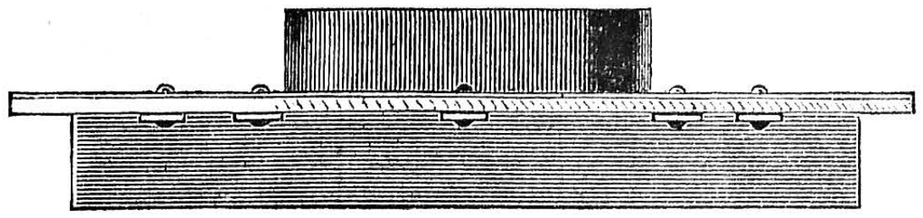


Fig. 7A

Fig. 8.

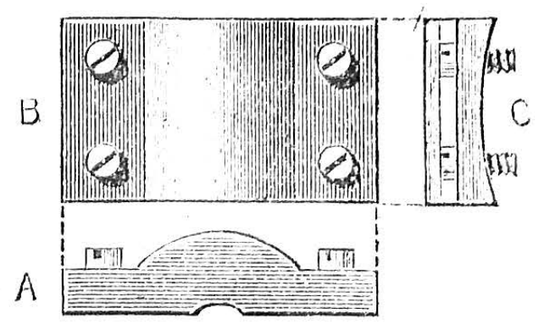
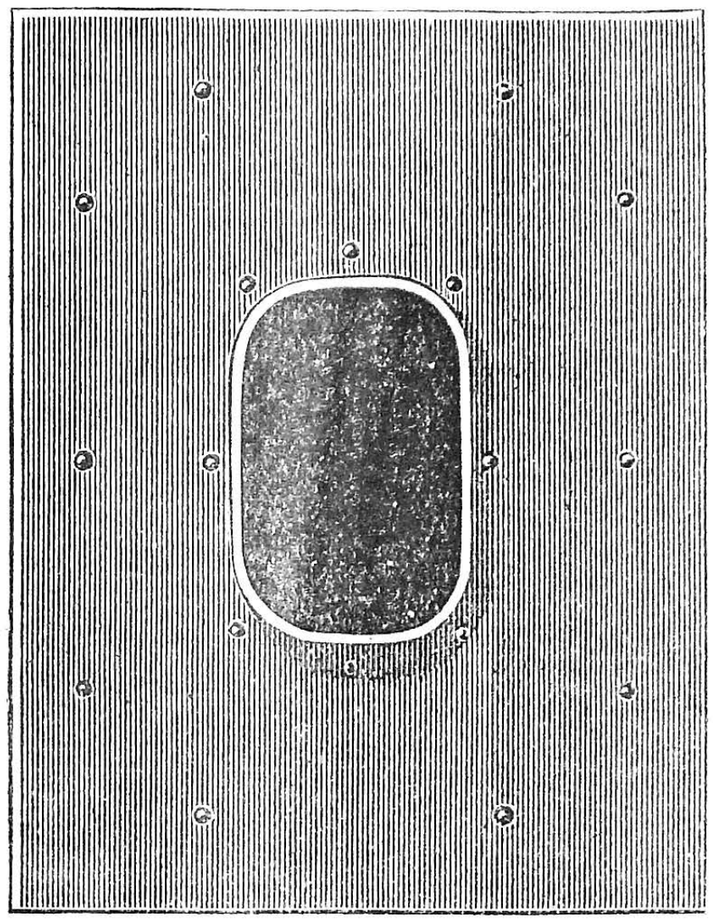


Fig. 7B.



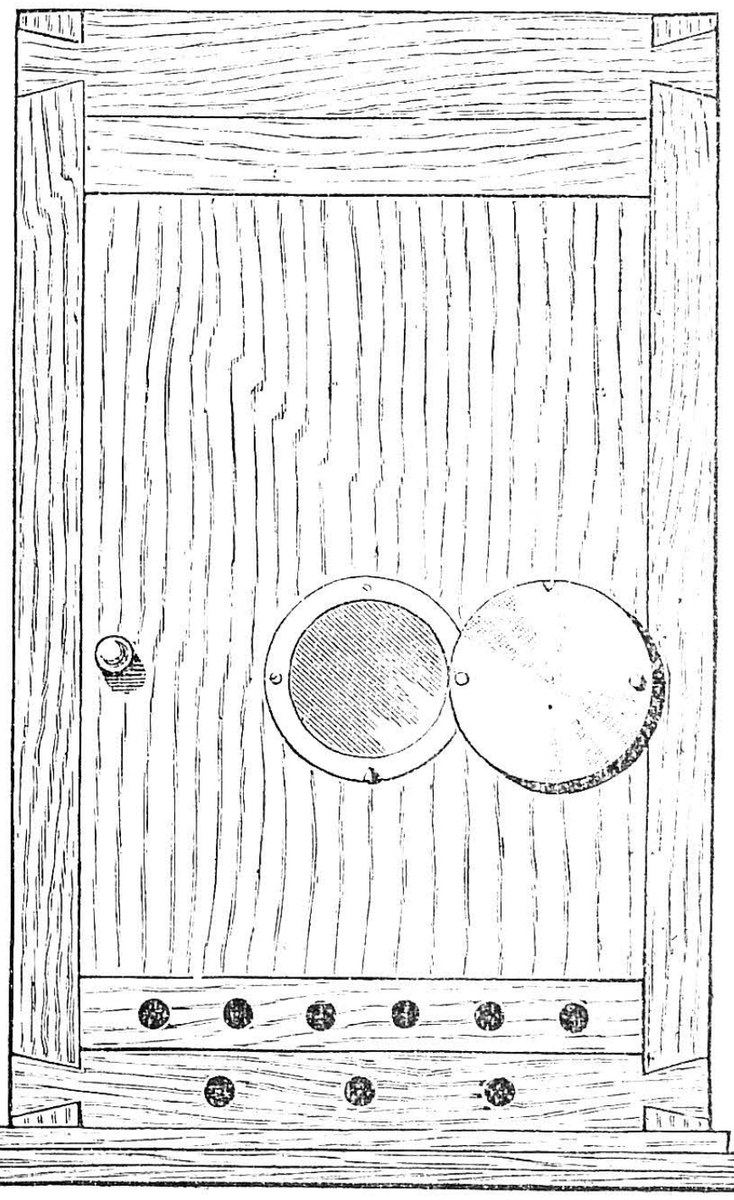


Fig. 6.

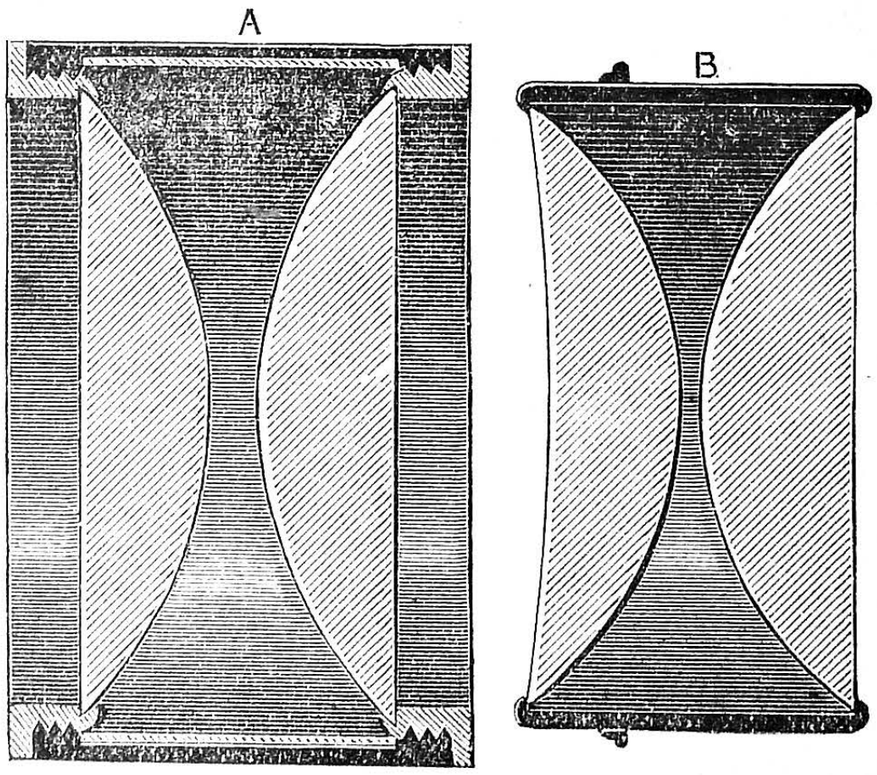


Fig. 5

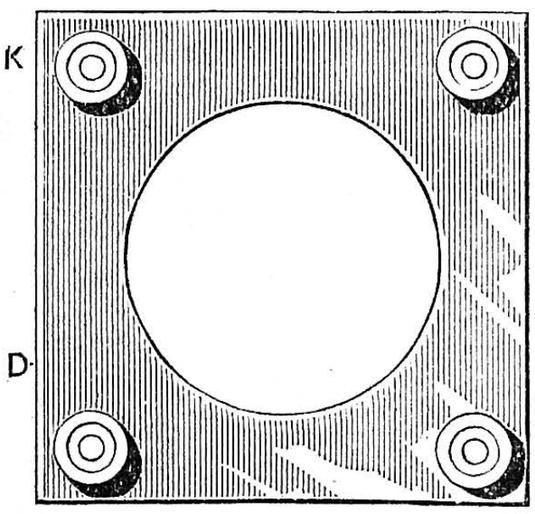


Fig. 4.

Sides against which the Door closes; E, the Presser Plate with the Ends curved forward; L, L, Condensers. Fig. 3.—Full-size Pillar and Boss for the Front and Presser Plate—A, The Pillar; B, the Sleeve over it; C, Running Boss; D, Spiral Spring. Fig. 4.—Plan of the Front Plate. Fig. 5.—A and B, Condensers in Cell. Fig. 6.—Back of Lantern. Fig. 7.—A and B, Top of Lantern. Fig. 8.—A, B, C, Plan Side and End of Pinion Cover.

front, 13½ in. by 8½ in. For the back will be required, at present, two pieces 8½ in. by 1½ in. These are dovetailed into the sides at top and bottom, as in Fig. 6. The bottom must be 1 in. larger all around than the body, with the edge moulded as shown.

Difficulty is often experienced by amateur wood-workers in working up a square edge: everyone should provide himself with a square shooting-board. If the block is set perfectly square with the board, the work must come out square, as also will be the edges. The front must have a circular hole cut to receive the lens and cell—say, about 4¼ in. diameter, the centre of the hole being 6 in. from the bottom; this, in ½ in. wood, can easily be cut with a hand fret-saw. In the illustration the brass plate carrying the condenser lens is represented as let in the front, but this is a mere matter of taste; for some reasons it is better not so, but this will be referred to again.

The front and sides are joined by brass screws; these will look much better if the heads are burnished, when they have a slightly rounded outline. They can be purchased, but are more expensive; they are easily burnished if one has a lathe. I have seen a small boy in a lantern factory do them exceedingly quickly thus: A piece of hard wood is screwed to the nose of the mandrel as a chuck, in the centre of which is a small hole into which the screw is turned. A burnisher is pressed firmly against the head, and a slight motion is given, so as to produce the convex outline, and in almost less time than it has taken to write these sentences the screw has been burnished and withdrawn.

It is hardly necessary to say that the screw holes must be marked off at regular intervals and be slightly countersunk, which will add much to the appearance of the instrument and be more workmanlike.

The bottom can now be put on. This should be fixed in its place by two screws, when with a ¼ in. bit two holes should be bored through the sides, front, and back. Hard-wood pins must be glued and driven in; these will hold much better than screws, as the wood is the long way of the grain.

The body must now be lined with tin-plate or thin sheet-iron—I should recommend the former—leaving the side nearest the wood bright, as it is well known that a bright polished surface radiates less heat than a dull one.

The lining need not be joined together. Sixteen or more bits of brass tubing will be required, ½ in. long by ¼ in. diameter. Holes must be punched in the corners of the lining, and screws passed through the tubes into the body, as shown (C, Fig. 1). Three ½ in. holes must be bored in the bottom rail of the back; by this means the lantern will be ventilated, and a current of air will pass around between the inside of the lantern and the lining, keeping it cool. It may be well to say here that probably a false bottom may have to be placed in the lantern, so as to rightly adjust the height of the lamp, but this, of necessity, cannot be done until the lamp has been procured. We may, however, indicate the rule to be observed. The edge of the burning wick should be about 1 in. lower than the centre of the condenser. When it is ascertained that a false bottom is required, one can be added by removing the bottom lining and riveting the false to it, using pieces of tubing of the requisite length to bring it to the required height.

The door must now claim our attention. The exact length of the door will depend on the form of the lamp used. Should the knobs of the rods for raising the wicks project beyond the back of the lantern—and they often do—then the door must be short enough to close over them. If, on the other hand, they do not project, then the door may come down nearly to the bottom rail. Both for appearance and strength, the door should have a piece grooved and tongued into the top and bottom, the opposite way of the grain. A 2 in. circular hole must be made in the centre of the door, with a narrow rabbet to receive a piece of ruby glass, which must be secured in its place by a ring of brass, as shown; this will be of service should the limelight be used. The body may now, with the exception of the top, be considered finished, and in our next paper we will treat of the optical arrangement.

HELICAL GEARS.

BY J. H.

Spur Wheels.

METHODS OF MOULDING—WHEEL-MOULDING MACHINE—METHOD OF CONSTRUCTING TOOTH-BLOCKS FOR WITHDRAWAL—EXPLANATION OF FIGURES—DETAILS OF CONSTRUCTION.

Methods of Moulding.—These helical wheels are, as a rule, made with wheel-moulding machines from tooth-blocks; scarcely ever from complete patterns, and only occasionally in core boxes. And but for the extensive employment of these wheel machines, the helical gears would not even now be used to any great extent, owing to the difficulty of constructing them by the other methods. Their invention actually dates from the early part of the present century, but it has only been since the invention of wheel-moulding machines that they have been a practical success.

Wheel-Moulding Machine.—I may mention, in the interests of the general reader, that a wheel-moulding machine is essentially a dividing wheel and worm and change wheels, together with the mechanism necessary for holding and carrying and withdrawing a couple or

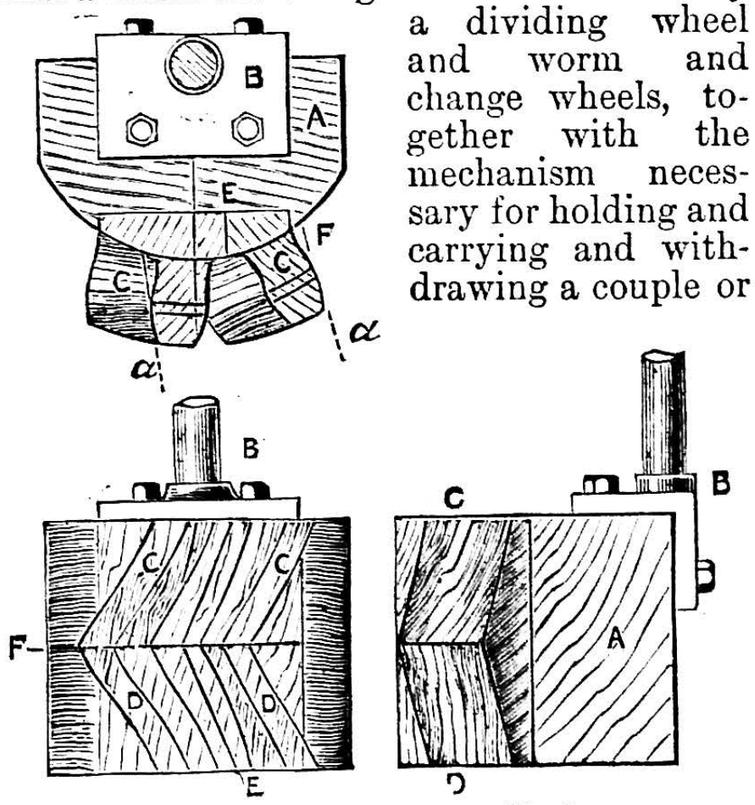


Fig. 4.—Pinion Tooth-Block.

three teeth, pitched and shaped like those on the complete wheel which has to be moulded and cast. A good example of a wheel-moulding machine is illustrated in my book on "Practical Ironfounding," p. 134. Wheel-moulding machines are constructed to withdraw the tooth-block from the sand after ramming, either in a vertical or horizontal, and sometimes also in a diagonal, direction, being thus adaptable to spur, bevel, worm, or skew gears. An entire spur helical block can never be drawn vertically, but it may often be drawn horizontally, though not always. Spur wheels can mostly be drawn horizontally; pinions seldom so, because of the undercutting of the outermost flanks. Neither bevel wheels nor pinions can be drawn horizontally.

Method of constructing Tooth-Blocks for withdrawal.—Now, the general practice is to adopt a compromise in both spur and bevel wheels. The teeth themselves are made distinct from, though temporarily attached to, a main block, or backing (A, in Figs. 4 and 5). The backing supports the teeth during ramming, and is then lifted vertically by the arm of the machine, leaving the teeth themselves behind in the sand. The latter are then taken away by the fingers of the moulder in the direction in which they will happen to come out the easiest.

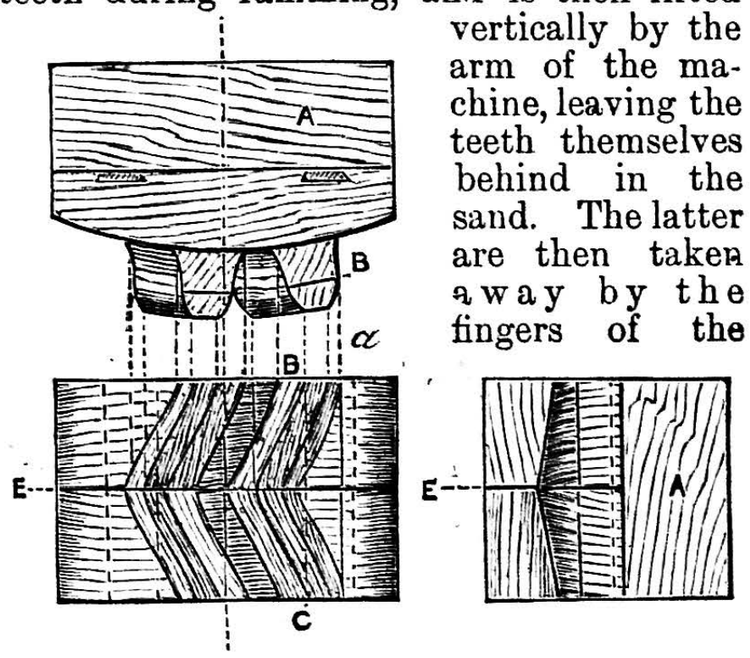


Fig. 5.—Wheel Tooth-Block.

I will confine my remarks during the remainder of this article to the subject of helical spur wheels, reserving the next for the description of bevels. And to guard against captious criticism, I will remark that, though I explain the commoner methods of construction, there are modified methods adopted in the formation of helical tooth-blocks. It matters little, however, which is selected, so that the ultimate result is secured.

I show a couple of tooth-blocks as used for spur wheels, in which two of the best and most frequent methods adopted are illustrated. I will first explain the reasons for their construction, and afterwards explain in detail how they are marked out and worked.

Explanation of Figures.—In Fig. 4, which is a spur pinion-block, A is the backing screwed to the carrier, B, of the wheel-moulding machine; C, C and D, D are four several pieces, between which the two pattern teeth are divided for convenience of delivery. These four blocks fit into the backing, which is grooved to receive them. They fit closely, yet slide freely in their grooves, so that the lifting of the block, A, does not disturb them in the sand. The same purpose is fulfilled by the dovetail fitting of the wheel-blocks (B, C, in Fig 5) into the backing, A. There is, further, no vertical division between the teeth, as in Fig. 4 (shown at E in that figure).

The reason why the tooth-blocks are divided vertically in Fig. 4, and not in Fig. 5, is that in consequence of the undercutting of the tooth flanks at F, due to the small diameter of the pinion, the pair of teeth could not be drawn back from the sand together without tearing it down, while they can in Fig. 5. This is shown clearly by the dotted lines, *a*, *a*. In both cases, however, the teeth are divided along the middle planes (F, Fig. 4; E, Fig. 5). This is not always necessary for the purpose of easy withdrawal; but it is convenient, and is an advantage for marking out the teeth upon the middle plane, which, without the joint face, would have to be cut with a templet. Further, if the teeth are not divided along

the middle plane, the proper ramming of the lower portion is somewhat interfered with by the upper portions leaning over in the way of the rammer. If the upper half is removable, the lower portion can be rammed in a more nearly vertical direction than if the teeth are in one piece. In the latter case the direction of ramming must be more horizontal. Sprigging the teeth is also better done with the top portion of the teeth removed out of the way.

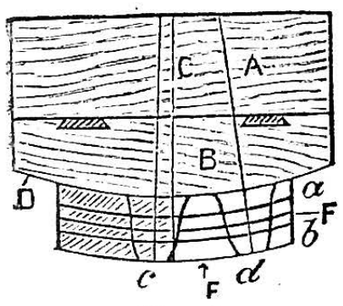


Fig. 6.

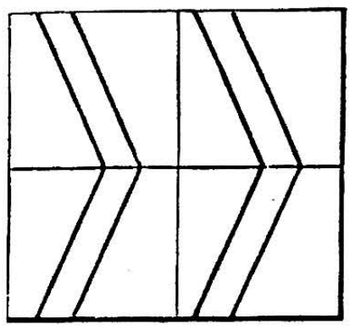
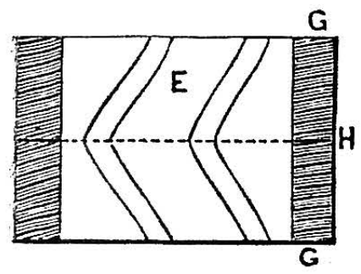


Fig. 7.



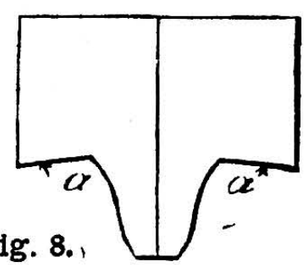


Fig. 8.

Fig. 6.—Lining out of Tooth-Block. Fig. 7.—Paper Templet. Fig. 8.—Wooden Templet for working Inter-Tooth Curves.

The construction of the spur tooth-blocks is easy enough; that of the bevels is not so easy. In the spur-block we have only level surfaces and curves at right angles thereto to deal with; in the bevel we have nothing but bevels.

Details of Construction.—In the spur helical block (Fig. 6) a piece of backing, A, is first prepared by planing into a cubical form, and the piece B is attached to it with dovetailed strips or other suitable fittings. A centre-line, C, is squared over, the curve, D, representing the roots of the teeth, struck and worked, and the block from which the teeth are to be worked fitted to this curve, and glued on.

The curves representing the tooth-point, E, the pitch-line, F, and such striking-lines, *a*, *b*, as may be necessary, are marked with trammels, the centre-lines, *c*, *d*, of the teeth upon the outer faces marked radially, and the outlines of the teeth struck thus:—Since in these wheels there are three terminable planes—namely, the two outer faces, G, and the middle plane, H—which coincide with the apex of the meeting teeth, the shapes of the teeth are marked upon all three faces, no matter whether the wheels are spur or bevel. The curve, E, which corresponds with the tooth-points, is worked round, and then the tooth-centres and outlines marked in the joint-face upon either one of the blocks. The lines representing the extremities of the tooth-faces are then marked upon the curved face, E, of the pattern block, along the edge of a bit of thin steel bent round from outer to middle faces.

My pattern-making friends will recognise this method as one commonly employed for marking out the threads of screw-wheels, worm-wheels, small elevator screws, etc. They scarcely need be reminded that it is necessary that the face, E, should be a true curve, free from lumps and hollows, and that the steel should be flexible and pressed to perfect contact all through its length. Then, and only then, will its edge yield a true helix.

Another good way—perhaps a trifle better than the bent steel dodge—is to get a slip of paper (Fig. 7) of the same width as the pattern-block from face to face; mark diagonal lines upon it corresponding with the terminations of the tooth-points and the angle of teeth, and lay and glue this upon the curved face, E, of the tooth-block. The diagonals will then develop into the helices required.

The helical form of the tooth-points and the shapes of the teeth on the outer and middle planes being obtained, the inter-tooth space is worked out by the aid of a templet (Fig. 8) cut to the exact shape of the inter-tooth space, and the helical twist of the flanks and faces is correctly developed during the act of working. This is clearly the case, because the centre lines of the teeth on both outer and middle planes are radial, and the centre line of the templet is radial; consequently, if the tooth flanks and faces are worked until the templet beds at *a*, *a*, accurately on the outer curve, E, representing the tooth-points, every separate section of the teeth will be truly radial, and the essential conditions of a helical thread will be fulfilled.

I may remark that the shapes of the teeth themselves are the same as in ordinary gears, and may be struck by means of rolling generating circles, or by means of an odontograph scale.

HARDENED SPLIT STEEL CHUCKS.

BY F. A. M.

Of all the chucks for holding small rods, wire, etc., while being turned, these are the best; in fact, it may almost be said they are the *only* chucks that will hold small work really true. Scroll chucks are very useful for holding stock, or material such as wire, and metal rods, off which screws, etc., are to be made; also for holding drills; but no one expects absolute truth in a scroll chuck. The Essex chuck springs have a range of

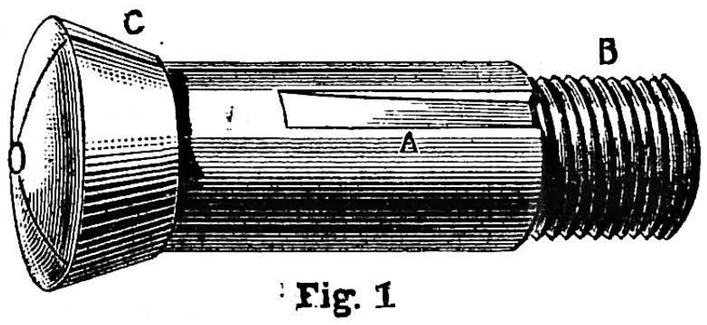


Fig. 1

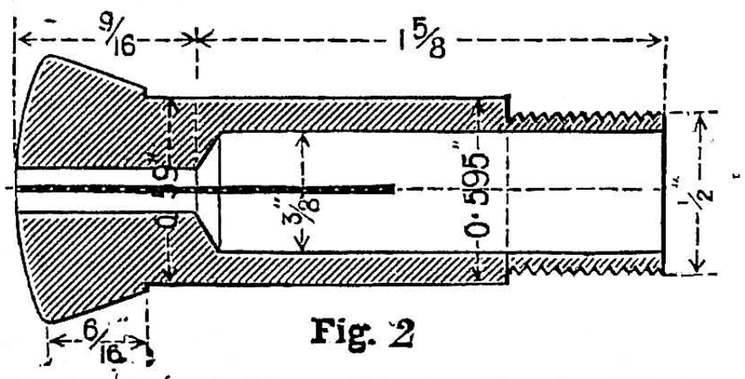


Fig. 2

Fig. 1.—Outside View of Spring Chuck. Fig. 2.—Section of Chuck.

about $\frac{1}{8}$ in., which prevents all hope of arriving at real accuracy; they are very cheap, and may do well enough for holding drills. To hold small work with perfect truth demands something in the style of Fig. 1, which is an outside view of a spring chuck, one of a set of thirty-seven sizes having holes varying by only $\frac{1}{100}$ in.; the smallest has a hole of $\frac{4}{100}$ in., and the largest of $\frac{4}{10}$ in. The same kind of chucks, but of much smaller size, are made for watchmaker's lathes, and they will hold a small needle perfectly true while being turned.

The chucks fit into a perfectly true hole in the mandrel of the lathe 0·015 m. or 15 millimetres (a full $\frac{1}{2}$ in.) in diameter. The hole runs right through the mandrel. A tube is put in at the tail end of the mandrel having a wooden hand-wheel fitted on it to hold and turn it by; this tube also fits the bore of the mandrel, and at its front end where it meets the chuck it has an internal screw which takes on to the screw B at the end of chuck (see Figs. 1 and 2). The key-way at A receives a little pin, which projects into the bore of the mandrel and prevents the chuck from turning. As the tube is turned the screw threads draw in the chuck, and the conical part C, which fits a similar internal cone, causes the chuck to close upon anything placed within it to the amount of $\frac{1}{100}$ in. The sides of the cone are inclined to the centre line 20°.

Fig. 2 gives a section of the chuck with its principal dimensions, which are metrical, but are here given in fractions of an inch. The pitch of the screw is 1 millimetre; or very nearly 25 to the inch.

These chucks are interchangeable; they are very carefully made in America and very expensive, the list price being $2\frac{1}{2}$ dols., say 10s., each. They are made of the best tool steel, hardened at the front end and ground true. The smallest sizes are ground true in the hole by tiny steel pin-like laps, charged by rolling them in diamond dust; the chucks are placed in a slowly revolving mandrel whilst the little lap runs at a great speed in touch with one side of the hole till it is quite true.

Probably anyone who wished for a set of chucks like these could get them made in this country for about 6s. each, but I am not aware that any of our lathe-makers supply them.

KALSOMINING.

Kalsomining, or wall colouring in distemper, is best done when the walls are not too cold or too hot. It may be done during the winter, so long as the walls do not freeze. There are a good many preparations put up for this purpose, and called by various names. However, if you are where you cannot procure this, it may be prepared in the following manner: White—To 10 lb. best whiting use $1\frac{1}{2}$ lb. white glue, $\frac{1}{2}$ lb. alum, and a little ultramarine blue. Put the glue in cold water, set it on the fire, and stir until dissolved. Put about half a gallon of hot water over the whiting, and when dissolved, add the glue, the blue, and the alum, which must also be dissolved in hot water. Stir this mixture well and run through a sieve. For first coating this may be used while hot, but the other coats must be cold. If your colour works too stiff, a little soap will help. All colours and shades are made by adding the dry colours. Before kalsomining, the crack and nail holes should be filled with plaster-of-Paris. Mix this with paste, and it will not dry so quickly. If you have a good brush, and work as quickly as possible to avoid laps, you will have a good job of kalsomining. A neat stencil border run around the top of the wall makes a nice finish.

The keeping clean of walls is a most important matter in every house, especially in the hot weather season, when so much dirt and dust cling to them—endangering life and health at every respiration by reason of the germs of disease contained on unclean walls. With colouring matter cheaper than paper, thousands of people might easily purify and brighten their own walls.

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NICKEL SMELTING.—The value of nickel as a non-corrodible material is well known, but so refractory are its ores that it is chiefly used for plating. We may, however, look now for wider applications of the metal itself, as some fifteen months since the Orford Copper Company experimented on new methods of treating the nickeliferous pyrrhotite and chalcopyrite ores of Sudbury, Ontario, and the result is that a method is devised for the proper reduction of the "mattes." The details of the process are kept secret, but the copper and nickel in the matte are separated, and the nickel converted into nickel oxide, which may be reduced or used in that form for making nickel steel, which is more homogeneous in texture when made from the oxide than from the metal itself. This new discovery has given such an impetus to the owners of the nickel mines in Northern Ontario, that the Drury Nickel Company have not only built a large smelter, but have also constructed a line of railway to connect their works with the Canadian Pacific Railway. Nickel, at a cheap rate, will be a blessing to the amateur, as it can be welded like iron; and so we can have a smith's shop at home without the dirt, and moreover it is a very clean metal to turn.

LINERS FOR BORING.—At the present day, when accuracy as well as speed is required in the manufacture of machinery, engines, etc., a good system to observe, when boring out bearings and connecting rod brasses, is to put in between the points of the brasses a liner. Say for a 6 in. brass put in a $\frac{1}{8}$ in. liner, and bore the brass out to $6\frac{1}{8}$ in. diameter. After this is done, take out the liner and put the brasses together, and it will be found that they will measure 6 in. diameter at the crown, and at the points $6\frac{1}{8}$ in. diameter, or $\frac{1}{16}$ in. clear at each side of the shaft—a necessary space at the points to avoid unnecessary friction. As this space has to be filed out by hand, why not do it by machinery at the same time as we bore out the shaft? It, at all events, saves time, and, as time is money in manufacture, a few hours saved on the brasses of an engine is a move in the right direction. This system also ensures that the brasses fit the shaft better.

CO-OPERATIVE HOME INDUSTRIES.—A new society which commands our interest and support is about to be started for the promotion of home industries, especially among our rural population. The object of the society is to afford a means of sale for the various handworks which are already carried on in cottages, and which might be produced in much larger quantities under further encouragement. It is estimated that some £30,000,000 annually is paid out by England for minor art work done abroad, and it is argued that a large proportion of this work might as well be done at home. Our working classes have often only too much leisure. There is the "out of work" time to which nearly all trades are subject, and in our agricultural districts the really active time of the year is small compared with the slack season. Farmers complain, too, of being obliged to support throughout the year the labourers whose services are only required for part of it, and the low wages, which is all they can afford to pay, come hard on the labourers, who do little to add to them. The proposed society would bring the home producers in direct contact with the world of buyers, everything being done on strictly co-operative principles, shareholders, salesmen, and craftsmen all sharing in the profits. It would thus fill the post occupied in Germany by the Kunstgewerbe, which exist in most of the towns of that country. By their means the people of the district may, on payment of a small fee, exhibit anything which they produce for sale, without an intermediary system of middlemen. Before long a definite plan of action will be submitted to the public. The new society must not be confused with any of those now existing for the purpose of teaching art work to the poor. Its object is simply to provide a means of sale for such work when it is produced. The foreign manufacturers of the articles for which we pay the £30,000,000 are content with so much smaller profits than our own people would think it worth their while to work for, that with a fair field it would be useless for us to attempt to compete with them; but when the expense of carriage and all the profits of intermediate agencies are taken into consideration, it is clear that British workers start with an immense advantage, and given proper organisation in the selling department, they ought, as soon as they can make things as they are "made in Germany," to sell their work for less than is now given for the foreign imports, while gaining considerably more than the actual workman in France or Germany has done. Already this society has some headquarters in the West End of London, and it should not be long before it develops into a thoroughly prosperous institution. There cannot be too many societies of this kind throughout the country in order to conserve the trade, and utilise as much as possible of the unemployed labour of the country. Those having time and means with a desire to do some good for their generation ought to co-operate and lend their services and encouragement to such a cause as this—one having so excellent an object as the cultivation of small home industries.

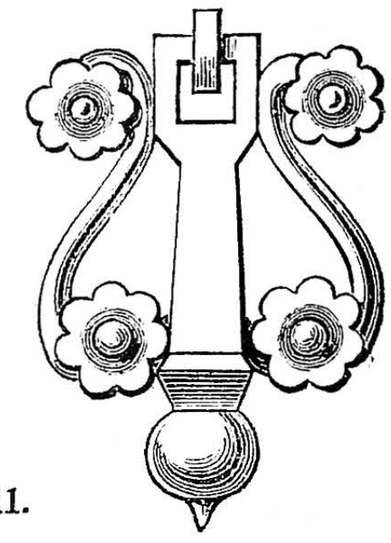


Fig. 11.

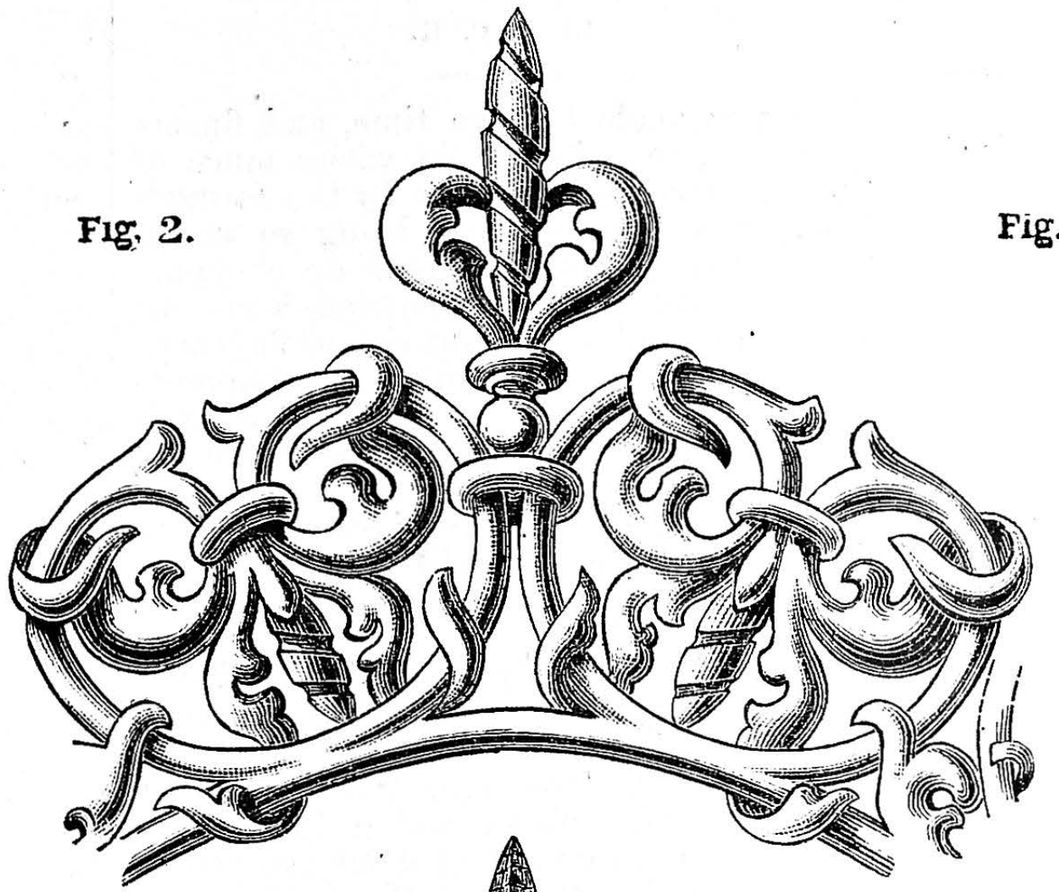


Fig. 2.

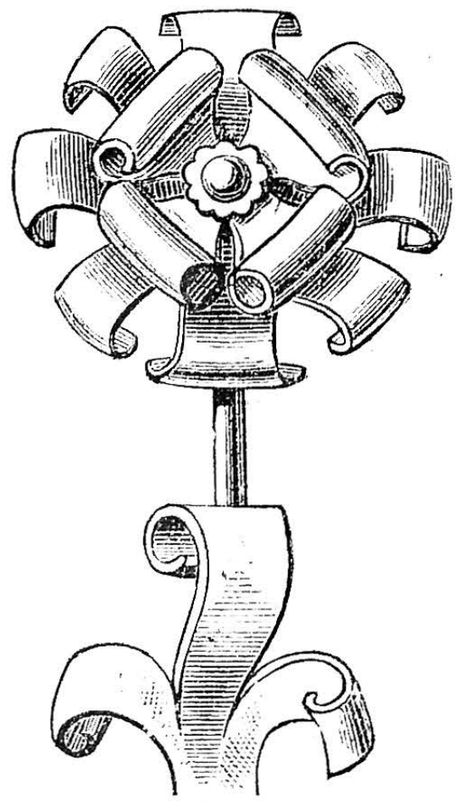


Fig. 6.

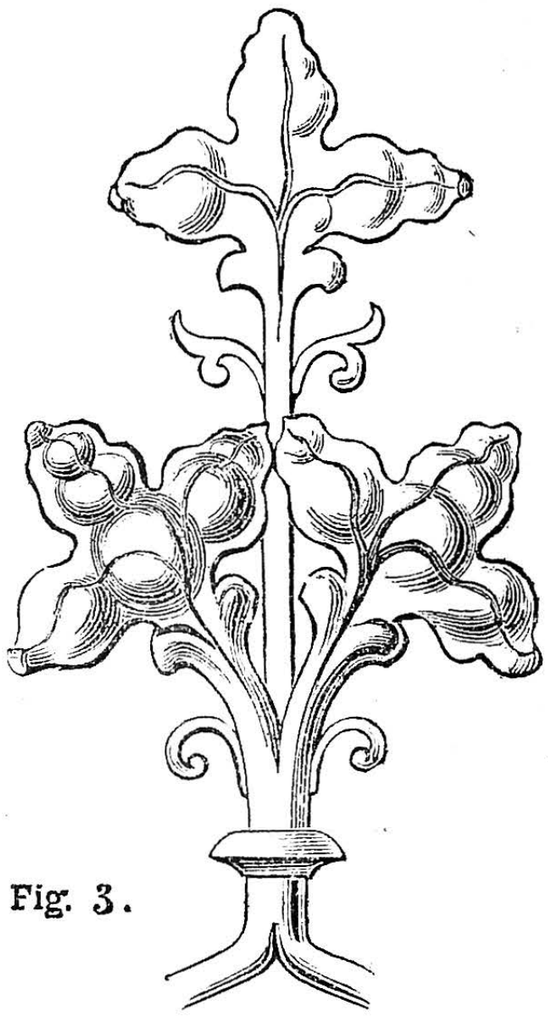


Fig. 3.

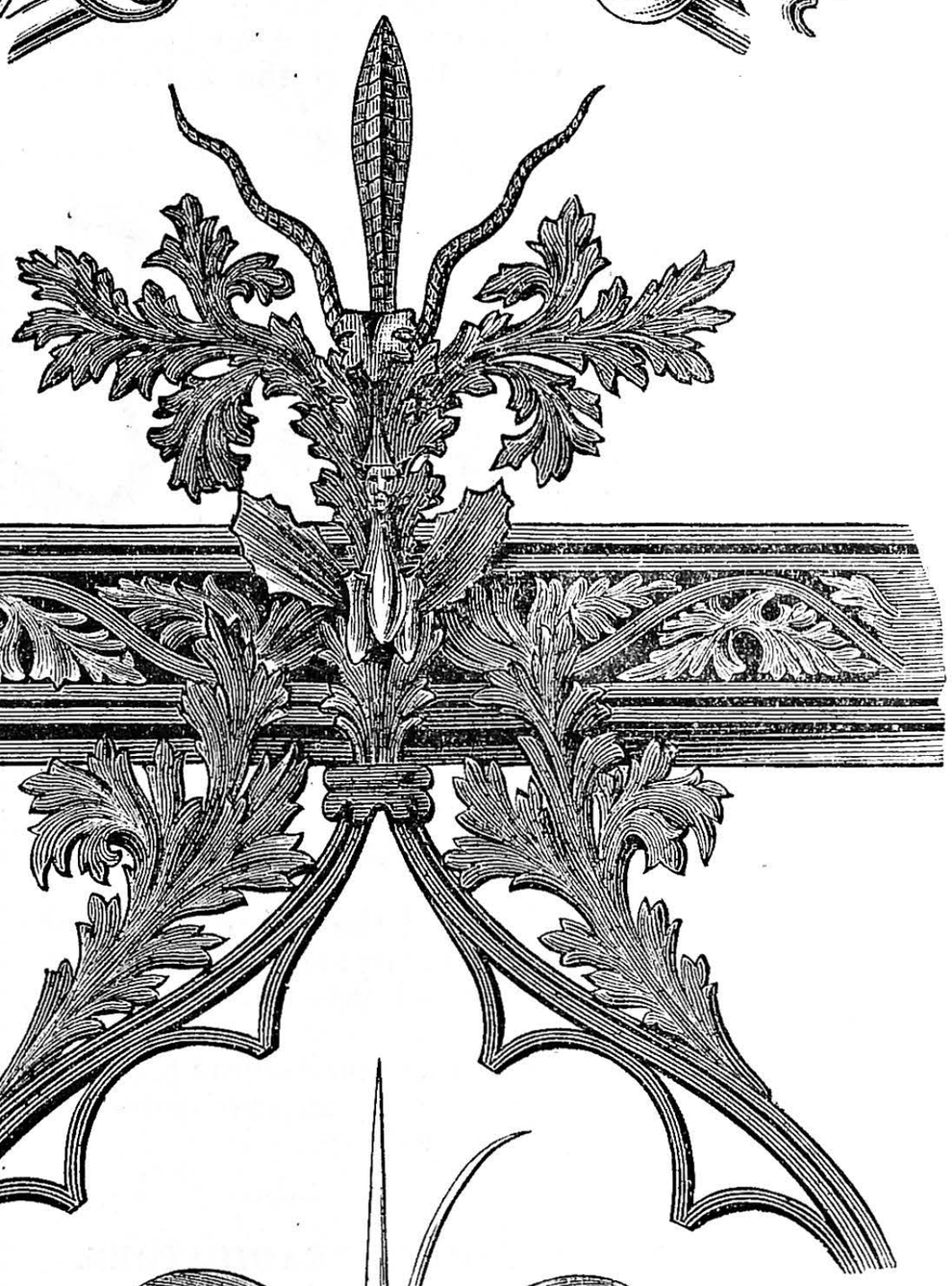


Fig. 1

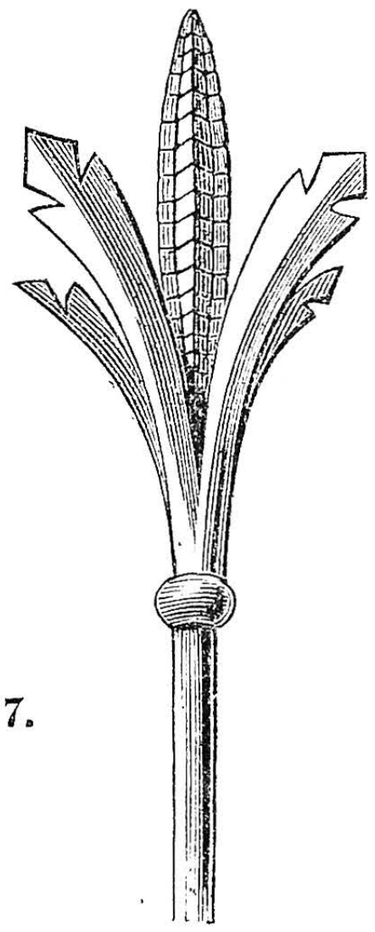


Fig. 7.

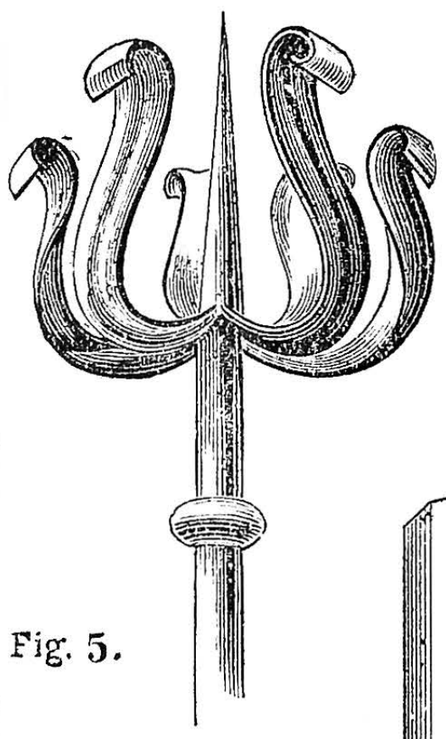


Fig. 5.

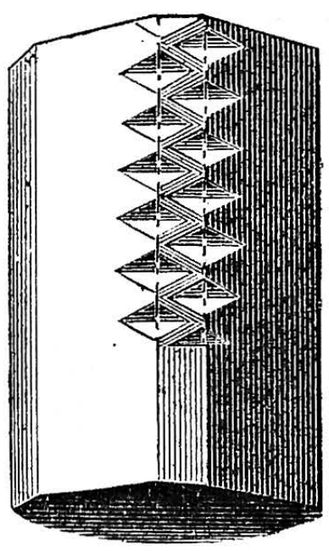


Fig. 10.

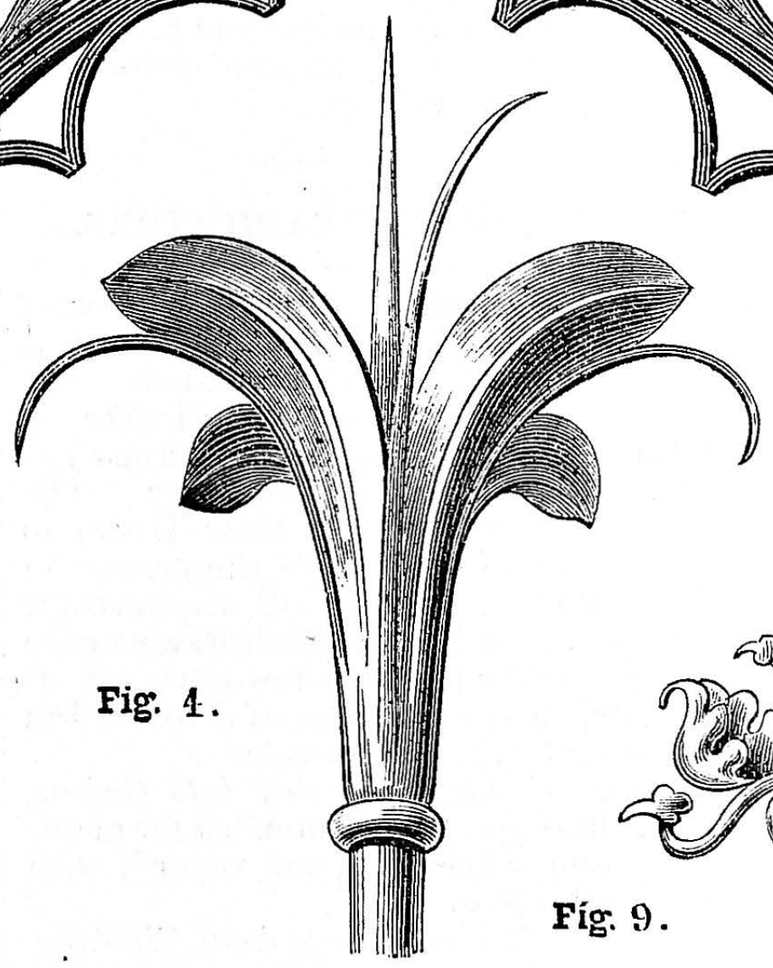


Fig. 4.

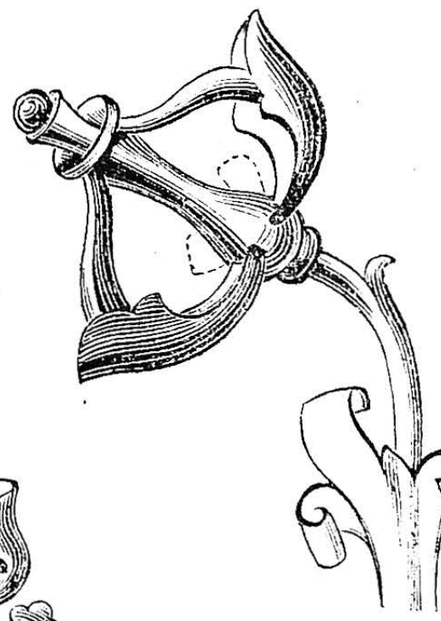


Fig. 8.

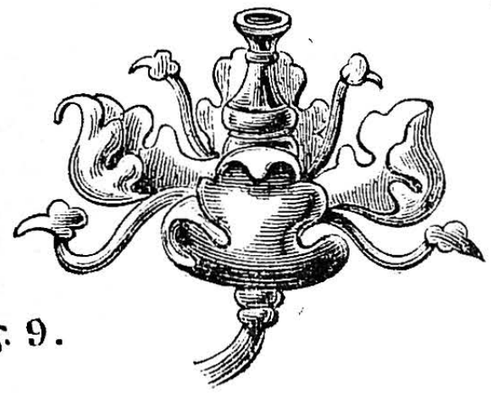


Fig. 9.

Old Spanish Hammered Iron. Figs. 1, 2, 3.—Crowns of Archways in Railings. Figs. 4, 6, 7, 8, 9.—Ornaments of Railings. Fig. 5.—Candlestick. Fig. 10.—Ornament on Shaft of Lectern; the Examples from the Cathedral of Santa Maria, Murcia. Fig. 11.—Murcian Street-Door Knocker.

SOME HINTS IN ART IRONWORK FROM OLD SPANISH EXAMPLES.

BY HIRAM PRICE.

THE OLD HAMMERED IRON OF SOUTHERN SPAIN—DESCRIPTION OF THE ILLUSTRATIONS.

The old Hammered Iron of Southern Spain.—To the art workman it is ever an advantage to make acquaintance with examples in his craft from new or unfamiliar sources. It enables him to infuse new blood, so to speak, into his work, and to keep his style from becoming mannered and uninteresting. The accompanying illustrations of old hammered iron cannot, therefore, be otherwise than acceptable. They are from the Spanish city of Murcia, which, it will be remembered, is in the south-east angle of the Peninsula, and out of the track of the ordinary tourist.

The cities of Southern Spain contain much interesting ancient ironwork, both within and without their buildings. The windows of old houses of the better class are each protected by a "*reja*," or projecting grating. These gratings are credited with having been made less as a safeguard against robbers than to prevent the Spanish damsels being carried off by their lovers without the paternal consent. The lower part of the *reja* is almost invariably decorated with grotesques in hammered iron.

Many doors, too, show fine work. Fig. 11 is the knocker of a Murcian street-door. This of course is late Renaissance—seventeenth-century work. And in addition to effective hinges, the studding of Spanish doors is often effective, the iron stud-nail forming the centre of a flower, which it attaches to the wood.

But it is in church interiors that the finest old work is to be found; and most of the examples given were sketched by me in the cathedral of Santa Maria, Murcia. Iron railings, which from their importance might almost be called screens, are made to separate the several chapels from the body of the building. Eight of the illustrations are from the ornamental parts of such railings. Without entering into precise dates—which would be useful to the antiquary, but not to the practical man—these examples may be said to belong to the later Gothic period and to that of the transition to the Renaissance.

Description of the Illustrations.—Fig. 1 is a rich example of the head of a gateway or entrance through railings to a side chapel. The grotesque animal in its centre is of much the same order as those found on the *rejas*. Fig. 3 crowns another entrance of a somewhat less ornate type. The part left unshaded in this is missing in the original, the restoration being a conjectural one of my own. Fig. 2 is the central part of another chapel entrance, exceedingly fine and effective, but in a later style. Figs. 4 and 7 are graceful iron finials from chapel railings. Figs. 6, 8, and 9 are also decorative parts of such railings. In Fig. 8 the flower has, in reality, four petals, but two have been omitted to avoid confusion. Fig. 5 is one of a row of iron candlesticks before the altar of one of the chapels in the same cathedral. Fig. 10 is from an iron lectern, also in Santa Maria. This lectern is supported by a square bar of iron, which would have looked out of keeping with the ornate foot and top but for the simple zig-zag ornament with which it has been enriched, made by taking off the right angle and cutting notches down the two obtuse angles thus formed. Of Fig. 11 mention has already been made. It is a knocker from the door of an old house in the city of Murcia, and is of more recent date than the other examples.

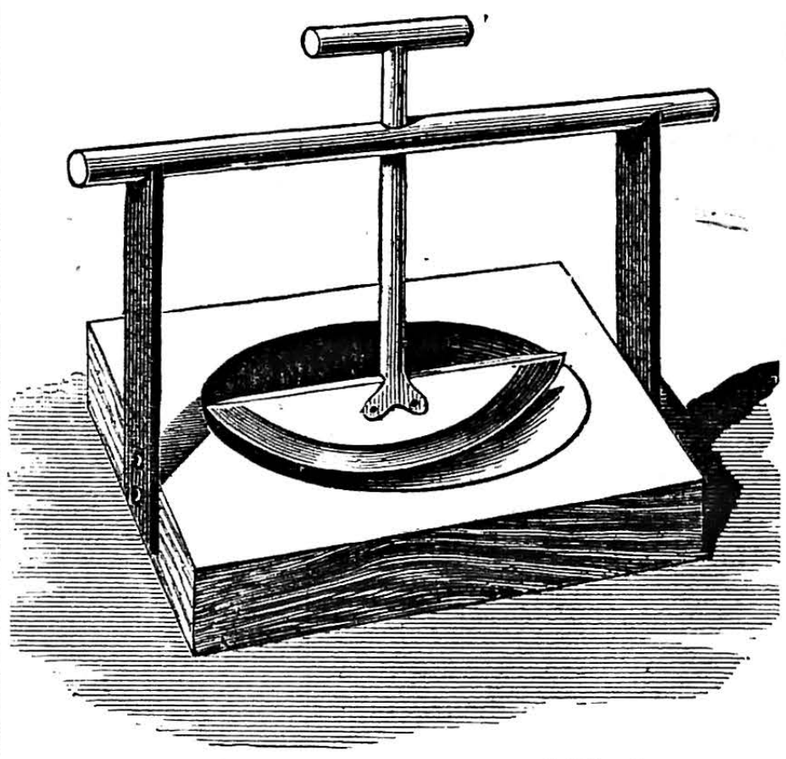
SUET AND HERB CHOPPER AND BLOCK.

BY J. C. K.

THIS was made to save time, and fingers from cuts, in a household where much of the food cooking was done by the farmer's wife. She prized it as being so useful that her small children could do chopping of suet and light easy-cutting herbs, as parsley and mint, without risk of fingers or spilling the cuttings from the chopping-block, the action of the knife being a driving and sloping cut in the hollow of the block.

The block, of 4 in. hornbeam (beech or lime will do nearly as well), is hollowed out three inches, forming a segment of a sphere in shape of hollow.

The chopper was a part of a broken hand-saw blade, curved at one edge like a cheese-knife, and sharpened to almost razor keenness. A ⅜ in. iron rod, 9 in. long, was riveted to this blade, and a large cross handle of wood was riveted on the top of the knife-rod. To keep the knife fairly



Suet and Herb Chopper and Block.

vertical in chopping, the rod passes loosely through a cross-piece framed to two uprights, notched and screwed into the sides of the chopping-block.

The illustration will make clear the whole of the utensil, so that anyone inclined to imitate it can easily do so.

GARDEN VERMIN ERADICATORS.

To protect Carnations from Wireworm.—Scrape out part of a potato and bury it close to the stem of the carnation. The wireworm prefers potato, and will take up his abode there, with all his numerous following. Destruction is then easy. The frost kills wireworms and their larvæ, so dig up to let the frost into the ground in winter. Another plan to kill wireworms is to sow the ground with crushed rape-cake before a shower; the wireworms eat it ravenously, and the rain causes it to swell in them, and kills them wholesale.

To prevent Maggots eating into Onions, etc.—Dig into the ground intended for planting, soot and wood ashes, and water it with ammoniacal liquor.

To prevent Broccoli Plants from Clubbing.—Dip the roots of each plant, before setting, into a mixture—a gallon of soot and 1 lb. of saltpetre, made into thick paint with water.

Another plan is to put into the ground with the plant a handful of sweepings of a farrier's shop; the hoof-parings prevent the attack of the grub.

To ensure a Crop of Turnips from the Fly.—The fly mostly only settles once, and that is only on the smooth leaf of turnips, seldom on the rough leaf to do harm. Soak half the seed to be sown in water over night; this will promote germination of the seed soaked; mix it with the dry seed in the morning with lime powder, copperas powder, or sulphur powder, and then sow. The earlier turnips will be taken by the fly, and the later growth will get into the rough leaf before the second visit of the fly, and pass unscathed.

To kill Wasps in their Nests.—In a wine bottle put a little turps, and pour it out, so as to leave only the fumes in it. Thrust this into their nest entrance; it will kill them. So will a tube of sulphur and gunpowder thrust in, and lighted when thrust in, and a turf put over it to keep the fumes in the hole. This stupefies those it does not kill, so that the nest may be dug out and the wasps killed.

To destroy Earwigs.—Earwigs may be destroyed easily. Get broad bean stalks, cut five or six inches long, and laid horizontally in the fruit trees they assail; blow them out of the hollow stalks into scalding water. A little moss in a small inverted flower-pot is a trap for them for dahlias.

To protect Flowers from Rabbits.—Dip some twigs or sticks in brimstone, and stick them in the ground round the flowers to be protected.

To extirpate Moles.—Strew the leaves of the elder in their runs; they will desert them. To kill moles—Get carbonate of barytes, put in a shallow pan, and some worms on it. When covered with it, lay the worms in the runs of the moles to eat; it will kill them.

LONDON FIRE-BRIGADE WORK.

BY HENRY FRITH.

PEOPLE who stand aside in amazement, and stare at or after the rushing fire-engine drawn by its powerful pair of horses, steaming furiously perhaps on its headlong way, do not see the work of the brigade. They see the engine, but do not see the machinery, the propelling power as it were, which sends forth the fire-engine thus fully equipped. Let us take a glance at the headquarters where Captain Simonds reigns supreme.

As the visitor enters the establishment in Southwark Bridge Road he perceives two fire-engines: one is a steamer, and is never permitted to get cold; the other is one of the ordinary type of manual, and around both are firemen busy, in "stable dress," polishing and rubbing the brass-work, etc. Everything on the extensive premises is beautifully clean, and we are certain that no "personage" will here find any mischief for the hands to do. Close by the entrance are the office and ante-room furnished with telephonic apparatus from the several districts. But scarce a sound disturbs the silence as we pass on to witness the inner life of the brigade on duty.

Someone may imagine that when the fireman is not engaged in extinguishing fire he is enjoying himself, pipe in mouth, but this is far from being the case. There is plenty to do. There are engines to be repaired, and service engines and surplus engines to be inspected. There are boilers to be tested, and many smiths, carpenters, etc., are daily employed in these repairs and in painting.

Everyone is busy, yet everyone is alert for duty if necessary. In the model stables we perceive the same condition of preparation. Horses stand

facing the door—not the manger—and wearing collars suspended over the neck, the harness is thus held up by a weight which the alarm bell releases. In a second the animal is ready, his halter drops, he trots out to the entrance, is harnessed to the engine, the great doors fold back at the same moment, the coachman, who has come in with his horses, pulls a rope which hangs over his driving seat, the street portals fly open, and the engine starts. This business is so rapidly performed, that on the occasion on which the writer was present, less than thirty seconds was sufficient to get all into order and ready to go.

As in other properly organised corps, there are recruits to be drilled, and practice to be attended to. The recruits are drilled from 9 a.m. until noon, and from 2 until 4 p.m. The drill consists in learning how to perform the duties which the men will have to become perfectly proficient in before they are permitted to be enrolled in the ranks as attendants on fires.

For instance, they must learn the manner in which ladders and the escapes are put upon the wagons for conveyance to the scene of the conflagration. The escape or ladder must be properly placed in position, and as there is a wrong way as well as a right way, the latter must be learned. Mounting and rescue drills also form important portions of the work to be learned and performed, but as every fireman is first a sailor, he already is naturally active, handy, and self-reliant.

Rescue is performed by means of a "dummy" figure, and with this heavy burden the recruit descends the escape, sending the rescued man head downwards into the receiving netting. A rescued man is carried differently from a rescued woman, the latter being grasped below both knees when carried on the shoulder, but when placed head first in the net the rescuer descends with her, holding her dress round the ankles. So the female comes down quietly, her swift progress being retarded by the fireman. The manner in which the men tumble into the escape and check themselves in mid-career when burthened with a body is something wonderful to witness.

This is not the only practice which has to be gone through. The other day we all read in the papers how two firemen leaped out of a window at a great height from the ground, and alighted without any injury. This was the result of practice, and of knowing how to jump. At the head-quarters the men are taught the "jumping drill." They leap from the windows into a sheet, or in some cases, perhaps, to the ground, without injury. By constant practice they are enabled to fall without any serious effects.

To see the men perform all these feats, to watch them proceeding steadily along a narrow parapet carrying a dummy representative of a man without fear or giddiness, to see them save the rescued one by the escape even in practice is astonishing. Much more surprising is it to watch them working at a fire, where to all appearance they are as cool and collected as at the head-quarters of the brigade upon a sunny afternoon.

The manner in which the men run, climb, and swing as actively as monkeys is owing to their training as sailors, and to the deft management of a hook which every man carries on duty. This implement, with a swivel-catch, supports the fireman, thus permitting him to use both hands in assisting the threatened inmates of a burning dwelling. What the caudal appendage is to the ape the hook is to the fireman on duty.

It will be perceived that the fireman at head-quarters has little leisure, and we understand that the members of the brigade are always supposed to be on duty save and except during their short holidays. At night as well as by day the men are always on the alert, and when the "call" comes they snatch coats and helmets from their pegs, leap on the engine, and only asking one question, "Where is it?" the coachman dashes out into the streets. We all know how the tide of traffic rolls back to permit the engines to pass; and when their work is done the men return drenched, scorched, weary, half-blinded by heat and smoke, or perchance wounded and bruised by fragments or stone walls.

Some, alas! never return. Go and look within yonder room in Old Winchester House, whose once famed precincts rang with revelry, and eke with strife. Proceed upstairs, and peep into yonder cupboard, and there you shall find some relics of those brave men who have sealed their devotion by the hands of death.

Remains! Yes; only remains indeed! relics: fragments, charred and blackened by fire and smoke, are all that rest here or elsewhere of many brave men who have died on duty. Here is a helmet, here on a pad a few fragments of a uniform, all that remains of a man and his dress; here a hose-nozzle, here a spanner, etc.: no more, save an inscription recording briefly the name of the deceased and the service he was performing when he died.

* * * * *

Thus the work of many men is ended. They pass to dust suddenly amid the roar of the flames, the rushing of the water, and the crash of falling buildings! Ashes to ashes! Let us pass on.

The fireman's work is over; he has quitted his brigade full of honour. He has done his duty. From recruit—one of 707 devoted men—he had kept watch twelve hours daily; he had polished his engine and repaired it—one of 158 in use; he had dragged miles of hose; attended telephone calls to numerous fires. He had been promoted, had wedded, had lived respected, self-respecting, in the brigade buildings, had saved many lives, and had been killed on duty at the last. His work is done: he obeyed orders—

His not to reason why;
His but to do or die,—
Into the valley of death,
Rode the men onward!

A few statistics will fitly conclude our brief sketch, as illustrating the work of the brigade. In the year 1891 the calls received were 4,164 (about one-fourth of these were false alarms); 2,892 were calls for fires of which 193 resulted in serious damage, and all of them necessitated the attendance of members of the brigade. This account shows an increase on the previous year of 337.

Sixty persons were burned out of a total of 268 endangered. Eleven men of various grades in the brigade have been commended for special merit in saving life, and one of them was also the recipient of a medal. The total distance run has been 65,800 miles, and 84,000 tons of water has been expended in extinguishing the fires.

Four hundred and fifty men are kept on watch every twenty-four hours in the metropolis, of whom 325 are on night duty. Numerous cases of accident and illness were reported, and in addition to attending fires the brigade has kept 164,250 watches of twelve hours each, has made 35,922 hydrant inspections, and 84,662 fire-plug tablet inspections, besides maintaining all the machinery and appliances in order, and written thousands of reports. There are 55 land fire-engines, 4 river stations, 9 steamers on barges, 47 land "steamers," 78 "manuals," and 17 under-six-inch engines; besides barges, tugs, skiffs, fire escapes, miles of hose, hundreds of call-points, alarm-circuits, and telephones, telegraphs, and bells to attend to; ladders, vans, and trucks.

Who cannot find a word of praise for the men who do all this important and varied work almost unrecognised by the public?

TOOLS AND MACHINES.

We have received from Messrs. Melhuish, Son, and Co., the well-known tool merchants, two volumes of catalogues got up in excellent style. One volume is devoted to cabinet and brass-foundry fitments, and forms Messrs. Melhuish's latest list of patented inventions and selected patterns of superior quality for the use of builders, ironmongers, cabinet-makers, etc. The other volume, price 1s. 4d., contains 800 illustrations of labour-saving tools and machines for woodworkers—among which we observe those specialities the Excelsior and Windsor Tool cabinets. All who can should get these volumes.

SCIENCE TO DATE.

Electro-deposition of Nickel.—The following is a good process for obtaining a white, soft, and homogeneous deposit of nickel:—1,000 grams of pure nickel sulphate, 700 grams of neutral tartrate of ammonia, 5 grams of gallic acid, are made into a solution with 20 litres of water. The neutral tartrate of ammonia is obtained by the saturation of ammonia by a solution of tartaric acid. The nickel salt should be neutral. The whole is first dissolved in 3 or 4 litres of water, boiled for about half an hour, and then diluted to 20 litres after filtering. Only a weak current is required.

Transmission of Power by Electricity.—The industrial importance of the new high tension currents is well brought out by the following calculation. Thus admitting that the transmission of force can be accomplished for a tension of 130,000 volts, then 50 horse-power could be transmitted across the ocean by a wire 2½ millimetres in diameter with a loss of 2 horse-power only.

Coco-de-mer.—There is now growing at Kew a young "double cocoa-nut palm" or coco-de-mer. The plant is a native of the Seychelles, and is very rarely seen in cultivation, for the germination of the double cocoa-nut occupies two years, and then it grows but slowly. The trunk of the adult tree reaches a height of nearly 100 ft., but it is only 1 ft. in diameter. The fruits average 40 lb. in weight, and each contains two or three large nuts in a thick, fibrous husk.

Artificial Formation of Globular Lightning.—Von Lepel has been making experiments on the artificial formation of globular lightning by means of static electricity. Two small copper wires are led from a powerful induction machine, and their terminals placed at a certain distance from the opposite faces of a plate of mica, ebonite, or glass. If now the machine is set in action, "small luminous red balls will be seen moving here and there, at times slowly, at others rapidly, and sometimes in a stationary position." The phenomenon is apparently dependent on weak tension electricity, for if the tension is increased it disappears, and the spark of an ordinary discharge is produced.

NOTES FOR WORKERS.

THE first railway made and controlled entirely by natives is being laid down in India, between Tarkeshvar, in the Hooghly district, and Mugra, a distance of about thirty miles.

THE American Society of Civil Engineers has selected next October 12 for the adoption of twenty-four-hour time on the railways of Canada and the United States.

MANGANIN—an alloy of copper, nickel, and manganese—has a very high electric specific resistance, being 0·42 ohm per centimetre, and is used largely in Germany for resistance coils.

JAPAN already possesses two modern cruisers of about 18 knots, one about 19, and three of 16 knots, and a torpedo gun-vessel of 22 knots per hour.

COAL has been discovered in the Port Curtis district of Queensland, Australia.

THE extreme distance at which the Eddystone light is visible from a ship's deck on a clear night is said to be 17½ miles. The lantern is 180 ft. above water level at high tide.

THE French smokeless powder is much more bulky than the English.

AN alloy of 95 parts of tin and 5 parts of copper is recommended for connecting metals with glass. It adheres strongly to glass, and its rate of expansion is nearly the same. It can also be used for coating metals to give them a silvery appearance. It is made by pouring copper into molten tin, and one-half to one per cent. of lead or zinc added will make it more or less easily fusible.

VEGETABLE fibre is used in Germany instead of animal wool. Two establishments near Breslau convert pine leaves into wool, flannels, and blankets. The latter are exclusively used in the hospitals, barracks, and prisons of Vienna and Breslau. Vegetable fibre clothing, etc., keep the body warm, and is vermin-proof.

PARAFFIN is found to be a good solvent for camphor. When required for use, it is warmed, and forms a clear and limpid solution which keeps well.

TRADE: PRESENT AND FUTURE.

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

TIMBER TRADE.—The timber trade in Durham county is steady, and there is now a much increasing demand for mining timber and pit props. Imports are rather less, and the stocks at West Hartlepool are being drawn upon. Prices are, on the whole, maintained firmly.

IRON AND STEEL TRADES.—The depression which has been experienced in all classes of railway material is at an end. We hear of considerable inquiries which should result in a greater demand for labour, and, perhaps, lead to an increase in the price. Many Sheffield manufacturers say that they have done more business during the first six months of the year than in the corresponding period of 1891. Inquiries are being actively made by the Government for large quantities of shell shot and piercing shot of various sizes. A fairly good turnover is taking place in the heavy iron trades.

BUILDING TRADE.—The building trade in Durham county is still brisk, and now that bricks can be obtained, works which had been stopped are being restarted. In the Newcastle district building operations are very active. In Rochdale and district the building trade continues in a fairly prosperous condition, work being plentiful and likely to be so for some time to come.

COTTON AND FLANNEL TRADES.—The condition of these does not improve in the least—in fact, in some places trade gets worse. Some people expect an improvement after the General Election. This is doubtful.

SHIPBUILDING TRADE.—On the Mersey there is no brightening of the prospect in the shipbuilding and engineering trades; general ironfounders are moderately busy.

COAL TRADE.—Steam coal is in large request, and manufacturing coal finds a ready sale at from 5s. to 5s. 6d. per ton. The house coal trade is weak, but prices have not fallen lower. Our Liverpool correspondent writes:—Owing to large stocks in Liverpool, prices in the export and ship coal trade are diminished. The present price, delivered at Garston Docks or on the High Level Railway, is 8s. 6d. to 9s. per ton for steam coal.

SILVER TRADE.—In the silver trades of Sheffield there is little change. Travellers from France bring back few orders. Usually a good trade is done in Paris from about this time until just before Christmas in wares made of Britannia metal, and which are designed and finished as a special line for the French markets.

TIN-PLATE TRADE.—Tin plates are delivered in Liverpool for exportation at the following prices: IC cokes, BV grade, 14 × 20, 12s. per box, best quality, 13s.; ICW, 12s. 3d.; IC charcoal, common, 15s. 6d., best, 17s. 6d.; black plates, 14 × 20, Bessemer, 9s.; best Siemens, 9s. 3d.; terne plates, 12s.; crystallised, £1 9s. 6d.; crystallised and decorated, £1 12s. One of the large tin-plate makers has gone out to America to build a mill there, and workmen from New South Wales have also gone. The tariff on tin plates being prohibitive, it has almost, if not quite, ceased to be an article of exportation to the United States. Makers of tin plates have been warned that Russians are in England with letters of introduction to makers to spy out the process of manufacturing tin plates from tinned blocks, the Russians having failed to do it.

CUTLERY TRADE.—This is very depressed in Sheffield. The Spanish houses are now closed to this country, owing to the new tariff, which came into force on the 1st of July. For months Sheffield manufacturers have been engaged in exporting goods into Spain and Portugal in quantities, and, in consequence, the trade with those countries will be paralysed for years in many branches of industry.

ENGINEERING TRADE.—No improvement can as yet be reported in the condition of the general engineering industries of the Lancashire districts, although one or two firms engaged on work of a special character are fairly busy. Machine tool makers are keenly competing for the few orders that are being placed; while stationary engine builders report a decidedly increasing slackness all round. Boiler makers are also now loudly complaining of absence of trade, while locomotive builders are but little better circumstanced. The Mersey shipbuilding trade shows no signs of returning activity, but in the Barrow district both shipbuilders and engineers are busy, and the former expect several new orders to be placed shortly. The iron market is in a state easily affected by outside influences, and the Parliamentary elections are having an appreciable effect upon business. It is generally considered that, although manufacturers of finished iron are working actually at a loss, prices will further decline, so that the present outlook is most discouraging. The steel trade continues quiet, and business in the metal market is also very unsettled.

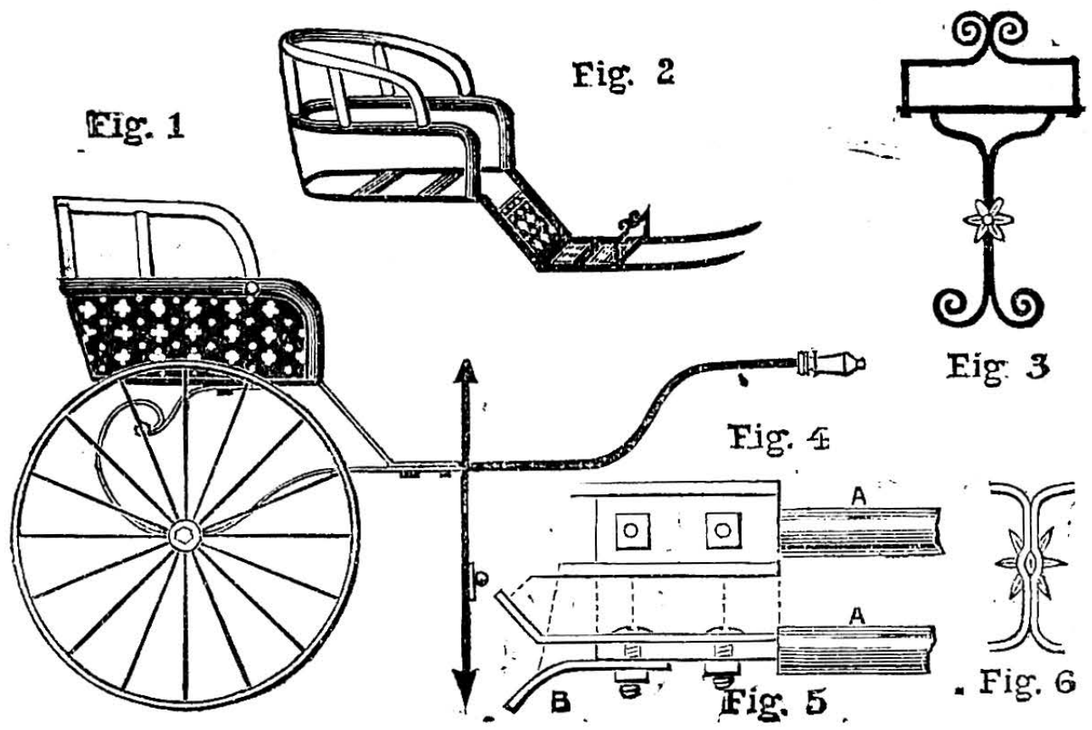
SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

I.—LETTERS FROM CORRESPONDENTS.

Metal Mail Cart.—S. P. (*Plymouth*) writes:—"Having taken WORK for some time, and seeing some readers inquiring for a design for mail cart, I take the opportunity of giving a design similar to one I have made for my child to ride. In the first place, I have made it without a particle of wood in it—the materials being steel, iron, brass, zinc, and plush. I am not a draughtsman, but you will be able to reproduce the design. Fig. 1 shows the side elevation, the body being covered with perforated zinc, and the top edge covered with crimson plush to prevent the child's clothes being torn by rough edges of zinc. At the top I have made a brass rail ⅝ in. diameter, and polished, with uprights. The wheels and spring I took from my perambulator, while the shafts are made with ¼ in. iron pipe, with china handles, the same as those used for coal shovels. Fig. 2 shows how to fix the battens for cushion, and also foot-rest. Fig. 3 shows the front leg and rail, also the brass star. Figs. 4 and 5 show how to fix the shafts to foot-rest; while Fig. 6 indicates the method of fixing the brass star with brass knob and nut."



Metal Mail Cart. Fig. 1.—Side Elevation. Fig. 2.—Method of fixing Battens for Seat, Foot, and Brass Rail. Fig. 3.—Front Leg and Rail and Brass Star. Figs. 4 and 5.—How to fix Handle to Foot-Rest. Fig. 6.—How to fix Brass Star with Brass Knob and Nut.

Manitoba and Emigrants.—H. A. H., M.D. (*Wawanesa, Manitoba*) writes:—"In No. 163 of WORK you publish a communication from a correspondent on the advantages of Manitoba. As a resident of that country for the last seven years, please allow me to give my views with regard to Manitoba for the benefit of intending emigrants. In the first place, there is no occupation in the country *but farming*. In November we 'freeze up,' and this 'freeze up' continues to the first week in April. The bricklayer, stonemason, and plasterer has to hibernate. If he has a farm, he cannot work at his trade and farm in the summer, and must have hired labour, which is very expensive—25 dols. to 30 dols. per month, with board. In the winter all farming operations are stopped, and the farmer is occupied in hauling out his grain to market and collecting wood to keep himself from freezing, often having to go ten, fifteen, or twenty miles, with a thermometer from 25° to 40° Fahr. below zero, and not infrequently is caught by an 'amiable blizzard.' Carpenters may get work all the year round; but I have seen carpenters working with nails heated too hot to hold, and with heavy buckskin mitts on. Work under such circumstances is too frequently scamped. If holding a farm, the same objections apply to him as to the bricklayer. Besides, out here we have the 'handy man' *ad nauseam*. Every man with a steel square, hammer and axe is a carpenter, and if he possess a jack-plane and saw, he sets up as a 'cabinet-maker.' When I first came here I was pestered by men to build my house whom I afterwards found out had never learnt the rudiments of their trade, and on full investigation were only 'handy men.' Fortunately, my hobby has been carpentry, and I soon detected the genuine from the spurious article, and got an old country carpenter to help me. The skilled carpenter has to contend with these handy men, and as the farmers are, as a rule, poor men, with heavily mortgaged farms, the skilled mechanic is nowhere. Blacksmiths do well, as a rule, but they must learn to adapt themselves to the wants of the country; they, too, suffer from the inroads of the handy man. In the machine shops of Canada—and to some extent this is true of the States—the skilled mechanic is scarcely needed. The machinery is put together in the roughest manner; any man who can use a file and rub off the burrs of the sand mould takes the place of the skilled mechanic. Articles are not painted, but dipped in coloured solutions and allowed to drain. A good deal of the furniture is simply dipped in cheap varnish and allowed to drain, as before stated. French polishing is unknown. As the manufacturers are protected by heavy import duties, there is no incentive to produce good work. The wage of the 'handy man' is that of the skilled workman. The cost of living in the towns is very high; a small wooden house costs 15 dols. per month rent, payable, when it can be got, in advance. A decent suit of clothes costs from 20 dols. to 30 dols. Everything except goods imported at a high tariff rate is of the shoddy type. And here let me enter a *caveat* against English manufacturers. Owing to the high import duties, only the third-rate articles of the manufacturers are imported, and these are charged at a high rate, and put forward as 'English goods.' The one-horse Canadian manufacturer produces something a shade better, and shouts that he 'downs the English manufacturer.' We get the tools generally found in country ironmongers' for amateur use palmed off as the perfection of English manufacture. I have heard it said in large wholesale places in London, 'Oh, that will do for the colonies; that is good enough for them.' This is a mistake. There are Old Country men in the colonies who do know a good article when they see it, and they suffer a severe mortification when they see poor goods palmed off as the finest productions of the dear Old Country. My parting advice to the skilled mechanic is to stay where he is and produce his very best; it is God's work, not his, that he is about. In spite of high tariffs, those who can afford them will buy English goods."—[Thank you for your letter and cuttings.—ED.]

Workmen's Holidays.—N. M. (*Sheffield*) writes:—"Working men have from time to time been roundly lectured from the pulpit, from the platform, and by the press for the persistency of their offerings at the shrine of their god, Football. Parsons, pressmen, and politicians alike have had their fling at them; but still their words are as though they had never been spoken. What is to be done? Do our workers ever think of the injury they are doing their wives and little ones, their employers, and trade of old England? No. We are inclined to think they have never thought of the question at all, but have been going on from day to day as though their periodical absences from work were to be taken as a matter of course, to say nothing of the personal loss of time—which means money—and the consequent inconvenience which arises through the absentee's neglect, whereby several pairs of hands are thrown idle through the fault of the footballer. In a large town in the north of England, which boasts of one of the finest football and cricket grounds in the kingdom, it is not uncommon for a gathering at an ordinary match to number 20,000 persons, *mostly working men;* and at a first class 'final' match the spectators may be increased to 30,000. Each afternoon it has been calculated to cost a working man *three shillings and sixpence* (and this at a low estimate) for the afternoon's pleasure, or an average loss of £3,000 in work undone which should have been done. Could not these matches be confined to Thursday and Saturday afternoons, or so arranged to take place in the evening? In these days of electricity darkness is made light, and the extra outlay of capital would be amply remunerated by the increased number of spectators. Something must be done to keep the trade of the country together."—["Shop" is a section of WORK open to all readers alike, therefore insertion is given to your letter. It does not follow, however, that we agree with all the views you express. "All work and no play," etc.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Patents.—S. R. (*Withington*).—When will the public understand that in granting a patent neither the Office nor the law in any way guarantees the validity of the patent, but simply grants one in response to the declaration of the applicant that he is the "true and first inventor," and that the same "is not in use to the best of his knowledge and belief?" An applicant for a patent is assumed to know and have clearly ascertained *whether* he is

the "true and first inventor" *before* he makes the application, and it has been laid down in the Law Courts by Lord Cairns that "every specification must be read as though the patentee had a knowledge of every previous complete and published specification of earlier letters patent." In England there is no power of refusing a patent so long as the regulations are complied with, except it be in the case of something extremely ridiculous, immoral, or judged to be prejudicial to public interests. The fact is that a patent is granted to the applicant on the strength of his declaration and statement and his compliance with the rules of the Office; so that, instead of its requiring wondrous ability to obtain the grant of a patent, any person who complies with the rules is almost quite sure to get one granted. But what such a thing is worth when it is obtained is *quite another thing*, its value not being decided by the fact of the grant, nor the grant even creating it a property. It is one thing—and an easy one—to get a patent; but it is quite another to *create* a property, and obtain a valid and sound patent which the law will support. When people can realise this great fact, we shall probably be less annoyed with the constant re-patenting of old inventions, and the creation of an increasing mass of "waste paper," which is daily proceeding at such a rate, as they will then have realised the ridiculous folly of inexperienced persons of any kind meddling in matters of which they know nothing, and which require skill, education, and experience on the part of those who undertake this kind of work. With these remarks we will proceed to reply to the questions of our correspondent. (1) None whatever. Only examines the documents to see if rules are complied with. (2) None at all. It is not their duty to do so. The applicant is assumed to have done all this before he applies. (3) As this is not done, there is no need to further remark on this question. (4) You are quite right in your supposition, which is the actual fact of the case. But the grant is, as before shown, made to you on *your* statement and application. If that is *untrue*, and you have ample means of ascertaining whether it is or not before making application, there is no one to be blamed but *yourself*. If it were otherwise, there would be no end of a row, and everyone refused would be considering himself an injured party, and the victim of some spite, ignorance, or prejudice. If our correspondent will refer to the article on Patents in WORK, No. 44, Vol. I., p. 694, to the replies in No. 136, Vol. III., p. 508, and also in No. 151, Vol. III., p. 749, and read and study the same, he will probably derive some benefit, and increase his knowledge on patent matters, and possibly be aided in avoiding many of the rocks on which so many inventors and intending patentees are so constantly landed.—C. E.

Designs.—J. W. (*Dublin*).—"Metal Work, and its Artistic Design," by M. Digby Wyatt, published by Day & Son, Lincoln's Inn Fields; it is probably out of print, but you can get a second-hand copy sometimes for about 35s.—J.

Foreign Competition. — MARKWELL.—Thanks for your letter and suggestions. The workers of the country cannot be too well informed upon these vital questions. We cannot, however, throw our columns open to correspondence thereupon. Controversialists must go to larger papers with smaller circulations than ours.—ED.

Battery.—A. H. (*Manchester*).—You will find that two or three bichromate or chromic acid cells, in series, will drive the model motor in WORK, Vol. III., No. 154, very well indeed. These cells have been given in "Shop" many times. As to your second question, if you number the binding screws from 1 to 4, making 1 and 2 from the magnet and 3 and 4 from the brushes, then if you connect your battery up to 1 and 4, and connect 2 and 3 together by a short piece of copper wire, you will have your model driven in series. If you will look up what has already appeared upon batteries in WORK, you will find connections fully explained. For your last question, when winding the magnet keep the wire even on the two arms and on the inside of the bend, making each coil radiate towards the outside; it will make no difference to the working if they do—as they must—go between each other on the outside of the curve.—J. B.

Gymnasia. — AJAX. — This subject shall be treated.

Lenses for Stereoscopes.—J. T. N. (*Dundee*).—Try Caplatzi, Chenies Street, Tottenham Court Road, who advertises in WORK.

Sharpening Plane Irons.—J. (*Whitehouse*).—Watch "Shop" for report upon this.

Flush Pipe.—J. M. (*Liverpool*).—Your letter has been forwarded to our specialist.

Bookcase.—CARDIFF BOY.—All your questions may be answered by a visit to a neighbouring cabinet brass-founder, as you apparently are fully acquainted with the manner in which all the parts work, excepting the catches. I should advise you to take a rough sketch with you. If you cannot succeed, write and tell us. Consult the French polishing articles in WORK.—J. S.

Steam Engine.—S. A. (*Oldham*).—You have not given me many dimensions, and have shown no exhaust-pipe. I have made a scaled drawing on the basis of your leading dimensions, and have put the exhaust branch on the top of the cylinder, where it also comes easiest for moulding. In Fig. 1, A is the sectional half plan of casting, taken through steam chest and passage; B is a sectional half plan of pattern, taken through centre; C is a half cross section decline of casting, taken through exhaust; D is a half cross section of pattern on the same line. A and C are self-explanatory; B and D I will explain; E is the cylinder body, jointed and dowelled on the line, F F. The flanges, G, are let into turned recesses in E. The print, H, is turned in one with the body, E, and smaller than the bored hole by the amount necessary for boring, say ⅛ in., in this case. The passage block, J, is fitted to the sweep of the cylinder between the flanges, the steam-chest block, K, is screwed upon it, and the flange, L, with the steam-chest print, M, screwed to it is *dowelled* upon J. The pattern, therefore, moulds with the print M downwards, in the direction of the arrow. The exhaust branch, N, with its flange, N′, and a print corresponding with the hole, O, the print being indicated by dotted lines, P, is next fitted to the centre of the cylinder, in the position of A in plan. The foot, R, jointed in the middle line, F, is connected by the rib, S, to the cylinder body, and to the flanges, G, by the brackets, T. The timber shading will render the arrangement of the stuff clear. We now come to the cue boxes. Fig. 2 shows the box used for taking out the hole in the steam chest. It fits into the print, M, in Fig. 1, and carries on its bottom board, A, the three prints, *a*, *a*, *a*, which take the passage and exhaust cues. The guide straps, *b*, *b*, for the slide-valve are put in this box. The method of framing the sides and ends together is that which is best adopted. Fig. 3 is the steam-passage box; *a* is the thickness which enters the print in Fig. 2. The opposite end is curved to fit the body cue of the cylinder, for which, of course, no box is required, the moulder using one of his standard boxes for that. Fig. 4 shows one-half the exhaust box; *a* corresponds with the print thickness in Fig. 2; and *b* with that in Fig. 1, P; *c* is the centre line of the steam chest; *d*, that of the longitudinal axles of the cylinder; *e*, *e* are dowels. If you want to know more, ask again.—J.

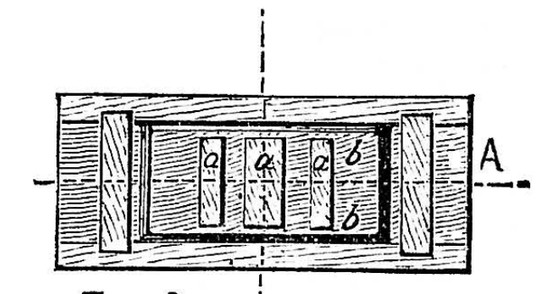


Fig 2

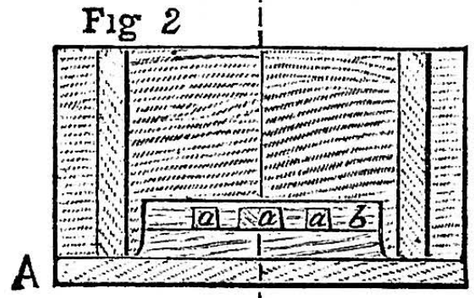


Fig 3

Fig 4

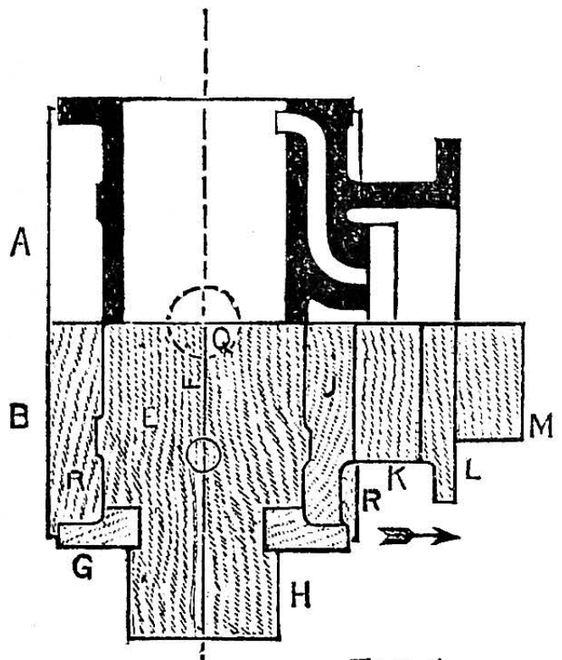


Fig 1

Fig 1A

Steam Engine. Fig. 1.—A, Sectional Half Plan of Casting; B, Sectional Half Plan of Pattern; C, Half Cross Section of Casting; D, Half Cross Section of Pattern. Fig. 2.—Box for taking out Hole. Fig. 3.—Steam-Passage Box. Fig. 4.—One-half of Exhaust Box.

Unprotected Idea.—A. F. (*Ovenden*).—Our correspondent, it seems, has an "idea" which he has not "worked out," and does not appear to know whether it is novel, whether it can be made practical, or whether it is the subject-matter of a patent. In his present condition he is in no position to treat with anyone, inasmuch as he has nothing to treat with. People are not so ready to take up "ideas" unless there is some proof that they either are or can be made of some commercial value. The only course open to him is to work it out in a drawing, and then see what the result is. If it is sufficiently clear, then he should make a model so as to give practical proof, after which he should ascertain what has been done before on the subject, so as to decide what is new, and what he may do without interfering with others. Then he will be in the position to treat with someone who will find the means to obtain a patent; but here he will be in great difficulty as to finding someone who will not take advantage of his unprotected state. As to having a model made—not being able to do it himself—he should employ someone to do it who will fully understand that it is a secret intended to be patented; which, if such party were to take advantage of the information, and he could prove it, the law would very soon settle such person.—C. E.

Wire.—TIMA.—If you refer to page 55 in the third volume of WORK (issue for April 11, 1891), you will find a paper dealing with wire gauges, having annexed two drawings of those test appliances. This will be all you need, as one of the sketches illustrates a gauge denoting the diameters of the very thinnest of wire. It may be well to say, in view of the possibility of your needing the information, that the parallel openings, and not the round holes, in the shaded gauge indicate the diameters of the wire.—J. S.

Incubator.—G. M. (*Sunderland*).—Thermometers can be obtained of Mr. Stephenson, who advertised in No. 149 of WORK, price 3s. 6d. post free. The evaporating tray should be nearly full of water, level with the top of the overflow pipe (see illustrations on p. 610, No. 143, Vol. III.). The sides of case should not be "very moist" when working. If this is so, the embryo chicks would most probably be drowned. As I have before stated more than once, ordinary thermometers will not do. To go to work with improper appliances is only to court failure. Judging from your letter, insufficient heat seems to be your trouble.—LEGHORN.

Home Arts.—D. T. G. (*Holyhead*).—The Home Arts and Industries Association held an exhibition lately at the Albert Hall, South Kensington. The exhibits included wood-carving, metal and leather work, pottery, and embroideries. All information can be obtained from the Exhibition Secretary, Home Arts and Industries Association, Royal Albert Hall.—J. N.

Registration. — BRUSH. — In reply to our correspondent, the name he mentions to us could not be registered, as it would be held to be "descriptive," not "distinctive." As the article is patented, he is—if the patent is properly drawn, and the claims carefully and clearly made — sufficiently protected in his rights. If he marks the articles he makes "Patent," and applies the word mentioned with his own name following, it will do all he wants, and he will be safe from all except such unprincipled scamps as care nothing for right or wrong so long as they can gain anything. As there appears to be one individual only to carry on the business, it would be impossible to register it as proposed; but there is nothing at all to prevent our correspondent carrying it on as proposed without registration.—C. E.

Incubator.—J. T. (*Biggleswade*).—If the heat in machine is 105°, and the thermometer registers only 93°, it stands to reason that the latter is wrong. But how do you know the heat inside is 105°? If you are testing it with another thermometer, see that both bulbs are on the same level. Having the scale outside should make no difference in the reading, so that if you have 105° inside, your scale should show it.—LEGHORN.

Incubator. — INCUBATOR. — It is a bad job if "solder won't stick" to tin; but why use tin? If you get a flue and pan made by a coppersmith, and the joints properly turned up and sweated, soft soldering will be sufficient, especially if you use my new arrangement for water supply.—LEGHORN.

Electro-Motors.—ELECTRIC TYRO. — Your request for the theory of electro-motors, of which the one in Vol. III., No. 154, is a type, has been forestalled. In WORK No. 171, and on page 230, appears a short paper which treats of the why and wherefore of the rotary motion in motors of the Siemens "H girder" type; and the little "Model" motor is nothing more nor less than one of the H girder class. The armature has but one coil, with a two-part commutator; the only difference is, that the original motor, or dynamo, by M. Siemens, had its armature working lengthways between the poles of the field-magnet; and in my little model motor the armature works vertically before the face of the field-magnet; this was done in order that the construction might be as

simple as possible; but the laws of motion remain the same as in the H girder class of motors. If you have been successful in making a bell from the scrap you mention in your letter—upon which I congratulate you—I am sure you will be equally so with the little motor; and I trust you will find it what it was intended to be—namely, an instructive toy—and when you have made it I hope you will no longer be "enshrouded in mist" as to why it goes one way and then another, and from it learn the principles of all motors of its class. You will want 30 yards of No. 28 silk-covered wire for the field-magnet—which will cost you at the rate of 6s. per lb.; the wire (No. 36) for the armature will be about 14s. per lb., and try and get on about 20 yards. You will find it best to buy your wire by the reel—it is cheaper in the long run; or if you want a small quantity, make a bargain for the bit left on a broken bobbin: it is always handy to have if you do get a little too much.—J. B.

Developing Ferrotype Plate.—RASTUS.—The rapidity depends much more on the sensitised surface than on the developer. With a good guide-plate the development would not exceed the time mentioned with most of the ordinary developers used; but no automatic rapid method can be expected to work irrespective of temperature and light: on this account no automatic machine will work without more or less attention. The reason a wet collodion is preferable to a gelatine dry surface is in the greater rapidity of development. No *very* quick development is possible with a dry gelatine surface to produce good results. The following will be found an excellent developer for wet collodion ferrotypes: Protosulphate of iron, 1½ oz.; nitrate of barytus, 1 oz.; water, 1 pint; alcohol, 1 oz.; nitric acid, 40 drops. Dissolve the iron and barytus separately, mix the solution, filter, and add the alcohol. For all dry plates, special developers must be made to suit them. The new developer of Dr. Andreson's, "Rodal,' or para-amidephenol, is one that suggests itself as generally suitable to gelatine surfaces for this purpose.—D.

Watch Spring.—RAW MATERIAL.—You will want a small screwdriver to take off cock (and name-plate if English lever or American); tweezers to take hold of screws and small pieces, etc.; a joint push or a stout needle to push out the pins from pillars, etc.; and to put in the spring you ought to have a mainspring winder, otherwise you will get the spring basket shape, and make it rub in the barrel. If the hook is in the barrel, you will simply make a hole in the end of the spring; but if the hook is in the spring (as it generally is in an English watch), then you want a pin-vice or slide-tongs to hold the wire to file up a hook.—A. B. C.

Blowpipe Solder.—H. H. (*London, E.C.*).—To make solder for use with the blowpipe for such work as small tin or compo pipes, take 2 lb. of lead, 2 lb. of tin, ½ lb. of bismuth; melt together in a ladle, and run out into thin strips about 15 in. long. Another recipe is nine parts tin, seven parts lead. Use only pure tin, clean sheet, or pig lead in making solder.—R. A.

WORK Wrapper.—R. G. H. (*Richmond, Va., U.S.A.*).—Thanks for note. Attack the postal authorities on your side, and say that no contraband matter ever finds its way into the pages of WORK.

III.—QUESTIONS SUBMITTED TO READERS.

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

Hydraulics.—DRIVER writes:—"Could anyone tell me if there is a book published on hydraulic work or hydraulic cranes?"

Fret Monogram.—C. H. D. (*Shepherd's Bush*) writes:—"Would any clever reader kindly give me an easy monogram, 'A. M. D.,' for fretwork or inlaying, about 1½ in. square?"

Hair Clippings.—HAIRCUTTER will be much obliged if any reader can suggest a profitable way of disposing of hair clippings, with a quick and inexpensive method of cleansing the same.

R. T. Monogram.—R. T. (*Glasgow*) writes:—"Will some kind reader be good enough to give me a design of my monogram, R. T., to cut in fretwood?"

Lifeboat Carriage.—E. K. (*Smethwick*) writes:—"I shall be obliged if any reader will give me information for making a carriage for a model lifeboat of the following dimensions: 9 in. long, 3 in. beam, and 2½ in. from top of air chambers to keel."

Gilding.—JEWELLER writes:—"Can any reader inform me how to make a gilding solution for use without battery? I have the following from two works on electro-plating and gilding:—Chloride of gold, 1 part; acid carbonate potassium, 31 parts; mix with acid carbonate potassium, 30 parts; water, 200 parts. I have asked at several chemists for acid carbonate potassium, and am told there is no such chemical. Should be glad to know what is meant; also correct proportions for 15 grains chloride of gold, and how mixed."

Ice House.—CARINO writes:—"I have just erected an ice or refrigerator house to keep butter; and although it is made of American white pine, there is a strong smell from the wood, and when the doors are shut for some little time and then opened, there is a very strong smell, which will, no doubt, taint the butter, as it is one of those things that easily absorbs foreign smells from its surroundings. I shall be glad if a competent reader will advise me what to do to get rid of this smell."

Spindles, etc.—J. J. H. (*Cardiff*) writes:—"Will someone kindly tell me if there is a book that will give full information on the working of spindle and four cutter moulding machines (wood), and also the different shapes?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Puzzle Brass Tobacco Box.—OLD HAND writes to J. T. (*Sunderland*) (see No. 159):—"Many years ago I saw a puzzle tobacco box, as per sketch. It was very nicely made, and with good joints, being hard to guess the secret. The pin of the

Puzzle Tobacco Box.

joint withdraws at A, which carries the end-piece of the joint. Let the interior of the box be *tinned*, and the outside corners slightly rounded. The size and proportions may be varied to suit the maker's fancy."

Crystoleum Painting.—M. (*Bishop Auckland*) writes to HANSOT (see No. 166, page 158)—"Instructions for this are given in Nos. 3 and 4, Vol. I. of WORK."

Enamel on Slate.—M. (*Bishop Auckland*) writes to H. A. H. (*Tunbridge*) (see No. 164, page 126):—"You might procure this from the Kingston Enamel Slate Works, Park Road, Hull."

Soap-making.—H. B. S. (*Liverpool*) writes to A. C. (*Manchester*) (see No. 166, page 158):—"Now the question is, do you want to make it on a small or a large scale? If the former, look up the indices of WORK, and you will find an article has already appeared on the subject; if the latter, consult the articles on Soap-making in Muspratt's 'Chemistry,' or in 'Chemistry applied to Manufactures and Arts.' The information is too lengthy for this column."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—REV. H. W. L. (*Sussex, New Brunswick*); C. E. S. (*Taranaki, New Zealand*); S. B. (*Rochdale*); G. W. (*Devizes*); AMATEUR; F. L. L. (*Richmond Hill*); TINKER; P. B. H. (*Southport*); DELTA; J. W. (*Dundee*); A. R. (*Moseley*); IN REQUEST; C. E.; W. H. T. (*Westminster*); EFF-BEE; J. W. H. (*Brackley*); COLNEITE; M. & Co. (*Middlesboro'-on-Tees*); F. A. D. (*Chapel Street*); H. H. (*Merthyr*); S. A. P. (*Bournemouth*); W. C. (*Wolverhampton*); TYRANYRE; B. J. (*Burnley*); H. C. G. (*Islington*); B. W. L. (*Leominster*); ON PLEASURE BENT; COMPASSES; J. W. W. (*Heckmondwike*); C. M. (*Hornsey Park Road*); H. H. (*Finsbury*); A. M. M. (*Holloway, N.*); G. A. W. (*Bayswater*); F. C. K. (*Mapleton*); CYCLE FITTER; W. F. (*Glasgow*); NIL DESPERANDUM; MASON; RUFUS; PRACTICAL (*London*); TOBIAS; SCREEN; H. J. C. (*Compton Bishop*); SIGNED LEARNER; SOAP; MORENO; D. F. (*Kincardine-on-Forth*); G. A. M. (*Nottingham*); PHONO; F. M. J. (*Bradford*); T. J. F. (*Brandon Colliery*).

"WORK" PRIZE SCHEME.

FIRST COMPETITION PRIZE WINNERS.

Subject—The Cycle: its Worth to the Nation.

THE Editor has the pleasure to announce the following as the result of the adjudication upon the Essays sent in for Competition:—

FIRST PRIZE (£3) for the Essay bearing the signature "Philolaus" (Rev. F. A. WODEHOUSE, Gotham Rectory, Kegworth, Derby).

SECOND PRIZE (£2) for the Essay signed "Endeavour" (ALEXANDER STEPHENSON, 3, Dixon Road, Govan Hill, Glasgow).

THIRD PRIZE (£1) for the Essay with the signature "Currus" (J. CHARLES KING, Burchett's Green Cottage, Maidenhead Thicket, Berks).

These Essays will be published in WORK and the Prizes remitted to the writers of such successful Essays in due course.

The Essays with the following signatures are deemed worthy of commendation:—"Pedlar," "Alpha," "Roti Wallah," "Pooskie."

NOTICE TO READERS.

The next No. of WORK (No. 175) will contain, among other important articles, the following:—

PHOTOGRAPHIC EXPOSURE;
HOW TO MAKE A GARDEN ROLLER;
SIMPLE STOVE SCREENS;
EVERY WORKER'S WATER MOTOR;
DRAWING OFFICE WORK;
DESIGN FOR AN UMBRELLA STAND;
etc. etc.

"WORK" PRIZE SCHEME.

SECOND COMPETITION.

For the three best suggestions for a new domestic appliance, household article, or labour-saving tool of general utility, the following prizes will be awarded—

First Prize, £3;
Second Prize, £2;
Third Prize, £1.

CONDITIONS AND RULES OF THE "USEFUL HOUSEHOLD ARTICLE" COMPETITION.

ALL Descriptions to bear the WORK Prize Coupon, cut from one of the numbers of WORK in which the Prize Scheme is announced.

Each Description to be signed with an original *nom de plume*, and to have the writer's real name and address securely attached to the manuscript in a sealed envelope.

Each Suggestion should be fully described in respect to its purpose, construction, and working, and, where possible, should be illustrated with a drawing of the article itself and its various parts to elucidate the description.

A Suggestion not illustrated will have an equal claim in the competition provided the description be sufficiently in detail to convey a full idea of the article suggested.

In the work of judging regard will be had to the practical nature and utility of the suggestions, and their prospective popularity.

The Prize Suggestions and Drawings, and any others, to be published, if desired by the Editor, in WORK, but the copyright thereof to remain with the authors.

Copies of MSS. and Drawings to be retained by the competitors, as in no case can the return of MSS. be undertaken.

The Editor of WORK will supervise the judging of the Suggestions, and the selection as determined upon is to be final.

All manuscripts intended for the "Useful Household Article" competition must be addressed to the Editor of WORK, c/o Cassell & Co., Ld., Ludgate Hill, London, E.C. They must reach him on or before SATURDAY, JULY 30, endorsed, "Useful Household Article" Competition.