WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. IV.—No. 190.] SATURDAY, NOVEMBER 5, 1892. [PRICE ONE PENNY.

WORK WORLD.

THE consumption of building wood in London is about 8,000 standards per week, and at £10 10s. per standard this represents a large amount of money expended on timber.

* *

There is now a pneumatic despatch tube from Paris to Berlin. Letters placed in the receiver at the former city reach their destination in an hour and a half, and sometimes as soon as thirty-five minutes.

* *

The largest rotary crane in the kingdom is being erected in the coke-yard of Saltley gasworks. It will have a radius of 75 ft., and will lift two and a half tons of coke at a time to any part of the area covered by its circuit.

* *

Gold output from Withwatersrandt was 4,600 oz. higher in September than in any previous month. If September's total of 107,851 oz. is maintained to the end of the year, the aggregate for the twelve months will represent a value of £4,200,000.

* *

Numerous tramcar accidents are caused by axle breakages. One great cause of failure exists in using "square collars." It should be remembered by those responsible for the construction of the cars that square collars often lead to a sudden snap.

* *

Ceylon has held the monopoly of supplying plumbago. Recently deposits have been discovered at Travancore, in India; the quality, however, is not equal to that of the Ceylon product. Plumbago deposits exist in Greenland, but difficulties of climate and transit prevent their being worked.

* *

Progressive is Japan. An electrical science periodical is now published in the Japanese language. This language appears to be incapable of accommodating itself to algebraic formulae, which has to be printed in the ordinary characters. This presents a curious appearance, set on end in vertical columns, with the Japanese letters between.

* *

English companies have enjoyed a monopoly in cable laying. Now, however, a cable has been laid from Marseilles to Oran, a distance of about 730 miles, by the "Société Générale des Téléphones Français." England, as usual. has expended her capital in experimenting and showing how a great work may be practically carried out with profit, and, thus taught, other nations follow.

* *

A coal-cutting machine at Eldon Colliery is driven by electricity. It stands 18 in. high, and weighs 32 cwt., and will cut stone as well as coal. It works at the rate of about 55 yards per hour when in full work, equivalent to 60 tons of coal. Thirty-two men have received notice to make way for this iron pitman, which requires only two men to work it.

* *

The Simplon Tunnel will, when completed, be the longest in the world—over twelve and a half miles in length. The power required to drive the drills will be obtained by damming the River Massa on the northern side of the tunnel, and from the River Cairasca on the South. The former will supply 1,550 horse-power, and the latter 2,760 horse-power. It is expected that the work will take eight years and a half for its completion.

* *

The telephone needs the open air to obtain the best results. To use wires placed underground, a metallic circuit will be necessary, similar to the one used on long-distance lines. To place the wires underground and to make a metallic circuit, which means to use two wires where one is used at present, will materially increase expenses, and the public must pay for the luxury. As the number of wires is increasing rapidly, it is evident that they must ere long be buried.

* *

One hundred and thirty bushels of wheat to the acre reads like fiction. General Sir Arthur Cotton has discovered a method of cultivating good wheat ground, by which it can be made to yield 130 bushels of wheat to the acre. The secret lies in deep digging and complete aëration of the soil before planting the wheat, then giving the wheat plants plenty of room to grow. He has tried the experiment on a small scale with great success.

* *

Burnley Corporation intend lighting the borough of that town with the electric light, and invite tenders for steam boilers, steam engines, fuel economisers, dynamos, accumulators, switchboards, cables, and travelling cranes. The Corporation of Accrington also propose the adoption of the electric light at a cost of £10,000 for plant. The Dublin Corporation have taken over the electric light works of that city. Increased activity in electric lighting is also observable in the metropolis, especially among private firms.

* *

Tin-bearing deposits of Burmah are of two kinds. First, there is the tin-gravel, which is found in most of the valleys, a mixture of rough white quartz pebbles with sand, garnet, black tourmaline, and grey cassiterite. The thickness of the gravel varies from one to six feet, and the yield is about 1 lb. of cassiterite—dioxide of tin—in 400 lb. of gravel. The country is uninhabited, and food has to be carried there. Chinamen are the chief workers. The second kind of tin-bearing deposit is eruptive rock, which is so weathered that grains of cassiterite can be washed out of it.

* *

Pennington's air-ship factory in Chicago has completed an aluminium car, which weighs 235 lb. The motor power consists of two beautiful little engines of alloyed aluminium. These engines each consist of four cylinders with four piston-rods attached to a single centre, and acting with reciprocal power. Hydrogen gas is exploded by an electric spark. One engine weighs a minimum of 45 lb., and has a maximum capacity of 15 horse-power. These engines drive the great wheel of four spoons that bores through the air auger-like and draws the ship after it, while the little fans on the sides elevate the ship or lower it.

* *

Packing rings made of cotton tubing filled with Portland cement are coming to the front. These can be used for making the joints of man-holes, flanges, and other connections, by wetting them thoroughly, laying them in place, and screwing them up, taking care to bring a uniform pressure over the whole circumference. Cement joints may also be made without the cotton covering. The cement is gauged into a thick paste with water, until it is of such a consistency that when plastered on a vertical wall it will neither fall off nor flow down. The surfaces to be jointed are carefully cleansed from grease, the cement laid on about $\frac{1}{4}$ in. thick, and the joint carefully screwed down to about $\frac{1}{8}$ in. After setting for four to six hours, the screws are tightened again. This joint costs about one-twentieth as much as an indiarubber joint, and one-tenth that of asbestos and tallow.

THE ART OF STAIRCASING.

BY GEORGE F. CHILD.

STAIRCASE WITH HALF-SPACE OF WINDERS OVER AN OBLIQUE PLAN—SETTING OUT THE PLAN—SETTING OUT THE ELEVATION—LENGTH OF NEWELS—PLANNING STAIRS TO AVOID DOORS—CUPBOARD UNDER STAIRS—SECTION ON C D—DRAWING MITRE FOR CAP—BLOCK FOR CUTTING MITRE—JOINING RAIL AND CAP—NEWEL AND CAP—SKETCH OF BLOCK AND CAP.

Setting out the Plan.—As will be seen from Fig. 2, the arrangement of the staircase in our present example is over an oblique plan—that is to say, the outside (11 in.) wall is not at right angles with the walls forming the sides of our staircase. This often happens where the formation of the building plot is not square or at right angles with the frontage. The stairs having been set out as before described in No. 184, p. 441, the winders will present no difficulty, as they can be set out from one full-size drawing, which will, of course, have been drawn to the correct angle, as shown.

Setting out the Elevation.—The sectional elevation (Fig. 1) can also be set out as before. It will be observed that the line of section having been taken through the bottom flight from A to B, the portion of the winders cut by this line will also show as a section, as will the whole of the step or fliers below them, Nos. 1 to 7 inclusive. The upper portion will be as seen.

Length of Newels.—The bottom newel (1) must be rather longer than the newels we have seen before, on account of an easement on the rail, which terminates in a *cap*,

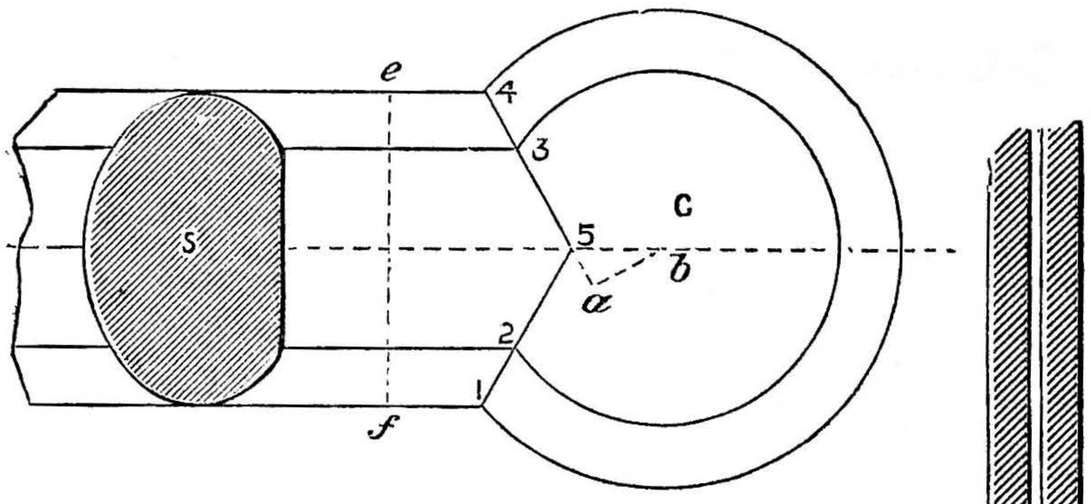


Fig. 4

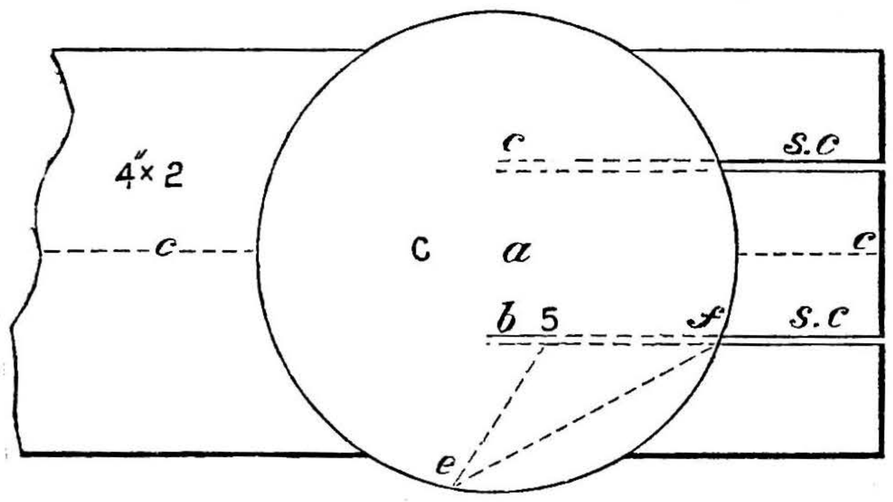


Fig. 5.

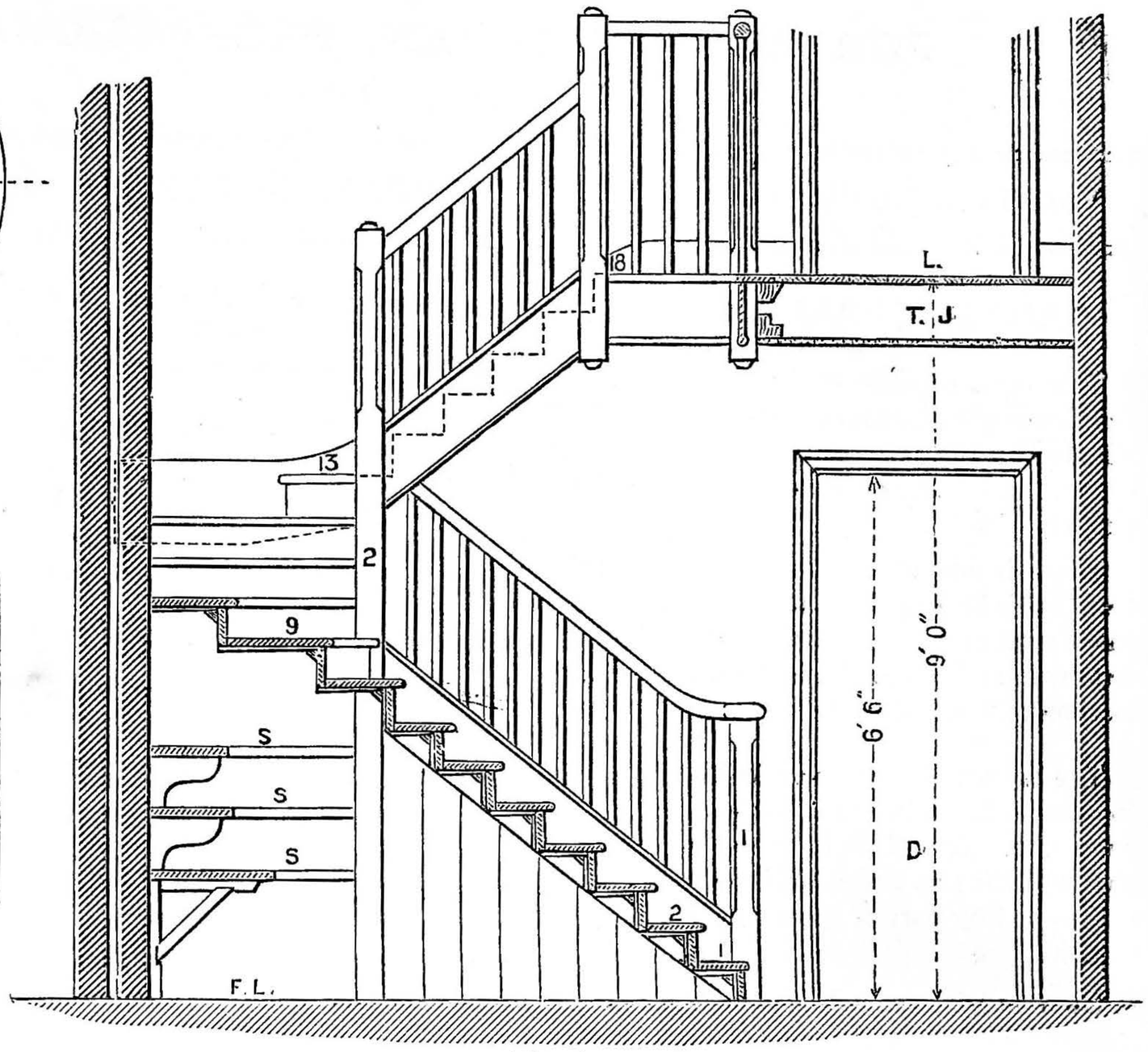


Fig. 1.

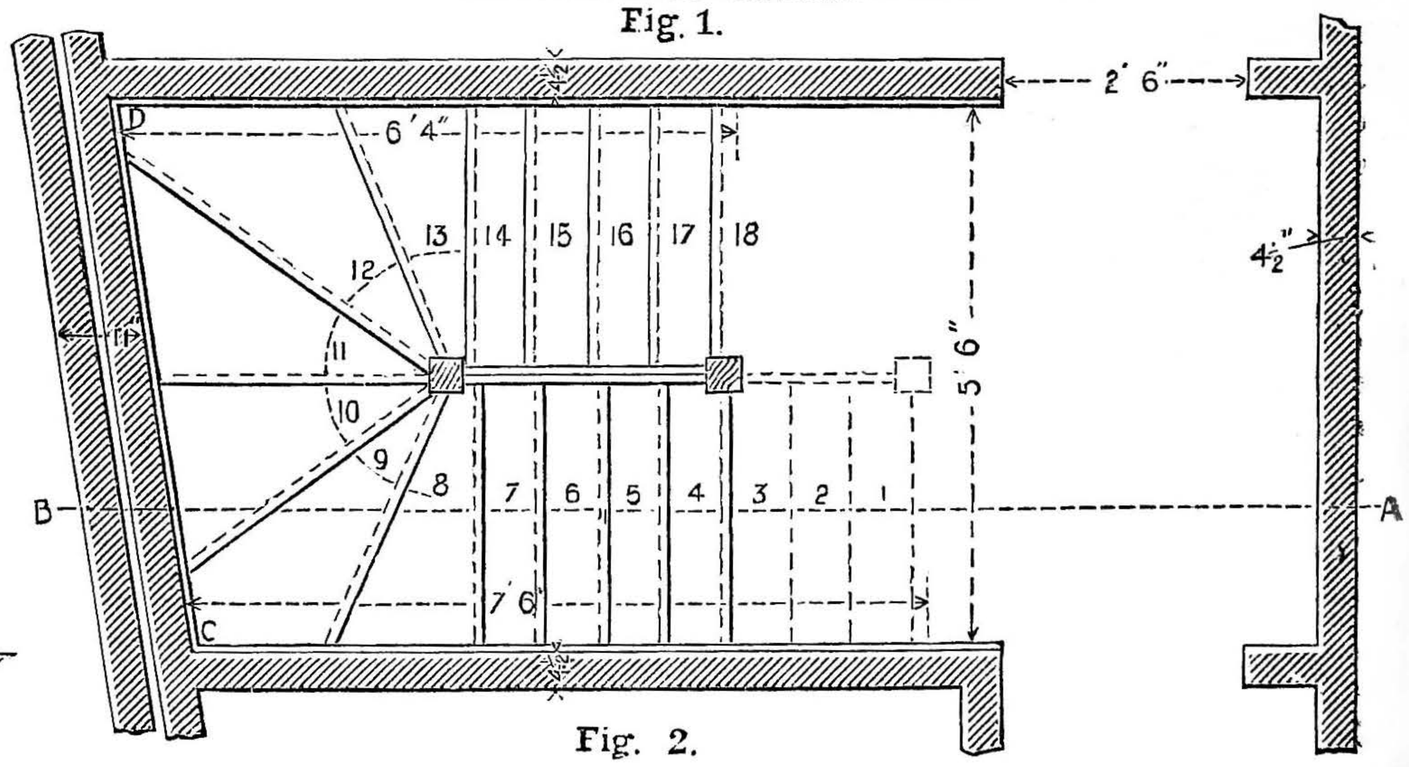


Fig. 2.

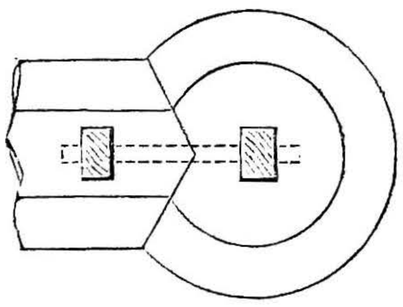


Fig. 6.

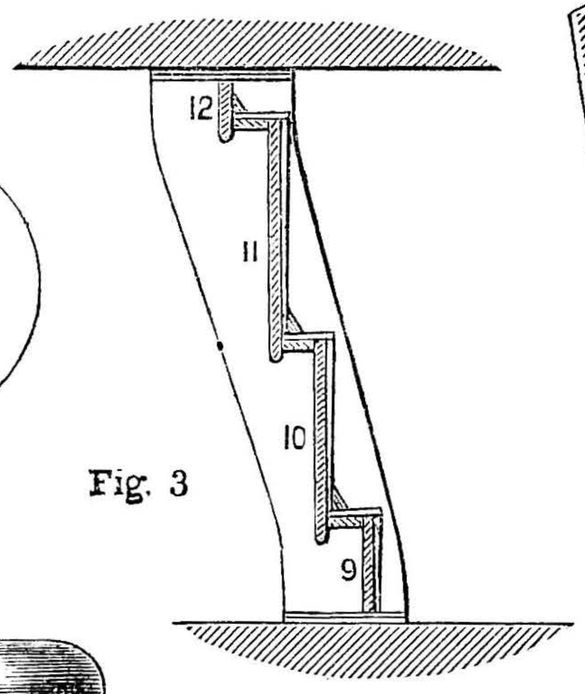


Fig. 3

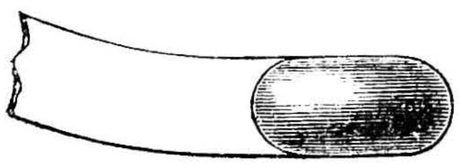


Fig. 9.

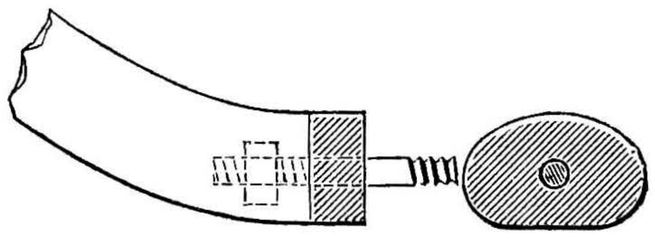


Fig. 7.

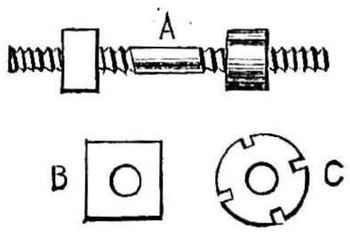


Fig. 8

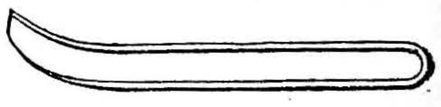


Fig. 10.

Staircasing. Fig. 1.—Sectional Elevation—F L, Floor Line; D, Door; L, Landing; S, S, S, Shelves; T J, Trimmer Joist. Fig. 2.—Plan—A, B, C, D, Section Lines; 1 to 18, Steps. Fig. 3.—Section on C D, showing Winders and String. Fig. 4.—Method of obtaining Mitre for Cap—S, Section of Rail; 1 to 4, Outer Line of Cap; 2 to 3, Line of Square; *f e*, Width of Rail; 1, 4 to 5, Mitre Line; *a b*, Width for Transference to Block; C, Cap. Fig. 5.—Block with Cap in Position—C, Cap; *c c*, Centre Line; *s c*, Saw Cuts; *e f*, Width of Rail; *e f* 5, Piece cut out for Mitre. Fig. 6.—Plan of Cap and Rail. Fig. 7.—Elevation of Rail, etched Portion showing the Mitre. Fig. 8.—A, Bolts; B, Square Nut; C, Round Nut. Fig. 9.—Connection between Cap and Newel. Fig. 10.—Handrail Punch.

as seen; the necessary length can easily be found by drawing the easement to the cap, which of course will be level on the newel.

Newel 2 may with advantage be long enough to take both top and bottom flights, and pass under the winders to the floor, thus forming a good support, and at the same time a post to which the door for the cupboard may be hung.

Planning Stairs to Avoid Doors.—Great care must be taken in all staircases to keep them clear of doors, etc., or otherwise unpleasant surprises may await us on taking them to be fixed. This can always be managed with a little attention.

Cupboard under Stairs.—It is often a matter for regret that more cupboard space is not provided in an ordinary house, as the housewife can always find a use for a good cupboard, no matter how large. In this particular the space available under a staircase is often neglected, when it might be turned to advantage at a very little cost.

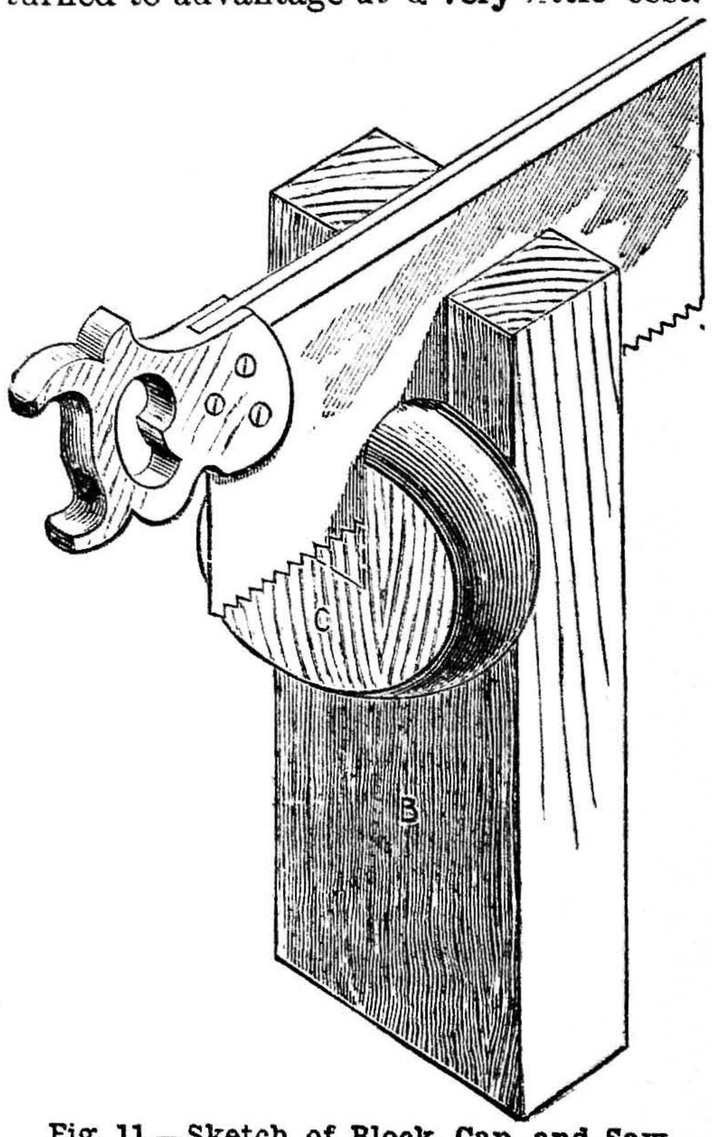


Fig. 11.—Sketch of Block, Cap, and Saw—B, Block; C, Cap.

In the present case a cupboard is shown in the section (Fig. 1), 1 in. match-boarding being nailed in the spandril under the bottom string, and shelves (s, s, s) being fixed on the walls, as found most convenient.

Section on C D.—This is merely a section to show the winders and string-board on the oblique wall. The method employed to set it out has been fully described in previous numbers of WORK.

Drawing Mitre for Cap.—This cap should be turned with the edge exactly the same section as the edge of the rail; this will, of course, depend on the shape of the rail. In the present case it is oval, as seen in section s (Fig. 4).

Draw the section s, also the lines *f*, *e* (these lines represent the width of the rail); now draw the outer line of cap 1 to 4. Next draw the line 2, 3, which gives the width of the square on the rail, and is for the balusters. Draw a line with the compasses on the cap, at the same distance from the edge, concentric with the outer line of cap. Now from the point 4, where the outer circumference of cap joins the line *e*, draw a line, cutting the point 3 where the inner parallel lines meet, and produce this line to 5. Now, by drawing a line on the other side through the points 1, 2 to 5, we obtain the mitre. This is as nearly correct as we can draw it without making a circular mitre.

Block for Cutting Mitre.—At Fig. 5 we have a method for cutting this mitre on the cap. Plane up a piece of quartering, say about 4 in. by 2 in., and draw a line down the centre, as *c c*; on each side of this line set off the distance *a b* (Fig. 4), as from *a* to *b* and *b* to *c* (Fig. 5). Now run a saw-cut down these lines, as seen at *s c*. Having thus prepared our block, mark on the cap c the extreme width of the rail as from *e* to *f*. Now bore a hole through the block on the centre line, and pass a long screw through into the back of the cap, thus fastening it securely. Now place the point *f* on the cap opposite the saw-cut, as seen, and run in the saw. Turn the cap over until the point *e* coincides with the other cut, and run that in also, thus obtaining the mitre. Other methods may perhaps be employed, but this is as good as any.

Joining Rail and Cap.—Fig. 6 shows the under side of rail and cap, with the holes cut to receive the nuts on the handrail screw. These are cut in to a convenient depth, and a hole bored in the centre of the *thickness* of cap and rail, with a twist bit of suitable size. The *square nut*, B (Fig. 8), is placed in the mortise on the rail, and the bolt is then turned in until it passes through the nut, leaving the other end to pass into the cap, as at Fig. 7.

The round nut is now dropped into the cap, and the bolt is pushed into it. Having started the nut, it is now driven home by means of the punch (Fig. 10), the thin end of which is passed into the slots on the nut, and gently driven with a hammer until sufficiently tight for our purpose.

Newel and Cap.—At Fig. 9 is seen a method of joining the cap to the newel. A pin is turned on the newel, and passed into a corresponding hole bored in the cap, into which it is glued and screwed.

Sketch of Block and Cap.—At Fig. 11 is shown a view of the block, with the cap fixed and the saw in position. This, it is hoped, will fully explain our meaning with regard to cutting mitre on the cap.

PHOTOGRAPHIC EXPERIMENTS.

CURIOUS, AMUSING, AND INSTRUCTIVE.

BY WALTER E. WOODBURY.

SPIRIT PHOTOGRAPHY—TO COPY DRAWINGS—PHOTOGRAPHING BRIGHT DISTANT LANDSCAPES—PRINTING ON SILK.

Spirit Photography.—Although spirit photographs are often believed by weak-minded persons to be the result of supernatural visitants, and have been a powerful agent in the hands of the fraudulent spiritualists, it is satisfactory to know that their manufacture is simple enough. While you are making a portrait of an individual, a confederate, dressed in a white sheet, should stand for a second or so behind the sitter. This will give a hazy sort of image, that can, with a fair stretch of imagination, be taken for any bygone relative. This method has its drawbacks, however, as the gliding in and out of your confederate is likely to attract the sitter's attention; then he might turn round, and spoil the fun. A far better plan is to make the spirit separately on the plate, either before or after exposure on the sitter. In a room made perfectly dark the draped figure, to represent the spirit, is posed in a spirit-like attitude in front of a black background. With a suitable lamp, light is thrown upon the figure. Next a fine piece of muslin gauze is placed close to the lens, which gives a cloud-like, indistinct appearance to the image. The exposure is made, and the latent image remains upon the sensitive plate, which is again used to photograph the sitter, with the result that, in development, the two images are made to appear at the same time, so that the sitter imagines that the spirit must have been hovering around him at the time the photograph was made. By the same means a variety of effects can be made—spirits floating in the air, mysterious hands, etc.

Another favourite method is to use a white background painted over with bisulphate of quinine, which photographs black. A spirit-like form is, however, left bare, and although not seen by the eye, this will appear as a white phantom in the picture.

To Copy Drawings.—There are three principal methods for copying mechanical drawings, tracings, sketches, etc. These are: (1) A process to obtain white lines upon a blue ground; (2) a process by which blue lines upon a white ground are obtained; and (3) a process giving black or violet-black lines upon a white ground.

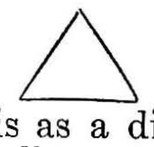
The first process is undoubtedly the simplest, as after printing upon the paper it is developed and fixed by simple immersion in cold water; but, at the same time, the white lines on the blue ground are not so clear and effective as the other processes. The cyanotype paper, as it is called, can be obtained ready for use at any draughtsman's stores, but if you prefer to make it yourself, here is the recipe: Two solutions are made—20 parts of red prussiate of potash are dissolved in 100 parts of water, and 10 parts of ammonio-citrate of iron in 60 parts of water. These two solutions should be mixed together immediately before using, and the operation must be performed in the dark. Paper is floated on this solution, or applied with a broad camel-hair brush, and hung up to dry. If it is well dried and carefully preserved from light, moisture, and air this paper will keep for some time. After printing—which, when sufficient, should show the lines copied of a yellow colour upon a blue ground—the prints should be washed in several waters; and if a few drops of chlorine water or dilute hydrochloric acid be added to the washing water, the blue ground will appear much darker and the lines rendered clearer and whiter. By this method the commercial paper sold is generally prepared. The prints may, if desired, be changed from blue to black by immersing in a four per cent. solution of caustic potash until the blue is changed to yellow. After being well washed, they are laid in a solution of tannin.

In the process giving blue lines upon a white ground, it is necessary that the action of the light shall be to convert the iron compound into one that can be discharged from instead of being fixed on the paper, so that we obtain a positive from a positive. Abney describes the process as follows: 30 volumes of gum solution (water 5 parts, gum 1 part) are mixed with 8 volumes of a citrate of iron and ammonia solution (water 2 parts, double citrate 1 part), and to this is added 5 volumes of a solution of ferric chloride (water 2 parts, ferric chloride 1 part). This solution thus formed is limpid at first, but will gradually become thicker, and should be used soon after mixing. It is then applied with a brush to the paper (which should be well sized) and dried in the dark. Exposure is accomplished in a few minutes, the paper being placed under the drawing in the printing frame. It is then developed with

potassium ferrocyanide 50 gr., water 1 oz., applied with a brush until all the details appear of a dark blue colour. The print is then rapidly rinsed, and placed in a dish containing the clearing solution, made of 1 oz. of hydrochloric acid and 10 oz. of water.

The third process, which gives violet-black lines on a white ground, is the following: Make up the sensitive solution with water, 16 oz.; gelatine, 4 dr.; perchloride of iron (in a syrupy condition), 1 oz.; tartaric acid, 1 oz.; sulphate of iron, 4 dr. The paper is floated on or brushed over with this and dried. The exposure is about the same as with the last process. When sufficient, the greenish-yellow colour will turn white, except the lines, which should be somewhat dark. The developing solution is composed of 1 part of gallic acid in 10 parts of alcohol and 50 of water. When immersed in this solution the lines will turn blacker. The finish is then made by thoroughly washing in water.

Photographing Bright Distant Landscapes.—It is very difficult sometimes to photograph landscapes with dark heavy foreground and bright distance. If we expose quickly for the background we lose the detail in the foreground; while if we give the correct exposure to the latter, the distant view will disappear, or appear only in a mist. To avoid this the following experiment will often prove successful: Take one of your stops, and outline it on a piece of cardboard. Cut this out, and, instead of making a circular aperture in the centre, make a triangular one, thus—



Blacken it all over, and use this as a diaphragm. The effect this has is to allow much less light to come from the sky and distance, and more from the foreground. By its use natural clouds can often be secured where otherwise impossible.

Printing on Silk.—Photographs can be made very effective printed upon silk, satin, or other fabrics. There are several methods of accomplishing this. A simple one is the following:* The silk best suited for the purpose is that known as Chinese silk, and this is first washed in warm water with plentiful lather of soap; then rinse in hot water, and gradually cool until the final washing water is quite cold. Next prepare the following solutions: Tannin, 4 parts; distilled water, 100 parts. Sodium chloride, 4 parts; arrowroot, 4 parts; acetic acid, 12 parts; distilled water, 100 parts. The arrowroot is mixed up into a paste with a little of the distilled water, and the remainder added boiling hot, with the acid and the salt previously dissolved in it. When the solution is quite clear the tannin solution is added, and the whole allowed to get fairly cool. The silk is then immersed for about three minutes, being kept under without air in the folds, and then hung up to dry, or stretched out with pins on a flat board. The material is then sensitised by brushing over with the following solution: Silver nitrate, 12 parts; distilled water, 100 parts; nitric acid, 2 drops to every 3 oz. Other methods of sensitising are by immersing in or floating on the silver solution. After sensitising, the material is dried by pinning on to a board to keep flat. It is then cut up as required, and printed behind the negative. Every care must be taken in printing to keep the material flat, and without wrinkles or folds. It must also be kept quite straight; otherwise, the image will be distorted. Printing is carried on in the same manner as with albumenised paper. It is then washed and toned in any toning bath. The sulphocyanide gives the best action. Fix in a ten per cent. solution of hyposulphite of soda for ten minutes; wash and dry spontaneously. When just damp, it is ironed out flat with a not over-heated iron. Black tones can be obtained with a platinum toning bath, or with the uranium and gold toning bath, made up as follows: Gold chloride, 1 part; uranium nitrate, 1 part. Dissolved and neutralised with sodium carbonate, and then added to sodium chloride, 16 parts; sodium acetate, 16 parts; sodium phosphate, 16 parts; distilled water, 4,000 parts.

Very effective results may be made by printing with wide white margins, obtained by exposing with a non-actinic mask.

Another method is the following: Ammonium chloride, 100 gr.; Iceland moss, 60 gr.; water (boiling), 20 oz.

When nearly cold this is filtered, and the silk immersed in it for about fifteen minutes. To sensitise, immerse the silk in a 20 grain solution of silver nitrate for about sixteen minutes. The silver solution should be rather acid.

Or immerse the silk in water, 1 oz.; sodium chloride, 5 gr.; gelatine, 5 gr. When dry, float for thirty seconds on a 50 grain solution of silver nitrate. Dry slightly over print, and tone in the following bath: Gold chloride, 4 gr.; sodium acetate, 2 dr.; water, 29 oz. Keep twenty-four hours before using. Fix for twenty minutes in hypo, 4 oz. to the pint of water.

* From the "Encyclopædia of Photography," by the author.

TARTARIC ACID.

Some light on the natural formation of tartaric acid is afforded by the recent discovery of a simple way in which this acid may be synthesised. A French chemist starts with glyoxalic acid—an acid found in gooseberries, grapes, and other fruits—and acting upon it with nascent hydrogen liberated from a mixture of zinc dust and acetic acid, obtains eventually tartaric acid, or rather the optically inactive form of it known as racemic acid, equal molecules of the dextro and lævo varieties being apparently produced. The explanation of the action is very simple. Two molecules of glyoxalic acid are merely brought together by two hydrogen atoms. Glyoxalic acid is $C_2H_2O_3$, while tartaric acid is $C_4H_6O_6$, a formula which, as will be readily seen, contains two molecules of the former acid joined together by two atoms of hydrogen. It is well known that oxalic acid, $C_2H_2O_4$, is formed most readily in vegetable tissues, and is closely related to glyoxalic acid. Having regard, therefore, to the reducing tendencies which are known to characterise chlorophyl, it is not improbable that the natural building up of tartaric acid may be thus explained.

Timber Coating. — To make wooden posts that are in the ground last as long as iron, mix boiled linseed oil with pulverised coal to the consistency of paint, and coat it over the timber, and there is no man who will live to see it rot.

Tempering. — Very thin blades, flat springs, small drills, and sewing-machine needles can be effectively hardened and tempered by heating them and thrusting them into a mass of mineral wax—crude paraffin.

HELICAL GEARS.

BY J. H.

Wheels Made in Cores.

General Conditions—Method of Formation and Division—Description of Core-box.

General Conditions.—When helical wheels are made by means of cores, essential methods of marking and working the teeth are, of course, precisely those already described; only, instead of fastening the teeth to a block, they are put into a box of suitable size (Fig. 13). It does not really matter how many teeth are put into the box, but they would usually range from about three in small wheels to six or eight in larger ones. Since the object in using cores for wheel making is to save the cost of repetition in working out of pattern teeth, in cases where no wheel machine is available, their number will obviously bear an economical proportion to the number of teeth in a given wheel and the number of cores that will have to be rammed.

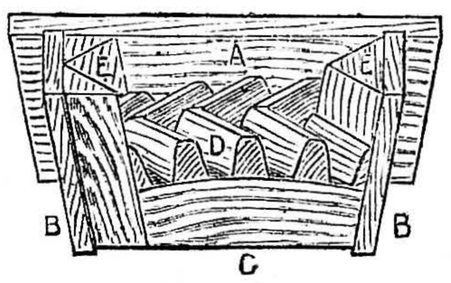


Fig. 13.

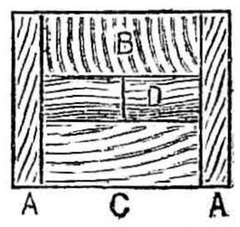


Fig 13A

Fig. 13.—Core-box with One Side removed.
Fig. 13 A.—Cross Section.

Method of Formation and Division.—When making teeth for a core-box, they will properly be divided along their middle planes for convenience of marking out. It will depend on the size of the wheel whether joints will be carried through any or all of the inter-tooth spaces. In a pinion of relatively small diameter, and quick curvature and wide teeth, it will be necessary or desirable to part the teeth in this way. In a wheel of large diameter, flat curvature, and shallow teeth, like that in Fig. 13, the teeth may be all in one piece. It becomes simply a question of the free withdrawal of the teeth without fracture of the sand. The same remarks apply, without exception, to core-boxes for both spur and bevel helical wheels.

Description of Core-box.—The illustration (Fig. 13) requires little remark; my notes thereon will be brief. It represents a core-box in perspective, with the nearest side removed to show the teeth, and also a cross section (Fig. 13 A) through the box. There are two sides, A, two ends, B, and a bottom block, C, curved to the radius of the wheel rim, and fitting within the sides and ends to carry the teeth, D. The blocks, E, are cut to the same diagonals as the teeth, and form the joints of the cores. Note that it is not usual to joint the teeth along the centre, which would leave marks of the joints on the castings, but along one edge. Thus the whole breadth of the point of the left-hand tooth is visible at that end of the box, while on the right the face of the tooth terminates at the block, E. Thus the portion of a tooth at one end is the complement of that at the other, and when the cores are laid end to end, the teeth formed at the joints are like those formed in the body of the cores.

I have now described, as fully as I can in the space at my disposal, the construction of helical-wheel teeth. The methods of making striking-boards and arm core-boxes being common to wheels in general, do not come within the scope of these papers.

WATCH AND CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL WATCHMAKER.

REPAIRING.

To Fit a New Set-hand Arbor.—Sometimes, through using a key too large, the square becomes fixed in it, and is broken off in the attempt to get the key out again. In such a case a new arbor must be fitted. Procure a rough one from the material shop. Hold it in the pin-vice by the square (having first seen that the said square is of the correct size, the *least trifle* smaller than the winding square), and file it slowly with a smooth file, very slightly taper, on the box-block; reduce it till it exactly fits the centre pinion up to the square and turns friction-tight. To do this properly is not so easy as one might suppose. It must not be done hurriedly, and must be tried in constantly. Having done this, fit it in the same manner to the cannon pinion, but rather tighter. Then cut it off to the correct length, allowing for the minute-hand, and round up the end nicely. Transfer it to the sliding tongs, and again grip by the square, but the other way up, and reduce the height of the square with a file till it equals the winding square. Then smooth-file it, bevel off the edges a trifle, and burnish the top.

To Fit an Hour-hand.—Select one of the correct length, and with a centre which fits tightly upon the pipe of the hour-wheel, and press it down *level* with it. If the pipe of the hand is too long, stick it upon a peg cut slightly taper, cut the peg off level with the bottom edge of the pipe, and reduce it with a file peg and all till correct.

To Fit a Minute-hand.—Select one of the correct length, and broach the centre out carefully to fit the centre arbor; when almost large enough to push on, rest the movement (the set-hand square) upon a stake in the vice, and laying the hand upon the centre arbor, give it a smart tap on with the hammer. Be careful that the *square only* rests upon the stake.

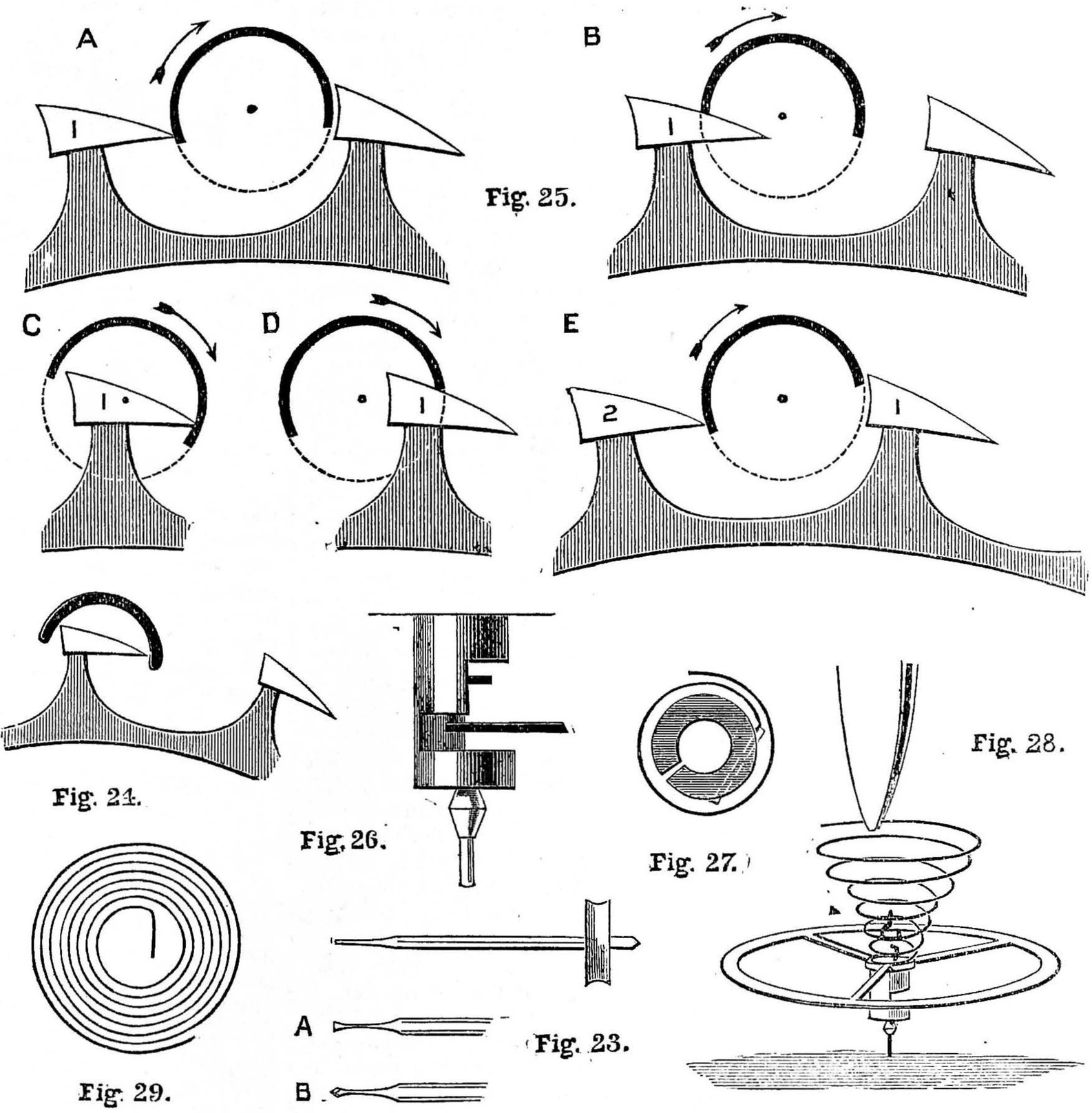
To Fit a Seconds-hand.—Select one to match the other hands; with the nippers cut it to the correct length. Then hold it in the nippers by its edge just at the centre, so that the brass pipe rests flat upon one jaw of the nippers, and with a slitting file cut the pipe to the correct length. Open it with a pivot broach till it pushes on tightly, but not too tight, on the seconds pivot, and take care it does not touch the dial anywhere, or stick up too much and catch in the other hands.

To Open a Hole in the Dial.—Sometimes the hour-hand pipe or the seconds-hand pipe will foul the edge of the hole in the dial through which it passes. In such a case, take off the hand in question, and notice between which hours the hole requires opening—say from the nine to the twelve, it requires freeing. Take off the dial, rest it flat upon a piece of cork in the vice close up to the hole, and with a round file and a little turps, using down strokes only, carefully clear it out. Take care not to let the file jamb in the hole, but hold it firmly at such a point that your finger first comes into contact with the dial. The file cannot then jamb by any possibility. In replacing a dial which is secured by screw studs, always secure it by turning these studs *in a direction which will unscrew them.* This will naturally draw up the dial feet, and prevent the dial from rattling or being loose.

To Adjust the Shake of the Motion Wheels.—If the hour wheel has too much shake under the dial, it will often cause the hands to catch. In such a case, a small circle of writing-paper or thin copper spring can be cut and dropped on it. Sometimes the minute wheel is so low down that it will not engage properly with the cannon pinion. In this case the same remedy can be applied, only underneath it instead.

Making Taps and Drills, etc.—Before passing on to a consideration of the escapement, as taps and drills have been mentioned in the foregoing repairs, the method of making them will be first explained. To make a *tap*, procure a good piece of steel a little larger than the required tap, and heat it to a dull red in a spirit-lamp flame to soften it thoroughly, and let it cool slowly. This done, taper it slightly with a file in the pin-vice, and proceed to cut a thread upon it with the screw-plate. This operation must be done most carefully; a half turn in and a quarter back must be the method of procedure, thus, as it were, advancing a quarter turn at each time. Use plenty of oil, and do not let it stick. Cut it till you have a full deep thread. Then rest it upon the boxwood block, and cut the end off square and round edges a little. At the extreme end the thread should be very slight, increasing up the tap to a full thread. Then with a smooth sharp file form it into a triangular shape, almost to perfect points at the extreme end, the flats not being quite so wide higher up. Triangular tops in such small sizes are not so likely to bind and break as square ones, and cut much more easily. This done, harden it by making it a bright red, and quickly cooling in cold water. Then brighten one face of it, and carefully warm in the flame till a pale straw colour steals over it. This operation is called "tempering," and has the effect of toughening what would otherwise be a far too brittle tool. Afterwards file notches in the handle end to indicate the number of the hole in screw-plate to which it belongs.

Drills are made as follows:—Procure a piece of good steel larger than the required drill, and with the pin-vice file it to the shape shown in Fig. 23, and knock a ferrule upon it, as shown, for the bow to work upon. These ferrules can be easily turned from brass rod in a lathe, or can be bought ready-made very cheaply. Having done this, hold it by the ferrule end, and rest the blade upon the edge of the stake, and with the hammer give it one or two smart taps to spread it, as at A. Sharpen this to the shape shown at B, and harden and temper the same as the taps. This is for comparatively large drills. For very small drills, after forming them, make the blades hot in the lamp flame and withdraw quickly—*i.e.*, "flirt" them in the air; this hardens them by suddenly cooling, the same as if they were plunged into water. With such small articles, plunging into a liquid of any sort is impossible. They are cold the moment they leave the flame.



Watch and Clock Cleaning and Repairing. Fig. 23.—Shape of Drill. Fig. 24.—Scape-wheel Teeth. Fig. 25.—Action of Escapement. Fig. 26.—View of Cylinder. Fig. 27.—Hairspring Collet. Fig. 28.—Method of holding Hairspring. Fig. 29.—Hairspring.

The Escapement.—Before proceeding to any repairs relating to this part of a watch, a thorough knowledge of its action is necessary. This will now be explained as clearly as possible. Upon examination with the eye-glass, the scape-wheel teeth will be found to be of the shape shown in Fig. 24, which also shows a section of the cylinder at the point at which the scape-wheel teeth act upon it. The face of each tooth is an inclined plane, or nearly so, which acts upon each edge of the cylinder in turn, and gives it an "impulse." In Fig. 25, at A, the point of one tooth is resting against the cylinder which is moving in the direction of the arrow. When the edge of the cylinder arrives at the point of the tooth, the latter advances, and in doing so the inclined plane drives the edge of the cylinder forward as it passes, as at B, and the point of the tooth comes to rest against the inside surface of the cylinder, as at C. The cylinder continues its motion till the force is spent, then, under the influence of the hair-spring, it returns, and permits the escape of the tooth, as at D. The point of the next tooth then falls upon the outside of the cylinder, as at E, and the same process is repeated as long as the force of the main-spring lasts. Each tooth, in turn, gives impulse to first one, then the other, side of the cylinder. Fig. 26 shows a side view, from which it will be seen that there is a slot cut in the cylinder to accommodate the arms that support the scape-wheel teeth. These arms must neither touch the bottom nor the top of this slot. This is a very important point, as, if these parts touch ever so lightly, the watch is sure to stop. It will thus be seen that if the balance (or cylinder) has much "end-shake," the bottom or top of this slot is sure to touch the wheel. If this is the case, it can generally be heard if the watch is held to the ear in its case, first one way up, then the other. Thus, if when dial up, a grating noise is heard which evidently proceeds from the cylinder, it shows that the bottom of the slot touches the wheel, and *vice-versâ*. Its remedy lies in a nice adjustment of the end-shake of the balance, which can be accomplished by packing up with paper under the balance-cock, or the bottom "chariot." When once the precise action of the escapement has been mastered, its adjustment and correction become easy. For instance, sometimes the points of the teeth, instead of falling upon the faces of the cylinder, fall upon the edges, and proceed to give impulse at once. In such a case the "depth" between wheel and cylinder is too shallow—*i.e.*, the cylinder requires moving bodily nearer to the wheel. This can be accomplished by bending back the pins of the "chariot" underneath, and so forcing it forward. In fact, a remedy will suggest itself for each little defect observed.

To Set the Escapement "in Beat."—When "in beat" properly, the balance will have no more tendency to stop on one side of the scape-wheel than on the other, and it will tick or beat evenly. If it does not, the small brass collet to which the centre of the hairspring is fixed must be turned round a trifle (it is friction-tight upon the cylinder). To do this, hold the balance in the fingers, and insert the blade of the oiler into the small cut in the collet, and gently turn it to the required distance.

To Set the Banking Correctly.—In the rim of the balance will be found a very small pin—the "banking pin." The function of this pin is to prevent the balance vibrating more than half a turn on either side of zero. If it did this, it would stop by reason of the scape-wheel teeth getting on the wrong side of the cylinder. It is effected by the banking pin coming in contact with a brass pin fixed in the balance cock at the back, at such a distance as to just clear the balance as it vibrates, but to stop the pin. It is therefore evident that when the balance is at rest, and the escapement in beat, this banking pin should be just opposite (half a turn from) the stop pin in the balance cock. If it is not, file it off, and, with a very small drill, drill a hole in the right place and put in another.

To Time the Watch.—The regulator, of course, is for this purpose, and it does so by means of the curb pins, between which the hairspring should play freely, just touching both of them at each vibration. By advancing the regulator, the acting portion of the spring is shortened, and by putting it back it is lengthened. This only acts within small limits. If it is desired to make a further alteration in amount, more than can be effected by the regulator, the hair-spring must be unpinned at its outside end, and "let out," or "taken up," as the case may be. It must always be remembered that lengthening the spring makes the watch go slower, and shortening it faster. Of course, after any alteration of this kind, it must be put in beat afresh by turning the collet round as described above.

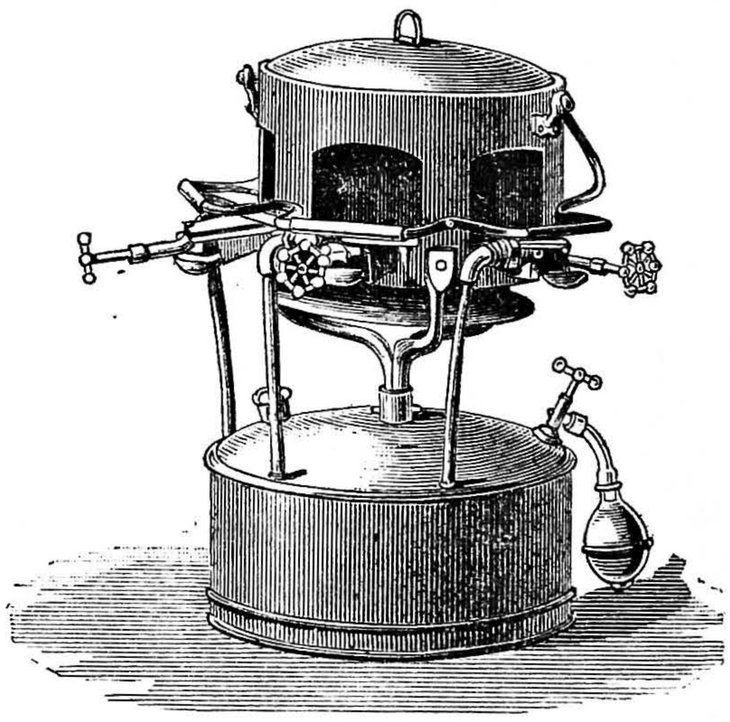
To Put on a New Hairspring.—Unpin the old one from the outside stud, and with the small blade of a pocket-knife carefully remove the collet from the cylinder. Then, with the pliers pull out the old spring, when it will come, pin and all. It will be seen to be fastened, as shown in Fig. 27, by a small pin cut off flush with the collet. Pick out another spring of the right outside diameter to pin in the stud properly. Put the balance on the stake with the cylinder through one of the holes, and lay the hairspring upon it in position, and push on the collet on the top to hold it temporarily. Then hold the outside end in the tweezers, as in Fig. 28, letting the bottom cylinder pivot just touch a watch-glass laid upon the board, and set it in vibration. Alongside of it on the board lay a watch with a seconds-hand, which goes fairly well to time. Watch this, and count the number of vibrations (double vibrations) the balance makes in half a minute under the influence of this hair-spring. It should be seventy-five, for a Geneva watch ticks three hundred to the minute. Try one after another till you get one which suits, or which you can make to suit by taking up a little. Then break away with the tweezers and a needle point the centre coils till it will pass easily over the collet, then bend it sharp round, as in Fig. 29, and put the collet upon a broach to hold it conveniently. Then put the end of spring into the hole in collet, and carefully pin it tight; afterwards with the tweezers so bend the spring at the sharp bend that the collet is quite central. This is important. When the collet is replaced on the cylinder, see that the spring lies flat. Then pin it in, set in beat, and try it, altering till correct.

I now think most of the ordinary repairs to Geneva watches have been dealt with, except *turning* jobs, which have been purposely avoided, and in my next the *lever watch* will be considered.

LUBRICANT.—A good lubricant for leather belting is obtained by mixing resin oil with 10 per cent. mica. New belting must be coated until the leather will absorb no more oil, and the belting is then ready for use.

TINNERS' AND PLUMBERS' FIRE POT.

IN the accompanying illustration we present a general view of a three-burner fire pot for tinners' and plumbers' use. It is an American novelty. The makers claim that this device has a capacity for heating more round irons or coppers than five men can use, and will also keep a pot containing 100 lb. of metal hot enough to wipe. The fire pot is referred to as being well adapted for use when lining tanks, making solder, pouring Babbitt metal or large soil and water-pipe joints. By simply removing

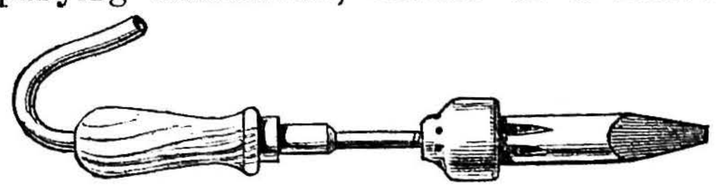


Tinners' and Plumbers' Fire Pot.

the spring pin the top may be taken off, leaving the burners exposed. The latter are movable and can be reversed, thus making a brazing forge, or the device may be used as a torch to melt out soil or water-pipe joints. All the burners have clean-out screw plugs, which render it an easy matter to keep them in order.

NEW SOLDERING SYSTEM.

WAGANDT'S gas and air soldering system, which is finding much favour in America, for which are claimed many advantages, consists of a self-heating soldering iron, heated by a combination of air and city gas, the air-blast being created by steam-power air pumps. The gas is conveyed through the building in pipes in the same manner as if for illuminating purposes, and the air is similarly carried, but in different pipes from the gas. The combination of air and gas is made at the operator's bench, and is also regulated at that point. The soldering irons, one form of which is shown in the accompanying illustration, consist of a hollow



Wagandt's Soldering Iron.

handle to which is attached the copper, the flames passing through the hollow handle and striking the back and sides of the copper. At the further end of the handle, as shown in the cut, there is a rubber tube attached, which allows the iron to be used in any position desired. The manufacturers state that this system is used on all kinds of work, from small toys to large galvanised work, in can factories, etc. It will be seen that there is no time required to start the system, it simply needing to be lighted. There is said

to be absolutely no danger from fire, and it can be used without skilled labour. Another point to which reference is made is the saving in coppers, due to the fact that the copper only is renewed and the iron handle does not have to be replaced. The flame strikes the back and sides of the copper and so prevents excessive wear on the point.

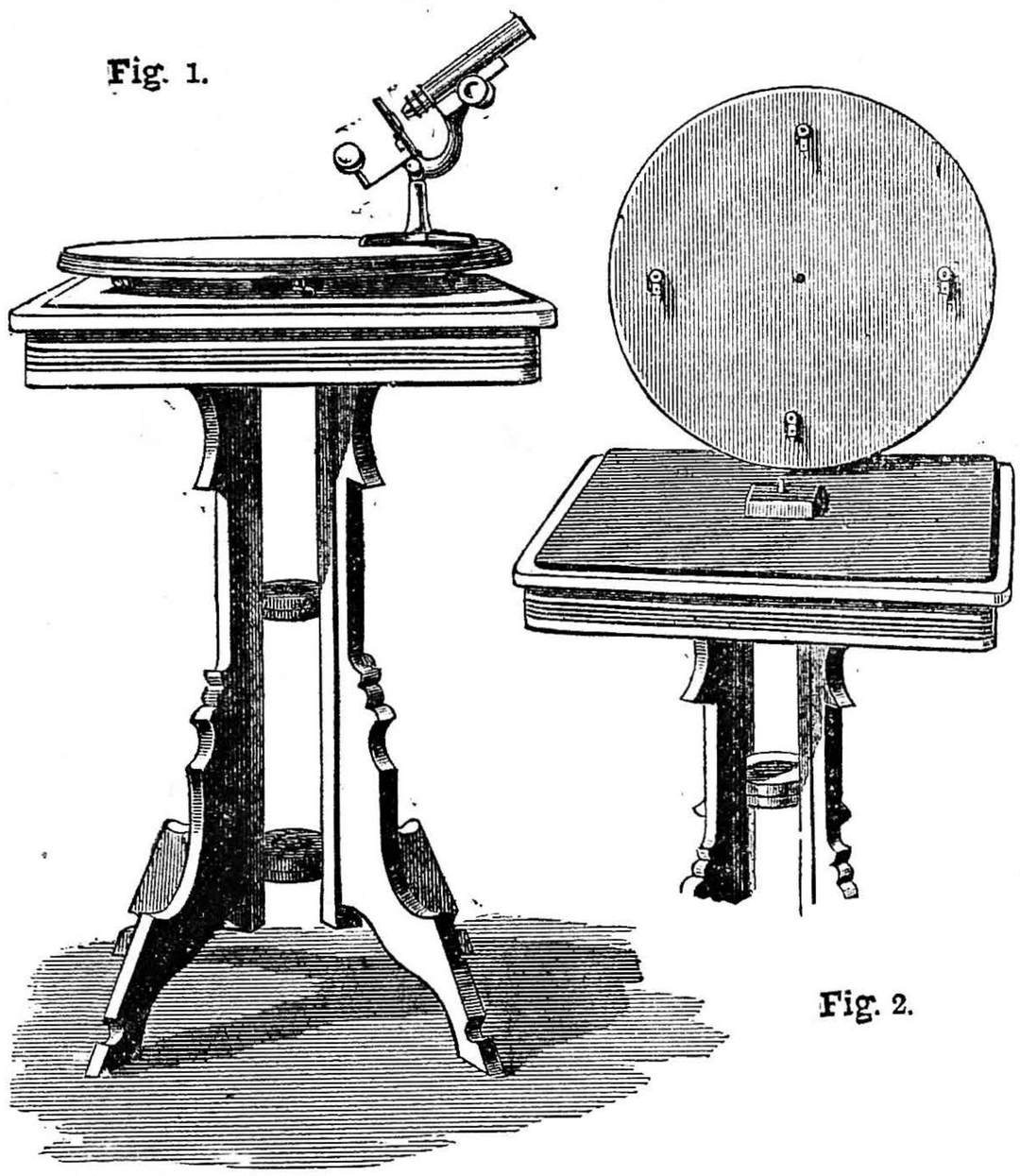
REVOLVING TABLE FOR MICROSCOPISTS.

BY F. S. MORTON.

THE readers of WORK who have a microscope will bear me out in the assertion that it is almost useless to attempt to entertain a company of friends with the instrument for an evening without a revolving table, or some substitute therefore. It can be done, of course, but the aching joints and dizzy heads of the party at the close of the exhibition are uppermost in the mind, and the wonders they may have been shown are forgotten in the thoughts of what a hard job it is to "look through the microscope." Revolving tables are sold by all dealers in microscopical supplies, but they are expensive luxuries; and even if the matter of expense does not have to be considered, there are not many who have room to stow away such a large piece of furniture when it is used so seldom. The following description and illustration will show how a revolving table may be made by anyone at a little expense, and one that will take up but little room when not in use. The secret of how these two results are both reached is that only a top is made new, any stand or small table answering for a support for it. Fig. 1 shows the table top on a small fancy table, with the microscope in position ready for use.

Get a small round table top sawed out, about 18 in. in diameter, and about 1 in. in thickness. Soft wood will do just as well as any, and will be a great deal easier to work on. If one is fortunate enough to live in the vicinity of a wood-worker's shop where such work is done, a small top like this can be procured at a very small expense, as it can generally be sawn from the board. If two boards have to be glued together to get the requisite width, of course the expense will be more. The edge should be moulded, or at least carefully smoothed off, so as to look well. Next procure four small castors at the hardware store. These are always kept in stock in various patterns, and the style best adapted for the purpose will be seen as soon as the work is begun. Castors with wheels ½ in. or ¾ in. in diameter will be plenty large enough. The bolt to which the truck frame is attached is generally much longer than can be used for the purpose, so it must be cut off, so that about ¾ in. will be left to go into the wood. Now fasten these castors on the under side of the round board, about two inches from the edge, and at equal distances from each other. Fig. 2 shows their position on the board. Adjust the trucks so that the four will all rest on the top of the stationary table, so there will be no tipping of the upper and revolving top. If there is any difficulty in adjusting the castors, use only three of them equally distant apart, and then any little inequality will not show.

Next cut a piece of thick millboard, such as bookbinders use, the same width as the revolving table, but square instead of round. In the exact centre of this fasten a block of wood, and into that drive a smooth piece of ¼ in. iron, allowing it to project about an inch above the top of the block. The thickness of the block will be regulated by the height at which the castors bring the table from the one below it. There should be about a quarter of an inch between the top of the block and the under side of the table when the latter is in place. In the centre of the round table now bore a hole from the under side nearly, but not quite, through to the top. Drive into this hole a piece of brass tubing large enough to fit on over the iron rod just fastened into the block on the millboard.



Revolving Table for Microscopists. Fig. 1.—Table Complete, showing Microscope in Position. Fig. 2.—Under Side of Table, showing Castors and Pivot.

The table is now ready for use, and the method of using it is as follows:—Place the millboard on top of a small table, the block and pivot coming in the centre. Drop the round top down over it, the pin entering the socket in the centre. This pin acts simply as a pivot on which the table revolves, and must work perfectly free. If this and the castors are rightly adjusted, it will be seen that the table will revolve very easily and freely.

The top should be varnished to keep it from warping, and if looks are an object, it should be stained or polished also. A second piece of wood may be used in place of the millboard, although the latter is very much lighter, and answers every purpose. If the trucks make much noise in running over it, a circle of felting can be glued on the track over which they run. I think the microscopist will find this table a perfect substitute for the regular revolving table, and it is certainly much less expensive, and can be made by anyone. Microscopists might inform their friends of it.

TRADE: PRESENT AND FUTURE.

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

RAILWAY MATERIAL TRADE.—In Sheffield inquiries for railway springs, wheels, tires, and axles are numerous. Good orders have been received from abroad, notably one from the Madras Railway Company for a large quantity of spring and cast steel.

COAL TRADE.—Sheffield coal trade prices are unchanged. Home manufacturers' sorts very slow of sale, shipping quiet, London lines dull, house coal an improved market, gas coal and coke in moderate request, and small stuffs a fair sale. The West Yorkshire pits are working less than five days per week.

SILVER TRADE.—Complaints as to overstocking in the sterling silver and electro-plate industries are ceasing. The renewed activity in this branch of Sheffield trade tends to show that stocks have been reduced, and better business may be expected for Christmas and the New Year. Already, indeed, there is a distinct revival in the silver trades.

TIMBER TRADE.—Recent sales in London consisted of Baltic and Canadian planks, deals and battens, floorings, matchings, etc.; also a lot of pitch pine and Dantzic timber, and some mahogany, cedar, rosewood, and other kinds of furniture wood. Among the prices realised, the following may be mentioned: 1¼ in. 1st yellow flooring, 12s. per sq.; 1 in. ditto, 8s. 3d. per sq.; ⅞ in. ditto, 6s. 9d. per sq.; 3 in. by 11 in. 1st pine, £28 15s. per standard; 3rd ditto, £9 per standard; 3 in. by 9 in. 3rd yellow deals, £12 15s. per standard; 3 in. by 11 in. 1st white deals, £11 10s. per standard; 3 in. by 9 in. 2nd white deals, £7 15s. per standard; pitch pine timber, 50s. to 56s. per load; Dantzic, 35s. to 63s. per load; mahogany, 3½d. to 1s. 2d. per foot; American walnut, 1s. 8d. to 3s. 7d. per foot; rosewood, £5 to £5 10s. per load.

FILE TRADE.—File makers are very quiet, but the home trade in files is improving.

MINERAL TRADE.—The following prices are now ruling at Liverpool: Sulphate of Baryta, "Angel White" No. 1, 70s., No. 2, 60s. to 65s., No. 3, 45s.; pumice-stone quiet; emery stone, best quality in demand, No. 1 lump, £5 10s. to £6, smalls, £5 to £5 10s.; fuller's-earth quiet, best lump, 55s., fine ground, £7, "Emerald" brand, ground, 80s.; plumbago, Spanish, £5, Italian and Bohemian, £4 to £12 per ton, "Founder's," £5 to £6; Blackwell's "Mineraline," £10; French sand, 22s. to 22s. 6d.; ground mica, £45 to £50; China clay steady, common at 18s. 6d., good medium, 22s. 6d. to 25s., best, 30s. to 35s.

IVORY AND PEARL TRADE.—Most of the ivory and pearl cutters in Sheffield have full employment. Bone cutters are also better employed. The Liverpool ivory market prices are high. Medium teeth were £2 dearer; Angola, £42 to £46; Gaboon, £42 to £46; Lagos, £48; Cameron, £46 10s.; West Coast Africa, £46 10s.; Congo, £44: all per cwt.

SHIPBUILDING TRADE.—A very small amount of new work has been secured by the Mersey shipbuilding firms, while at Barrow new orders are scarce.

STEEL AND IRON TRADES.—These trades in Sheffield remain unchanged, and the prices for hematites and Bessemer are unaltered. A new company, with a capital of £200,000, has been formed to manufacture steel by a new process, which is said to be much more economical than any now in use. The orders for machinery have been placed. Only a small business is being done in the Lancashire pig-iron trade, and prices exhibit a downward tendency. For steel plates of boiler-making quality prices of £6 15s. to £6 17s. 6d. are ruling; for common tank plates, £6 5s. and £6 2s. 6d. are usual rates.

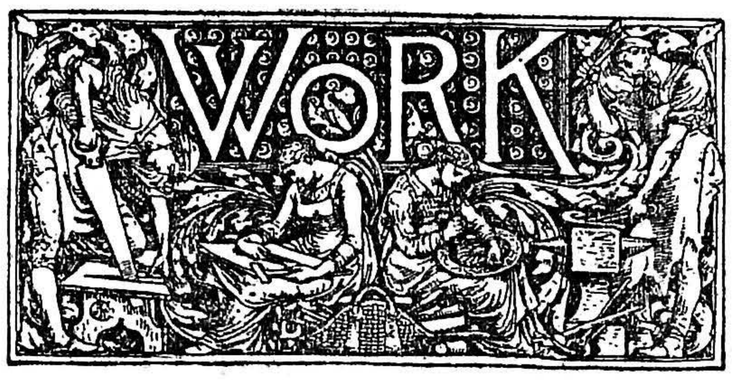
FLANNEL TRADE.—This is beginning to feel the effects of the crisis in the cotton trade, though, at present, the look-out is nothing serious, there being a good number of orders on hand, and most of the mills working full time.

NOTICE TO READERS.

NEXT week's WORK (No. 191) will contain, among other illustrated papers, the following:—

THE WAY FRENCH SABOTS ARE MADE.
HOW TO LEARN DRAWING OFFICE WORK.
HOW TO MAKE A SIMPLE COIN CASE.
SHOP CANDLESTICKS AND TALL-BOYS.
ELECTRIC TRICYCLE.
CARPENTRY FOR BOYS.
DESIGN AND DECORATION OF ALL AGES: CELTIC AND SCANDINAVIAN.

*** The Editor makes this intimation in the hope that readers, having friends interested in any of these subjects, will bring the same to their notice.



is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

(Sent post free to any part of the world.)

3 months, free by post	.. .. ..	1s. 8d.
6 months, "	.. .. ..	3s. 3d.
12 months, "	.. .. ..	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.

*** All letters suggesting Articles, Designs, and MS. communications for insertion in this Journal will be welcomed, and should be addressed to the Editor of WORK, CASSELL and COMPANY, Limited, London, E.C.

NOTICE.

WORK correspondents are wanted in every Town.

VALIDITY OF BRITISH PATENTS.—Probably the most glaring defect in the British system of granting patents is found in the fact that novelty is not insisted upon in the inventions protected. In point of fact, the office will take fees from two or more inventors for precisely the same invention. Moreover, patents are freely granted for physically impossible inventions—perpetual motion and the like. In America and Germany a search of the records of previous inventions is made before a patent is granted, and unless the invention possesses novelty and utility a patent is not granted. The granting of a patent under such conditions becomes a guarantee of novelty and validity. A movement for rectifying this evil in connection with British patents is being made, and it is expected that an effort will be made to establish a system of preliminary examination, whereby an applicant may have the option, on payment of a nominal fee, of obtaining a report by an official examiner upon the question of the novelty and validity of his invention. This examination would not preclude the applicant from making private searches, either himself or by his agent. The putting in force of this system would involve the employment at the Patent Office of competent engineers and other experts; but there is little doubt that these could be found at salaries not exceeding those now paid to the present examining clerks. It is to be hoped that some measure of this sort will be laid before the next session of Parliament.

FOREIGN *versus* ENGLISH TRADE.—A comparison with the Continental and American iron and steel trades shows that our rivals in business do not suffer equally with ourselves. In Austria the iron market continues favourable. Belgium, where trade is but poor, shows an increase of 70,424 tons of pig iron manufactured in excess in the year 1891. From France we gather that business is dull, but that rates are steady; in Germany there is no alteration, the recent improvement being maintained; in Spain the imports have declined, but there has been a development of exports during the first seven months of 1892 to the extent of 44,841 tons; and in America the iron trade is fairly steady; while in England there has been a "slump" in the steel trade equal to 19·3 per cent., and in pig iron of 24·9 per cent.

MIND AND MINERS.—It is a curious thing, but the physical gloom that miners spend their working hours in does not seem to have in any way communicated itself to their mental vision. On the contrary, they appear to see much further ahead than any other section of the working classes. Only just now is labour in general awakening to a sense of the importance of political power. The miners, however, have awakened to that sense long ago. So far back as 1874, when, as yet, there was no labour movement, the miners of Northumberland had a paid representative in Parliament, and the miners of Northumberland now work less than eight hours a day without any compulsory Act of Parliament. In the present Parliament the miners have at least six paid representatives forming the bulk of the labour members, and pledged to the miners' programme. Has any other class of workman a representative? Not one. Of course, there is an explanation for this as there is for everything. Miners are all congregated round about the mines in which they work, and as a consequence their voice in these districts is the preponderating voice. Still, the fact that the voice is united is an indication of discipline and mental activity. Cheers for the miners!

ELECTRICIANS' COMPETITION.—It will be no surprise to our many thousands of subscribers to be informed that the subject of electricity is one which commands the interest of a large section of readers of WORK. The leading subject of this scientific age, it has a world of students and workers, who are constantly concerning themselves in tests and experiments in order to extend and develop the possibilities of the old-age element—the most remarkable development of which has been its sudden advent as an illuminant for public and private purposes. Its prospects and possibilities do not, however, end here, since in the near future there must be a great region opened to it as a motive power both on land and water. The interest of the subject being, then, assured, we have every justification in devoting one of our prize competitions to a matter which cannot fail to be interesting to our readers and the public at large. As will be seen from another column, we offer three prizes for the best suggestion for the application of electricity to some useful domestic, commercial, or scientific purpose. This, doubtless, opens up a very wide field; but as the suggestions will need to be original, and will be adjudged according to their practical value and prospective utility and adoption, the range which land, sea, or air may afford may not, after all, prove unwelcome. We shall hope to find that the competition will elicit some interesting ideas which, if they do not succeed in gaining prizes, may yet be worth publication. Young readers as well as old may engage in this competition, and there is no reason why every schoolboy should not make a bid for the prizes—the subject of electricity being one upon which boys are, we know, especially keen.

FORTUNE-TELLING MACHINE.

BY P. B. H.

INTRODUCTION — THE REVOLVING CARD — THE REASON FOR IT—DESCRIPTION OF MECHANISM—THE METHOD OF BALANCING COIN RECEPTACLE AND OPPOSITE END OF LEVER—SHAPE OF COIN RECEPTACLE—THE METHOD OF WORKING THE SAME — AN ALTERNATIVE METHOD OF DRIVING BY CLOCKWORK—THE METHOD OF TAKING MONEY OUT OF THE BOX.

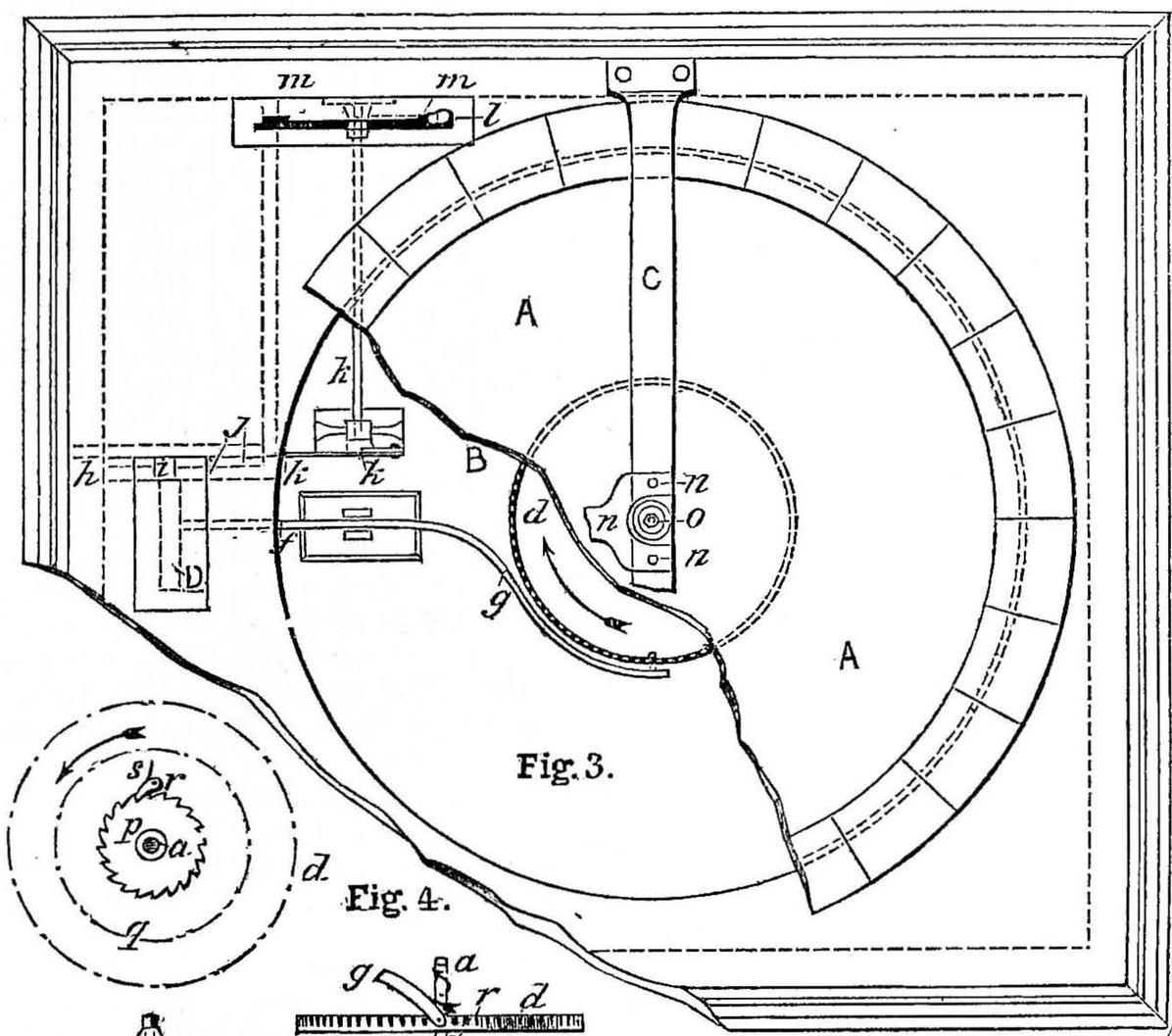
"AMATEUR" writes saying he possesses a metal balance and fortune-telling card, and asks for some arrangement for working them by dropping a penny in a slot. As a description of such a machine would be far too long for the space at disposal in "Shop," I am writing the answer as an article for the benefit of any reader of WORK who may desire to go into the fortune-telling line.

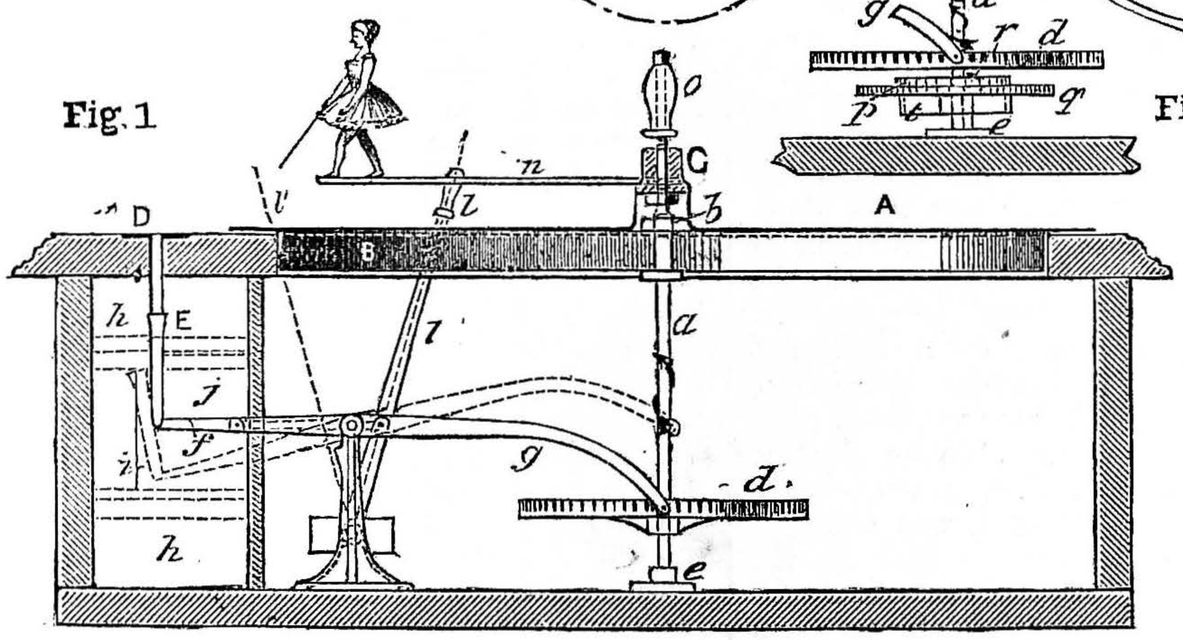
I am afraid, however, that no suitable arrangement can be fitted up that would work satisfactorily by the weight of a penny only, as "Amateur" desired. In all penny-in-the-slot machines the weight of the penny only releases certain mechanism, which then permits, on the application of some other outward force, certain internal actions to take effect: thus, the weighing machine is worked by the weight of the person weighing him or herself; the sweets, matches, etc., are obtained by drawing out the drawer after having dropped in a penny, which releases the bolt that before prevented it being opened, and the pushing back of the drawer relocks it, not the penny which had been inserted.

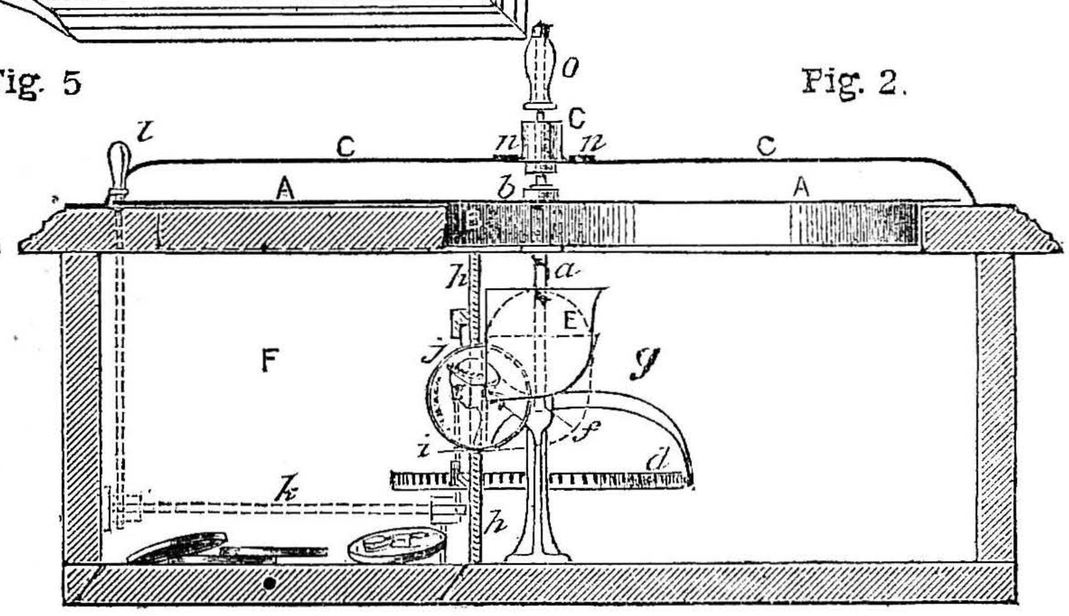
I would suggest some such an arrangement as shown in Figs. 1, 2, and 3, where the penny, dropped into a slot, releases the wheel, and allows each person to turn the card for him or herself. I should make the *card* revolve for several reasons: the principal one is, that it would run more smoothly and with much less friction, and therefore much longer than the figure, which I should have fixed, as shown in Fig. 1, pointing to the card in front of the box. Thus, the fortune always appears in one place, where it can be easily read; whereas, in the case of the *figure* revolving, the box would often have to be turned round when wanting to read the fortune, as the figure would not always stop in the front of the box.

I will now proceed to describe the mechanism. The fortune card, A, should be pasted to a circular piece of moderately heavy wood, B, through the centre of which passes a spindle, *a*, provided with collar and nut, *b*, for holding the same. It is carried in footstep, *e*, on the bottom of the box, and held in a vertical position by the bridge and boss, C, through which the spindle, *a*, passes, and to the top of which latter a small handle, *o*, is fixed for turning the same, together with the card. On shaft, *a*, just under boss, C, a loose collar is fixed, to prevent the shaft being lifted out of the footstep, *e*, while below a toothed wheel, *d*, is fixed to it, the use of which can be easily seen. D is the slot through which the penny is dropped into the receptacle, E, which, from the extra weight of the penny, falls together with the end of lever, *f*, to which it is fixed, the other end, *g*, rising to position shown by the dotted lines, releasing the toothed wheel, *d*, and thus allowing spindle, *a*, together with the card, to be rotated. The lever, *f g*, is carried by a fixing from the bottom of the box; this fixing has a snug cast on on the left-hand side, near the top, so that the lever, *f*, will not fall below the position shown by the dotted lines, as in that case the copper would not fall through the slot, *i*. I may here state that the end, *g*, of the lever must be so much heavier than the end, *f*, together with the *empty* coin receptacle, that when this latter is empty the end, *g*, must drop down by its own weight, thus allowing the small pin in the end to engage in the teeth of wheel, *d*, and thus prevent any rotation of the card; and again, when the penny is put in E, *g* must rise out of the wheel. Thus the best plan, when making this lever, would be to make the two ends, *f*, *g*, balance when a halfpenny was in E. If they balanced with this amount in E, it is evident *g* would drop if the halfpenny were removed, and it would rise if a penny were inserted.

For the shape of the receptacle, E, see Figs. 1 and 2, the latter more particularly. Its diameter should be rather larger than a penny; the left-hand side of it (see Fig. 2) should be open, the end, *h*, of the money-box, F, alone keeping the coin in its place, and the lower portion should slope downwards to the left, so that if the slot, *i*, were not closed, the penny would roll into the box, F. In order that the machine may work correctly, the opening, *i*, must be able to be closed or opened at will. This I have arranged for by making the shutter, *j*, movable sideways over the opening, *i*, by means of connecting rod, short lever, and shaft, *k*, inside box, all worked by the long lever, *l*, centred inside but projecting outside the box, and movable in a brass slot, and held in position at either end by making it spring into the recesses, *m*, *m*. The figure is carried on the end of a piece of sheet-brass, *n*, fastened to the bridge, C, by rivets or bolts, as shown plainly in plan (Fig. 3).







Fortune-telling Machine. Figs. 1 and 2.—Sectional Elevations. Fig. 3.—Plan: Part of Card removed and Figure. Fig. 4.—End View of Shaft, *a*, looking from Below. Fig. 5.—The same View as Fig. 1.

I will now explain the working in this, its simplest form. Suppose lever, *l*, were in position shown in drawing, and a penny were dropped into slot, D, E would fall and *g* would rise, thus releasing the fortune card, but only for a moment, as the slot, *i*, with lever, *l*, in position shown, is not closed, so the penny rolls out into the money-box, F, and E rises again, while *g* falls into position as drawn, the persons thus losing their money. This is so that anyone attempting to take an unfair advantage not only loses his money, but his fortune as well. In order for it to work properly, the lever, *l*, must be pulled back into position, *l'*, this action closing the slot, *i*, by sliding the shutter, *j*, in front of it. If a penny were inserted now, E would fall as before, and *g* would rise and remain up till the penny is released. The card can now be turned by means of the handle, *o*. The fortune having been told, the lever, *l*, is put forwards: the shutter, *j*, at the same time slides back and the penny falls out,

when E rises and *g* falls, thus blocking the mechanism till another penny is inserted.

A good plan would be, instead of allowing people to lose their pennies by placing them in D while lever, *l*, is in its forward position, to arrange a shutter to cover slot, D, worked by lever, *l*, when being moved from *l'* to *l*, and to open it, on the motion being reversed.

Should it be more preferable to drive the card by clockwork, it might be arranged as shown in Figs. 4 and 5, where I have redrawn the bottom portion of shaft, *a*, with wheel, *d*, footstep, *e*, and end of lever, *g*, just as in preceding figures, and lettered the same parts with the corresponding letters. I have redrawn them in order not to create any confusion in the first three figures. Fig. 4 is an end view of shaft looking under wheel, *d*; Fig. 5 is the same view as Fig. 1. Suppose the shaft to rotate in the direction shown by the arrows, as this is the most convenient. On the boss underneath wheel, *d*, cast or otherwise, fix a ratchet-wheel, *p*, with teeth inclined as shown in Fig. 4. Thus, if *d* were turned, *p* would also turn, and if *p* were turned *d* would turn together with shaft, *a*. Close against ratchet-wheel, *p*, fit a spur-wheel, *q*, to which must be pivoted the pawl, *r*, held in position against teeth of ratchet-wheel by small spring, S. Get wheel, *q*, fitted with smooth drum, *t*, as shown in Fig. 5: this wheel must run free on shaft, *a*, so that if it were held, shaft *a* might revolve in the direction of the arrow, without hindrance, as the pawl, *r*, would slide over the teeth of *p*, but if turned in a contrary direction, the wheel, *q*, being still held, the shaft, *a*, could not revolve.

Suppose you had some clockwork, the last wheel of the train gearing into wheel, *q*, care being taken that *q* is driven in the direction shown in the drawing by the arrows. If you wound up the spring of the clock, *q* could not turn, as the pin in end of lever, *g*, holds *d*, which again holds *q* by the ratchet-wheel. Drop a penny in machine; then lever, *g*, rises and releases *d* and *q*, and the clockwork now drives round the whole apparatus, together with card. You will, if no other means are available, have to wait till the spring unwinds, which would be very tedious. In order to prevent this long delay, I would suggest that by means of a second lever (similar to *l*) placed on the *right-hand* side of the box, a brake be applied to the drum, *t*, on wheel, *q*; by this means the clockwork might be stopped gently without the spring running down, at the same time allowing the fortune-telling card to whirl round till stopped by friction alone, as the pawl, *r*, would allow it to turn in that one direction, though wheel, *q*, were still. In the case of clockwork, great care should be taken that lever, *g*, does not fall while the wheel, *d*, is revolving rapidly, as the pin or something else would break. I should strongly advise the use of the simpler method.

I have shown the method of getting the money in the box. It can be got out by making a door to open sideways or downwards, or the bottom might be cut out with bevelled ends, as shown (Fig. 2), being hinged centrally by a pin passing through it. You have only to lift the right-hand end with your finger, and the coins will slide out.

To clean Indian brass-work, first rub all over with some lemon juice, then scrub well with soap and hot water. Dry with a cloth, and then rub and polish with a chamois leather.

BRITISH WORKS AND INDUSTRIES.

NEEDLE MAKING.

WIRE BURNISHING—HARDENING—TEMPERING—SCOURING—HANDING—GRINDING, SETTING, AND CURING—FINISHING—CALYX-EYED NEEDLES—WRAPPING—CONCLUSION.

WHEN we left our needle it was roughly made, but nothing more. Let us trace it through its later stages.

Wire Burnishing.—The rudely-formed needle of early days was necessarily rough in the eye, and must often have cut the thread, to the no small mortification of the seamstress; and as much as a century ago we find ingenious men bringing forward inventions to remedy this defect. The origin of the system of wire burnishing before us is to be found in a contrivance by one of the Morralls, of Studley—a name long connected with needle making—which was patented more than fifty years since. The needles are threaded on fine wires which are slightly roughened, so as to give them something of the quality of a file. The wires, fixed by their ends to uprights, are stretched across a kind of table, the top of which can be worked backwards and forwards by a crank. This causes the needles to swing and dance wildly from side to side, and they are made to continue this violent exercise for some forty minutes. However salutary it may be for the eyes of the needles, the spectacle of a shop in which whole ranks of burnishing machines are going at the same time is to the human eye decidedly bewildering. The result of this process is to wear the aperture smooth on every side.

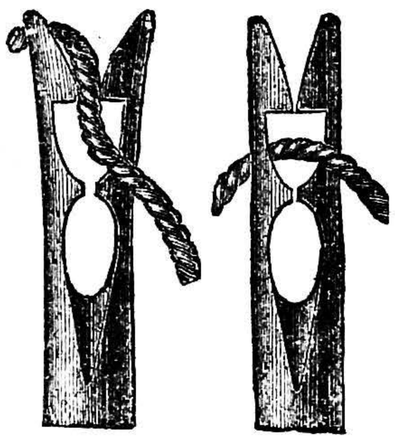


Fig. 7.—Calyx-eyed Needles.

Hardening.—Hitherto the steel of the needle has been quite soft. The processes which it had to undergo could be best performed while it was in that state. It now has to be hardened. The hardening of all steel implements is essentially much the same—they are heated to a high temperature, and then cooled by plunging them suddenly into some cold fluid. For hardening needles, much skill and judgment are required, and a good hardener can often earn an income which might move the envy of many a professional man. In former times it was usual to harden needles in water, but far back in the present century it was discovered that oil was far less liable to render them crooked. The best cod oil is used for the purpose. The heated needles are slid into the vat of oil on a kind of sieve, and as they are at once cooled, they are lifted out almost immediately by raising the sieve. They have to be washed with soapsuds and dried with dust.

Tempering.—The needle is now hard, but brittle, and to make it tough and elastic it must be tempered. The old way was by exposing to a low heat in a furnace, and then allowing of a gradual cooling. The larger varieties of needles are still treated thus, but a gas flame is used for ordinary sewing needles. The Messrs. Milward have a patent arrangement peculiar to themselves, and it is not one of the least beautiful of the many admirable pieces of mechanism in their mills. An endless band of wire gauze carries a continuous stream of needles through a gas flame, and delivers them, tempered, on the other side.

Scouring.—As yet the needles are black, rough, and unsightly—they have to be scoured. A quantity are laid in a strip of canvas with emery, oil, and soft soap (though I believe the so-called emery is more properly powdered quartz). This delightful mixture when rolled up, tied at the ends, and bound with twine, has a certain resemblance to a roly-poly pudding, only perhaps a little longer and not quite so thick. In the scouring mills (see Fig. 6) are solid tables, known as "runner benches," on which heavy wooden slabs, called "runner blocks," are pushed backwards and forwards by cranks. A roll of needles is placed under each end of a runner block, and the runner is set going. The needles pressing against and rolling over their fellows in the revolving bags are mutually helpful in scouring each other, and the friction is kept up on an average for some nine or ten days, the rolls being occasionally taken out and opened for the addition of more moisture. As the process proceeds, the grit applied is finer; and towards the end, after a washing with soapsuds, putty-powder (oxide of tin) is substituted for the emery. The so-called emery gives a scratchy white surface, but the putty-powder produces that beautiful dark gloss known in the trade as "colour." Scouring is succeeded by a thorough washing.

Scouring, as thus described, is no recent introduction, and formerly it was chiefly carried on by water-power. The Washford Mills, which give name to the Messrs. Milward's Works, were originally water-mills on the neighbouring river, Arrow. But steam has become the ordinary scouring agent, and the above-mentioned firm have now transferred their scouring operations to their factory in the town of Redditch.

The rough treatment undergone by the needles in this process causes many to be broken, bent, or otherwise injured; there is also danger of the entire roll heating, and thus becoming spoiled.

Handing.—From their troubles in the scouring mill, the needles come in a state of apparently hopeless tangle and confusion; but the ease with which they are straightened in skilled hands—by a few shakes in an iron pan and a touch or two with a trowel—seems almost magical to an outsider. They now have to undergo a careful sorting for the removal of such as are blemished. This is the work of women. Each needle has to be taken separately under the finger; but practice makes the sorter expert, and she will get through a packet of No. 10's, containing some 68,000, in a couple of hours.

It should be noted that through the earlier stages needles are apportioned in packets of 50,000 or upwards, and pass from shop to shop carefully labelled. This is to prevent their getting mixed with needles of other sizes.

In the later and lighter processes, many expedients for economising labour strike the visitor to the Washford Mills as noteworthy: as, for instance, the means by which all the needles in a packet are brought to lie with their heads in one direction, and their points in another. The ends of a row of needles lying promiscuously are pushed over the edge of a table; those of which the points project remain where they are, but those of which the heavier heads project fall to a ledge below, where they all lie in one direction, and the separation is complete.

Another simple, yet most ingenious, contrivance is the "handling machine." Though in every packet of needles the wires were originally of precisely the same length, some are sure to become shorter than others in the process of grinding. The difference will not be great: an ordinary observer might not notice its existence; but the trade requires accuracy, and each length in the size has its own particular use. The old mode of separation was to raise the longer needles from among the shorter by pressing them at the ends between the palms of the hands; hence the term "handing." The machine which is to be seen doing this work at Messrs. Milward's has a wheel with transverse grooves on its face, which takes up the needles from a hopper, and as it revolves the ends of the longer ones come in contact with a small stud, which throws them off, and they are shot down a spout to their proper receptacle; a second stud, set a little more closely, shoots off the next length down a second spout; and so on with the others.

Not less interesting is the automatic counter. This, like the last machine, has a grooved wheel which takes up the needles. Each of these in passing through moves a cog-wheel, and this motion is transmitted through other wheels to the hand of a disc; the number that have passed is thus indicated. A check in the machinery

calls attention to each completed thousand. This instrument is chiefly employed to divide the large packets into dabs of 2,000 each, for convenience in after and lighter processes.

Grinding, Setting, and Curing are terms, the first of which is applied to rounding off the heads, and the second to sharpening, and at the same time rendering slightly more obtuse, the points, on a small grindstone; the last means removing from the countersink of the eye any possible sharpness that may remain. The curing apparatus is a little cylinder stuck full of pin points and revolving rapidly, against which the eyes of the needles are held.

Finishing is giving a final polish to the implement. A revolving cylinder, covered with buff leather, dressed with a polishing composition, and driven at a high speed, gives the required finish to the needles which are pressed against it. The finishing of ordinary sewing needles is, at the Messrs. Milward's Mills, done by a machine invented by a member of the firm. In this, three or four times as many needles are finished in a given time as could be turned out if they were held to the buff by hand. Small rollers, covered with rubber, receive the needles from a hopper, and press them against the buff, giving them, as they do so, the lateral revolution needed to enable every side to be polished alike; the finished needles are then carried forward to the receptacle which waits for them.

Calyx-eyed Needles.—Before leaving the subject of needle making, a word should be said of this patented speciality of the Messrs. Milward's, and upon which they appear to look as, possibly, the needle of the future. The different schemes brought forward from time to time to facilitate so small a thing as the threading of a needle might furnish subject-matter for a volume. At the present time there are two self-threading needles (so-called) in the market: one, made at various Redditch factories, which threads through a slit at the side of the eye, and this, which threads through its top. It is claimed for the calyx-eyed needle that it can be threaded with ease in the dark. The form of its head is shown in Fig. 7. Also in the figure may be seen the method of threading it by pressing the thread through the nick at the top, and the needle as it appears when threaded. Of the two eyes, the upper one only is for the thread. The lower one, connected with it by a slit, is merely to allow the sides of the head, which act as springs, to have sufficient play; a single long eye would have given the thread too much liberty.

The making of these needles calls for especial care throughout. For the eyes, the hand stamp only is used. The slit is cut by a delicate revolving saw, the needles being fixed in ranks for that purpose: the dainty little automatic machine which does this is one of the most interesting sights of the Washford Mills. To ensure due elasticity in the sides of the head the steel needs to be tempered with the nicest skill. That these must cost more than ordinary needles is therefore a necessity.

Wrapping.—Formerly it was usual merely to fold up the needles loose in little packets, but at the present day it is usual before wrapping to stick them upon cloth. The method of sticking them is ingenious. Down the centre of a long strip of paper a narrower strip of cloth is gummed by its two sides only, the middle being left loose; this is known as a "strap." A small steel band is pushed along the opening between paper and cloth, and a narrow line of cloth is thus made to stand up in relief from end to end of the strap, through which the needles can readily be thrust. The work-woman has a small, flat, topless, metal box, in which she places a set of needles with the points projecting. The set is generally 10, 12, or 25, and there are automatic machines for counting out the needles in assorted sizes or otherwise. The box holding the needles in an even row, the work-woman can push them all at once through the cloth, and she then rubs them home with the side of her box. Spaces are left between the sets, and through these spaces the strap is afterwards divided with scissors.

The portions cut off are then enclosed in the well-known wrappers of purple paper, which have already been cut to size, and creased ready for folding by machines for those purposes. It may be interesting to mention that the use of purple wrappers for needles did not originate in any arbitrary fancy, but because this paper would, by turning red, reveal the presence of any acid likely to cause rust.

The packets, when labelled, are stored in heated rooms. This is to obviate, as far as possible, all danger of rust through dampness; for rust is the great enemy of the needle.

Conclusion.—In what has been said above little more has been done than to give a sketch of the manufacture of the ordinary sewing needle. But there are other needles, of which Redditch produces a vast variety—as sewing-machine, sail, surgeons', packing, darning, tambour, embroidery, and many more—to describe the making of all which would take far too much space. In the needle capital and its district some 20,000 persons live by the needle trade and its minor allied industries. As a class, the needle makers are respectable, intelligent, and well-to-do; crime and poverty are rare among them. The heavier and rougher parts of the work are, of course, done by men, but of the workers in the factories the great majority are females, manual quickness and patience being rather demanded in most of the processes than strength; thus the mother and her girls often do more towards the support of the family than its head.

The needles made in Redditch are sold in every part of the globe. There are before me estimates of the entire annual and daily outputs of the district. The figures are startling, but as they appear to be based on no very certain data, I forbear to give them. It may, however, be mentioned that Messrs. Milward's alone produce something more than a million each working day.

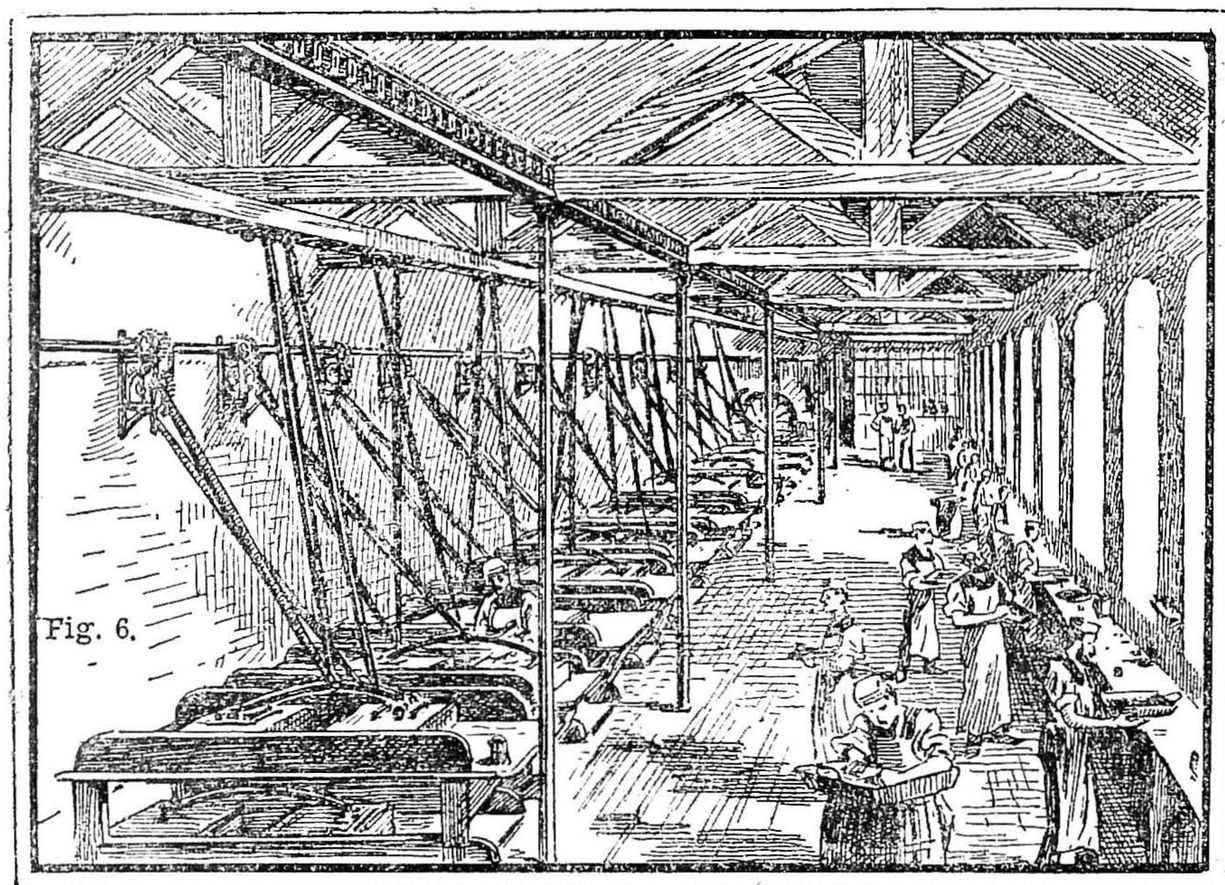


Fig. 6.


Fig. 8.

Washford Mills. Fig. 6.—Scouring Room. Fig. 8.—Eyeing Room.

It is believed that the world's population is increasing at the rate of nearly 6,000,000 a year, and that it is, at the present time, about 1,480,000,000.

According to Professor Roberts-Austen, gold passes from the liquid to the solid state at 1,045° C. (= 1,913° F.), and palladium at 1,500° C. (= 2,732° F.).

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.*

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

I.—Letters from Correspondents.

Arithmetic.—F. B. C. writes:—"Student, in his problems on p. 364, No. 179, has transposed his A's and B's in both cases. They should have been written:

A	99,992-B	A	3,692-B
A	29,999	A	1,000
B	70,000	B	8,999
A	00,007	A	0,101
B	99,992	B	9,898
Total ..	299,990	Total ..	23,690

In working this, use is made of the facts that 9 is one less than 10, 99 one less than 100, and so on. In adding together rows of 9's, the answer must be the number of rows followed by as many 0's as there are 9's in the row minus the number of rows. Thus:

	9,999
999	9,999
999	9,999
2,000−2	30,000−3
which is 1,998	which is 29,997

In our problem the unit (2 in the cases above) B places in the first row is the same number as times that A and B intend now to add lines. Leaving for a minute the first line, examine the others. Whatever A puts down, B follows with a row which, added to A's, makes all 9's. Thus:

29,999	00,007	1,000	0,101
70,000	99,992	8,999	9,898
99,999	99,999	9,999	9,999

We see, then, that in both sums the last four lines are the same as if they were only two lines, but all of 9's, and B has only to mentally add together two lines of 9's. We have seen that to do this he has to take the number of lines of 9's (in both cases here it is two), and add as many 0's as there are 9's in the row—thus, 200,000 and 20,000 in each sum respectively—and then take away from these results the number of lines of 9 added; but this figure he has purposely added to the first row, and may, therefore, ignore it both here and there. The answer will always be the first row of figures with the added unit transposed to the other end of the row and a nought put in its place; thus: A puts down 9,999, to which B adds 2 as 99,992; answer will be 299,990."

A Big Band-saw.—A Correspondent writes:—"Messrs. T. Robinson & Sons have completed a monster band-sawing machine, which they claim to be the best machine for heavy work which has yet been made. The Gloucester Wheel and Waggon Company ordered a machine capable of cutting oak logs from 4 ft. to 5 ft. in diameter, and they sent up a log of 4 ft. in order to test the machine. This was done quite recently, and the result was in every way satisfactory, for, though the log was a rough curly tree 10 ft. long, the saw cut it through in three minutes: which certainly cannot be called bad work. The band-saw is 42 ft. long and ⅛ in. thick, and runs on wheels 6 ft. in diameter, the bottom wheel being the driving one. The machine altogether is beautifully made and fitted, and can be stopped instantly by a touch of a lever. The pulleys are fitted with ball bearings, thus reducing friction to a minimum."

Erratum.—On p. 369, No. 180, third paragraph, "boiler parts should be lubricated," etc., should read, "such cylinders should be lubricated," etc.

II.—Questions Answered by Editor and Staff.

Brickwork.—S. B. (*Haydock*).—You can obtain prices of brickwork from Laxton's or Lockwood's "Builders' Price Book;" but as you are, no doubt, aware that materials and labour vary in price in different districts, no book will give you exactly what you want. For any district you might get a list of prices from a builder in that district, or you may calculate it yourself in the following manner: Find how many bricks will build a yard of one-brick wall, or 9 in. thick. Then, if the cost of bricks be 30s. per thousand, one-tenth will be the cost of bricks in 1 yard, or 3s., if one hundred bricks build a yard. In the same manner the quantity of mortar may be found, and the labour by calculating how many bricks can be laid in an hour—which will vary according to the class of work. You will find a good deal of valuable information in the price books which will assist you in making your calculations. There are some articles on Bricklayers' Work in Vol. II. of Work, which will give you the methods of measuring different kinds of work.—M.

Boot and Shoe Repairing.—T. O. (*Harpurhey*).—Articles appeared in Work, Nos. 112, 117, 122, 126, 130, and 137, and are being continued.

Gilding Pier Glass.—Name-maker.—There are three chief methods whereby picture frames and similar ornamental woodwork are gilded. The cheapest class—known as "German gilt"—is cheap "white" metal, laid on in leaves, and coated with a yellow shellac lacquer, which brings the white to a gold colour. The other processes are known as "water gilding" and "oil gilding." Water and oil gilding mean that a gelatinous or an oil size is used as a means of affixing the gold leaf to the prepared surface. The former process is beyond the work of an amateur, requiring much preparatory knowledge of an experienced and practised nature. In Vol. III., No. 121, you may find a very condensed but able article on the water-gilding process. This article you should study, in any case. But, assuming you have a frame, previously gilded and now shabby, your best plan is as follows: First, well wash with a little warm soda-water, to remove dust and grease. Next coat it carefully with a finely strained and quick-drying coat of white lead paint. Stop all holes, etc., with a little white lead stiffened with whiting. Then coat all over with gilders' *oil gold size*, purchased, ready for use, at the oil and colourman's. If all is as it should be, you then stand the frame away where it will be free from dust and damp until the next day. It will then be dry, but "tacky"—*i.e.*, sufficiently sticky to make the gold adhere. The gold you purchase in books of twenty-five leaves; cost, about 1s. 3d. If you can use the gilders' "cushion and tip" (see article alluded to), well and good. If not, then buy transfer gold, and place each leaf against the size and gently press the paper at back with cotton-wool. After gilding, carefully dust off and coat with thin patent or clear size. Japan gold size is much used by the amateur and for trade gilding purposes, when the work has to be completed right off. It is a kind of varnish liquid, and dries fit for use in from fifteen to thirty minutes; but gilding on this is not nearly so good a job as on oil gold size. The best colour leaf for ordinary purposes is termed "extra deep." Liquid golds—viz., bronze powders in a solution of oil or spirit—are not to be compared to gold leaf. Either the nature of the solution takes all the brilliancy out of it, or else, if this is retained, it is at the sacrifice of the lasting qualities.—F. P.

Marbling.—H. T. R. (*Hamilton*).—To treat the subject of "painted imitations of marbles" in a *practical* manner will require considerable space; and Work does not "do things by halves." You must therefore wait until the requisite opportunity presents itself, and, meanwhile, get all the value you can from the various papers, dealing with other departments of the decorative trades, that you will find appearing in Work. The Editor is pleased to learn the "Trade News" and "Work World" paragraphs are valued so highly. Readers' letters and suggestions are, I know, always carefully considered and studied, with a view to increasing the usefulness and popularity of the paper.—London Decorator.

Plumbing.—Subscriber.—Our correspondent, who adopts the above *nom de plume*, wishes to know what constitutes a plumber, or, in other words, what kind of work they ought to undertake, and makes the extraordinary statement that it is not a trade at all, but simply an infringement on other trades, especially that of the whitesmith. He denies their right (and capability) to do hot-water work, bell-hanging, and spouting, and indulges in considerable criticism on the style and quality of the work. I will therefore endeavour to throw a little light on the matter, if possible; and while admitting that there is a deal of truth in his remarks, will try to show that plumbers are not so black as he has painted them. In the first place, things have altered very considerably since "Subscriber" entered the trade of whitesmith some fifty years ago. At that time the line of demarcation between trades was more rigidly kept. It was then quite as much as a man could do to learn and keep himself up in his own particular branch, and he could, if a good hand, always get work; but now, owing to the increased thirst for knowledge, and to the valuable aid afforded by such magazines as Work, it is easier to learn three trades than it was to learn one fifty years ago. Then, again, a man is often compelled, by force of circumstances, to do work that does not strictly come in his trade. Take, for instance, an ironmonger's shop employing, say, a whitesmith, plumber, and tinsmith. Now, each of these men will, at times, have two-handed jobs, and, as labourers are the exception and not the rule in ironmongers' shops, they will have one or the other of their fellow-workmen to assist them. This, naturally, gives them an insight into each other's work, enabling them, on an emergency, to supply their place; and if they "chum" well together, they impart to one another useful hints and valuable information; and just in proportion to the extra knowledge they acquire, so much the more valuable do they become as mechanics, whether in that situation or another. I am writing from actual experience, so I know what I am talking about. With regard to bath and hot-water work, I do not know what a master plumber would say to a man who applied for a job and said that he knew nothing about it. Respecting bad work of this class, I am prepared to prove that for one bad job done by a practical plumber there are a dozen botches made by whitesmiths and others who attempt plumbing work—in the South of England, at any rate. As the plumber was originally the man who fitted up all the water-pipes of a house when they were of lead, it is quite natural that he should not like to be shut out from the work simply because of a change of material. Whitesmiths certainly cannot carry out bath work with satisfaction, as they cannot make the wiped joints which necessarily occur in all good work. At the same time, I do not cavil at their doing it, if they can. With regard to spouting, I think most plumbers consider that class of work *infra dig.*, and leave it to tinsmiths and carpenters. To sum up, the whole affair is in a nutshell. A man's trade is just what he feels and proves he has the ability to do; and, as I have frequently remarked in these columns, the more versatile his knowledge, the better his chance of success in the battle of life.—R. A.

Anaglypta.—Lincrusta.—*Anaglypta*—signifying "surfaces in relief"—is one of the most successful of decorative materials. It is made from a special waterproof pulp, and, when soft, is subjected to great pressure from metal rollers bearing the design. Its chief qualifications for interior decorative purposes are lightness, the great amount of relief that can be obtained, and its beauty of designs and great capacity for economical decorative treatment. The Company supplies the decorative trades with beautiful sets of patterns at a nominal sum, and if you write to Queen's Mill, Lancaster, they will send you an illustrated trade list. Private buyers must purchase through local agents or decorators. At a later date, should there be any demand for it, I will submit for the Editor's approval some practical notes on decorating the material—in effects of Japanese leather—of solid wooden ceilings and dados, imitation fabrics, and so forth, by the best and cheapest methods.—London Decorator.

Water.—B. (*Fulham*).—The hardness of water is chiefly due to the presence of carbonate of lime. This is insoluble in water free from carbonic acid gas, but as all water, excepting distilled, contains this gas, so does it contain carbonate of lime in solution. Dr. Clark's method of softening water consisted in adding a little lime or lime water. This combines with the free carbonic acid gas, and settles to the bottom as carbonate of lime; whereas the carbonate of lime originally in the water is no longer held in solution by the gas, and therefore also separates out and settles to the bottom. The precipitate, as it settles, carries down with it some organic and suspended impurities, and this purifies the water to some extent as well as softening it. For domestic use, add a little powdered lime or some lime water to your water till it just shows faintly alkaline to litmus paper by turning red litmus paper (sold at 2d. per book) blue. Allow to stand till clear, and then decant off the clear, softened water from the sediment of carbonate of lime. The hardness of water is further due to the presence of sulphate of lime, but this cannot be removed. The only way to make perfectly soft water is to distil it and condense the steam, but this would not be required for any domestic purposes.—F. B. C.

Dyeing Rabbit Skins.—J. R. (*Canterbury*).—Your safer plan will be to dye them as sealskins are dyed—that is, not to immerse the whole skin, but to brush the dye into the fur, repeating the process till the proper shade is gained, and carefully drying between the dressings.—M. M.

Dents in Woodwork.—W. H. (*Fraserburgh*).—The bruised surface can generally be brought up level by means of several folds of wet brown paper or rag being laid on the damaged portion, and then pressing a hot iron against it. A poker may be used, or, better still, a flat piece, or a worn-out file—in fact, anything that will give heat extending a little over the width of the bruise. The iron should not be *red hot;* use only sufficient heat to draw up the bruise; any excess may, especially in the case of veneered goods, cause a blister instead. Should this means prove ineffective, or the dents be too deep to allow of their being drawn up, use the hard stopping, full particulars of how to make and use which refer to Work, No. 150, p. 726. It is against our rule to send replies by post; the answers are framed as far as possible so as to be useful to others besides the querist.—Lifeboat.

Hydraulic Lifts.—A. E. P. (*Vauxhall*).—A leakage in the starting valve would certainly cause the lift to rise slightly if the waste valve is not left open. Anything wrong with the packing causing a leakage there would produce the opposite effect. It is time to re-pack when the gland packing leaks. The rams are usually packed with U-shaped leather rings inverted, with a copper ring inside to prevent collapse. Water entering the collar from the cylinder presses it against the ram when the pressure is on. I have had under my notice an accumulator packed with gasket, and working at a pressure of 1,400 lb. per square inch; one packing lasted fifteen months. I do not know of a book on Hydraulic Lifts, but you might find one in Messrs. Lockwood's (Stationers' Hall Court, E.C.) catalogue of books.—F. C.

Canterbury.—W. S. (*Oswestry*).—Your only way to get this Canterbury design will be to get No. 105 of Work, through Cassell & Company, or elsewhere, taking care you get the supplement.

Mica.—G. W. (*Birmingham*).—If you will refer to the London Directory, you will find many mica merchants. Messrs. Defries, of Houndsditch, could

probably supply it, and there are sellers of it in Hatton Garden, London, E.C.

Hairspring.—J. H. B. (*Pendleton*).—The clock gaining so much shows that the hairspring is too strong. If you cannot get a weaker one, take the one got off the staff and off the collet, and rub it down on an oil-stone, pressing it with a cork and rubbing in a circle, occasionally shifting its position on the cork so as to cut it equally: this will weaken it by making it narrower. There is always a difficulty in getting duplicate parts to all these cheap clocks, so that accounts for the clockmakers saying they are not worth repairing, as the manufacturers of many of them do not sell parts.—A. B. C.

Wiping Joints.—C. H. (*Swansea*).—You ask for a mixture that is used by plumbers to wipe a joint without the use of irons to keep up the heat. I know of no mixture except the usual one of lead and tin of the proper proportions—viz., one of tin to two of lead, with a little variation either way, according to the nature of the work. As to keeping up the heat, that can be done without irons, by means of a blowlamp or by continual application of hot metal from the solder-pot. The best work on plumbing that I know of is that by Mr. P. J. Davies, published by E. & E. N. Spon, Charing Cross. There is a book by S. S. Hellyer, called "The Plumber and Sanitary Houses," publisher, Batsford, Holborn. It is a very good book, but it is not so comprehensive as the first-mentioned work.—R. A.

Battery.—W. T. (*Houghton*).—The Editor now has a paper of mine under consideration as to making bichromate cells in a very simple way; but you will find that any form of bichromate or chromic acid cell will work the model motor (Vol. III., No. 154). You will require two cells at least, connected in series. Any good ironmonger will either sell you or get you the silk-covered copper wire that you may require, as now every ironmonger keeps electric bells, etc. If that will not do, write to any of the London electricians that have been mentioned from time to time in WORK—for instance, Messrs. Orme & Co., 65, Barbican, E.C.—and they will supply you. I am glad you have been so successful with the weather-glass you made from WORK.—J. B.

Bagatelle Board.—W. C. L. (*Manchester*).—You should advertise this in the "Sale and Exchange" column of WORK.

Lantern.—R. W. (*Keighley*).—Your question will be answered in an article of the series on "Bent Iron Work."—J.

Selvage.—B. H. (*Winsford*).—To avoid the expense of engraving blocks to illustrate elementary construction, let me advise you to purchase Sexton's "Boiler-Makers' Pocket Book," published by Spon, at 5s., and the "Boiler-Makers' Assistant," by Courtney, published by Lockwood, at 2s. 6d., where you will find the development of steam boilers and other forms worked out.—J.

Furnace Charcoal.—LIMPRICHT.—I fear it will not work, nor supply the cylinders with enough steam. There is generally a bother with these small engines, the steam supply soon running down.—J.

Battery for Electric Light.—R. G. B. (*London, W.*).—Mr. G. Bowron, Praed Street, W., can supply you with all materials required to make a battery. He is the nearest tradesman to your residence. The cost of a battery to light a lamp of from six to eight c.-p. will be about thirty shillings.—G. E. B.

Electric Light.—H. Y. (*Poplar*).—It seems a pity to discourage your aspirations for a better light in your "parlour of a Sunday evening," but the truth must be told, and this is: you cannot get a better light from an electric lamp and battery costing fifteen shillings. You will get a better light by investing the 15s. in a good paraffin lamp, and oil to burn in it. Electric light from a primary battery is the most costly light in use at present. There is no such thing as cheapness about it, so you cannot have it cheap. Electric light is more costly than gas. You will have to wait until one of the electric light companies lay their mains down in the High Street before you decide on replacing your present dull light with electric lights.—G. E. B.

Automatic Models.—E. N. (*Bristol*).—Messrs. I. & J. Soar's address is 21, Blake Street, Ilkeston, Derbyshire.

Chemical Chest.—E. W. N. (*Shrewsbury*).—I think the best way to fit up your chest would be to have a hinged cover and three or four removable trays divided into compartments for the chemical boxes, and lay the trays in the chest over each other. Another idea for such a chest is to make it like a miniature chest of drawers. There need not be any rails between the drawers, the points being made higher than the sides; and each drawer should have a lock and key, locking into one side of the chest.—F. J.

Electric Light from Primary Batteries.—F. T. J. (*Keighley*).—In calculating the resistance of an electric light circuit to find the available volume of current, you must take into consideration the resistance of the lamps and the conducting wires, as well as the internal resistance of the cells. I think ·11 ohm will represent the resistance of your cells. I should advise you to use No. 16 copper wire as a conductor of current between the battery and lamps. This has a resistance of ·2013 ohm per lb. If you can get two 8 c.-p. lamps, requiring 1·3 ampères, at a pressure of 18 volts, you might be able to light both of them in parallel with current from your twelve cells in series. You may do as you propose with the reserve cells, but do not switch in more than one at a time. I suspect you will find, as I did, that lighting by means of battery is an intolerable nuisance. Information relating to resistance of cells, wires, etc., may be found in Mr. Bottone's shilling "Guide to Electric Lighting."—G. E. B.

Electrotyping.—R. A. R. (*No Address*).—Daniell cells are the most constant, and the best type of battery for electrotyping, but you will not be able to cover large surfaces with copper deposited with current from four cells of pint size. The surface of zinc in each cell should at least equal the surface of the anode, and this should be slightly larger than the surface to be electrotyped. The size of the vat is of no consequence whatever in determining the size of the battery.—G. E. B.

Electrical Engineer.—T. H. H. (*Birkenhead*).—If you wish to become a practical electrical engineer, it is necessary for you to serve a term of years in a good electrical engineer's shop. You may learn the theory of the science by studying books, and thus read up to pass a science examination. After this, you may call yourself an electrician and teach the science; but knowledge thus obtained will not equal that obtained by practice.—G. E. B.

Cement Mortar.—F. H. M. M. (*Alexandria, Va.*).—The most satisfactory method to adopt for keeping the water out of your cellar will be to plaster the outside of the walls down to the foundations with cement mortar, mixed in the proportion of one of cement to three of clean sharp sand. If this mixture is slow in setting, add more cement; it should be at least ¾ in. thick. When moderately set, fill in round it with dry rubble or half bricks, packed loosely, about 1 ft. thick, and carry a drain from the lowest point of the foundations; the water will sink through the stones, and run off at the drain. If you cannot get to the outside, you might try a thicker coat inside, but a drain and rubble round the outside will still be necessary; in the former case the wall would be kept drier. The bottom laid in the manner you propose, with concrete, will answer in either case. It will be best to have the wall moderately dry when the cement is put on. Or you may use asphalte outside instead of cement, giving two or three coats till it is about ½ in. thick, but the wall must be dry, or the asphalte will not adhere. If you do it outside you could clear one side, or a portion of one side, at once. Am glad to hear that you are pleased with WORK and have secured new subscribers; the more subscribers that are obtained, the better will the magazine be. If every subscriber made it a point to obtain one new weekly subscriber WORK would have a truly phenomenal circulation.

Spirit Varnishing.—J. B. (*Accrington*).—A short paper shall appear shortly.—ED.

Carbon for Dry Battery.—W. A. (*Edinburgh*).—The carbons employed in the construction of the Gassner dry battery are hollow cylinders of about 1½ in. in diameter, with solid tops for connection with the binding screw. Carbons for these batteries may be hollow or solid, square, rectangular, or round, or mere flat plates, and one, two, or more of these may be used in a cell, providing they are connected together at the top, and do not touch the zinc cylinder nor take up too much space in the cell. There should be ½ in. clear space between any part of the carbon and the zinc, and the tops of the carbon plates should stand up quite ½ in. above the top of the cell.—G. E. B.

Shocking Coil.—H. B. J. C. (*Birmingham*).—The dimensions suitable to your purpose will be as follows: Core of iron wires, ⅝ in. in diameter by 5 in. in length, made to slide in the hollow core of the bobbin, and fitted with a brass or wood knob for drawing the core out. Bobbin of ebonite, 4½ in. long by 1½ in. in diameter. Wind on this four layers of No. 22 silk-covered wire for the primary, then fill up the bobbin with your No. 36 wire, or put on as much as you have, even if the bobbin is not full. When the conductors are connected to the two ends of the primary the shock will be quite strong enough for a child. When they are connected to the two ends of the secondary, and the core is out, the shock will be unpleasant to most people; whilst with the core in and a pint bichromate connected to the coil, the shock will be too great for a strong man to bear. But why spend your time and money on a shocking coil? It is of no use at all to anyone outside the medical profession. By using the material to construct a small spark coil, you may spend many happy hours in amusing yourself and friends.—G. E. B.

Plumbing.—WORKING PLUMBER.—Practical papers are just about to appear. Tell all your plumbing friends.—ED.

Writing on Glass.—T. W. V. (*Leicester*).—The glass tablets to which you refer—"Bovril," "Cadbury's cocoa," etc.—are not embossed in the ordinary way, but are cut out by a process of grinding termed "sand-blast." The ruby or blue film that is flashed on is simply ground out by the aid of machinery instead of burnt out by acid. If you write to the London Sand-blast Decorative Glass Works, 58A, Gray's Inn Road, and mention for trade purposes, they will probably send you a small sample and quote prices, from which you will learn the comparatively cheap prices that the most elaborate designs can be supplied for. Stencilling is of no use for acid work. With repeats for lamp such as you mention, I should draw it out on lining paper, then rub over the back with whiting, and mark over letters, leaving a white impression on the glass. This would save time spent in cutting a stencil, for stencils are really useless for good work. You must rely upon the pencil and your own smartness, and practice. Good Brunswick black is best for stopping-out. Write Messrs. Wilkinson & Sons, Attercliffe, Sheffield, for particulars of their goods for embossing.—F. P.

Mounting Lathe on Sewing-machine Stand.—G. S. B. (*Huddersfield*).—This question has been asked several times. You can, of course, do what you propose if the lathe be very small—by "very small," I mean, perhaps, of 2 in. centre, a watchmaker's lathe. I think you could very likely buy one second-hand, and no doubt you will find it easy to mount it on the table of the sewing machine. I cannot give you any more directions without seeing the sewing-machine stand. Pray do not suppose you can exert enough power to drive an ordinary lathe; you might as well try to wind a church clock with a watch-key or drive a tenpenny nail with a tack hammer. You may turn chessmen and draughts, or do small work in metal, such as parts of a model engine, etc., and small drilling up to about $\frac{3}{16}$ in., and the little lathe might prove very useful for such things as those.—F. A. M.

Lacquering Desk Corners.—ALPHA.—To relacquer your desk corners, you must first carefully clean off all the old lacquer; as you cannot get the corners off, you must take care that you do not scratch the polish of the woodwork. I should use fine glass-cloth on the end of a piece of stick. Of course, it will require patience and more time than if they could be got off, but you must not mind that. When the lacquer is all off, give a final rubbing in straight strokes to polish; finish with powdered pumice-stone, rubbing with a small cork. With regard to lacquering, as it would be awkward to heat the brass equally and without injuring the wood, you had better use a cold process lacquer. This you can procure from Palmer's, Old Street, St. Luke's. It simply requires laying on with a soft camel-hair brush. Do not take too much up at a time, or it will run, and spoil the work; do not give two coats till the first is dry and hard.—R. A.

Clock; Conjunction of Indices.—H. R. F. (*Colne*).—As your indices revolve—A twice a day, B once in thirty days, and C three times in forty days—their relative rates of speed are 2, $\frac{1}{30}$, $\frac{1}{40}$, which ratios are also represented by 240, 4, and 9, which are the numerators of corresponding fractions having 120 as a common denominator, which, being common, does not affect their relative values, and may therefore be omitted. Taking, first, the two indices B and C, it is evident C will go once round the dial and overtake B during its second course, as the speed of the former is more than twice that of the latter. If D = distance in the minute spaces of the dial passed over by index B before reaching C, then

$$D = 60 \times \frac{4\,D}{9};\ D - \frac{4\,D}{9} = \frac{5\,D}{9} = 60$$

and D = 108 divisions. Therefore, at every 108 divisions these hands will be together; the interval of time between successive conjunctions will be found from the proportion:—

$$60 : \frac{40}{3} :: 108 : 24 \text{ days,}$$

because the index C travels over the 60 minute divisions three times in forty days. The distance D′ passed by the index A before reaching the index C, is

$$D' = 60 \times \frac{9\,D'}{240} = 60 \times \frac{3\,D'}{80};\ \frac{77\,D'}{80} = 60, \text{ and } D' = \frac{4800}{77}$$

As the hand A travels 120 minute spaces per day, the intervals of time between the conjunctions between A and C will be

$$\frac{4800}{77 \times 120} = \frac{40}{77} \text{ days.}$$

To find the number of days in which the two conjunctions coincide, we must find the least common multiple of the intervals; to bring both fractions to the same denomination, 24 is multiplied by 77, making 1,848. The L. C. M. of the numerators is thus found—

$$\begin{array}{r|l} 8 & 1848,\ 40, \\ \hline & 231,\ \ 5, \end{array}$$

$$8 \times 231 \times 5 = 9{,}240, \text{ and } \frac{9240}{77} = 120 \text{ days.}$$

During this period the indices will make the following numbers of revolutions round the dial:—

$$A,\ 120 \times 2 = 240;\ B,\ \frac{120}{30} = 4;\ \text{and } C,\ \frac{120 \times 3}{40} = 9 \text{ re-}$$

volutions. This will be the least interval between two triple conjunctions of the hands.—F. C.

Air-pump.—J. S. (*Beith*), referring to my answer in No. 166, says:—"What I want is an air-pump to be driven by a ½ h.-p. steam engine for exhausting square iron vessels, something the same as applied to the milking machines, where the resistance is much the same, as for every stroke of the air-pump the vessel becomes filled with milk." Now, that certainly is a more sensible way of putting a want before the mind. Might I say here for the good of the brotherhood, that if one has an idea to work out, and wants a little assistance, it would be far easier if the correspondent would send a sketch of his work? If it is something he wishes to keep secret until he patents his idea, and that were said in the communication, the Editor and such of his staff as the matter might be submitted to may be trusted to deal honourably; I presume everyone to whom the Editor submits questions are tried men. Now to the answer. The air-pumps described by me are altogether unsuited to J. S.'s needs; they

are laboratory instruments. The problem stands thus, to my mind: From a given vessel abstract air so that a fluid may flow into it—if on such a scale as to require a ½ h-p. engine, then I should employ an exhaust fan: this may be made of any power. In a steel converter a blast is thrown into converter of tremendous force. Some years ago, in Crewe, a party of visitors were going through the railway works, and one, pointing with his umbrella to the large pipe connected with the exhaust fan, had it forcibly wrenched from his hand by the suction, and drawn into the machinery, doing such mischief that it cost a hundred or two pounds in repairing the same—a somewhat expensive pneumatic experiment. In the absence, then, of any definite knowledge of the kind of work to be done, I should suggest a chamber attached to the iron vessel containing an exhaust fan, driven at a high speed, which would produce such a vacuum in the vessel as would permit the flow of milk or other fluid by atmospheric pressure. If this does not help J. S., then I would suggest that he send in confidence a sketch of the vessels he wants exhausting, with their position, etc., and I or someone else will, no doubt, be able to help him further.—O. B.

Magnetised Watch Parts.—J. A. (*Thirsk*).—The only thing I can advise to make a thoroughly reliable job of the watch is to take away all the parts that are magnetised and put new ones; and if the wearer has to do with electrical works, then put non-magnetic pieces. You can take the magnetism out by making red-hot: that, of course, means spoiling in this case, and the above is the only remedy.—A. B. C.

Solder.—J. A. (*Thirsk*).—Two parts pure silver, one part brass; or, two silver, one tin for quick running white solder for silver, jewellery, etc. The best flux is borax.—A. B. C.

Clocks.—One who Wishes to Know.—Britten's "Watch and Clock Makers' Handbook, Guide, and Dictionary," price 5s., published at the Horological Institute, Northampton Square, Clerkenwell, London, E.C. Also one by Mr. Glasgow, price 4s. 6d.; and another by Hasluck, about same price. Either of the above may be ordered through any bookseller.—A. B. C.

Graining.—Excelsior.—Articles appeared in Work, Nos. 55, 62, 65, 69, 72, 78, 81, 93, 127, 134, and 138.

Quarter Horse-power Engine.—J. R. B. (*Accrington*).—Articles appeared in Work, Nos. 106, 110, 121, 125, 131, 136, 141, 145, and 149.

Plumbing Papers. — T. J. (*Droitwich*). — A series of practical papers on Plumbing, etc., is in course of preparation, and in it the various queries you have put will be attended to. I shall endeavour to be very clear and explicit as heretofore; glad to find my work appreciated.—R. A.

Tin from Waste Cuttings.—A. R. (*Aberdeen*). Search back numbers and indices, and watch "Shop" column for another reply.—R. A.

Brazing.—A Reader.—Search in the back numbers. Whilst we are at all times ready to help any reader if he will state his wants definitely, it would be a waste of time and space to repeat general instructions that have only very recently appeared.—R. A.

Precious Stones.—Apprentice.—Cornelian and carnelian are but two names for the same kind of chalcedony. The first is derived from the horn-like ("cornu," a horn) appearance of its fracture. The second name, carnelian, is given to it on account of its flesh-like colour ("carnis," flesh). That is their derivation, but now, when a little more care is being taken in description, the cornelian is said to have a waxy lustre on its fractured surface, while that of a sard is dull and horn-like. Engraved gems are arranged in these three classes—viz., cameos, intaglios, and scarabs. Cameos have their design cut in relief, and stand out from the background of a different colour. Intaglios have their designs sunk into the gems. Thus an intaglio is just the reverse of a cameo. With an intaglio the chief aim is to produce an impression, therefore it is suitable for signet rings and for seals; with a cameo the gem adorns by the beauty of its appearance, and, consequently, is employed in the other articles of jewellery. A scarab combines the characteristics of both cameo and intaglio, for the back of the scarab is cut to represent a beetle in the manner of a cameo, while the face has the design sunk into it—that is, in intaglio. These definitions are quite apart from the material they are formed out of. A cameo is a cameo, whether cut out of shell or out of a piece of opal attached to its matrix—a kind of cameo, by-the-bye, which is now rather in demand—or out of onyx or sardonyx; the term cameo applies to the condition of the gem after it has been carved with the figure or figures raised above the ground. In the same way an intaglio is still an intaglio, whether it be cut in sard or crystal or glass. Therefore, either of the terms should be preceded by a descriptive word to indicate the sort of cameo or intaglio it is—for example, a shell cameo or an onyx intaglio, as the case may be. A most celebrated collection of this class of gems belongs to the Duke of Devonshire, but the British Museum is very rich in specimens, too.—H. S. G.

Printing at Home.—Worker.—A series of papers is with the printer, and will appear shortly in Work. Tell your friends.

Electro-deposition of Iron.—J. C. (*Stratford*).—Iron is sometimes deposited on the face of an electrotype of a wood engraving to protect it from wear in the press. This is termed "steel-facing the electro," because the iron thus deposited is nearly as hard as steel. The work can be done by professional electrotypers. Try Messrs. Hare & Co., Essex Street, Strand, W.C., or Messrs. Dellagana & Co., Fetter Lane, London. If you find any difficulty in getting what you require, write to S. R. Bonney, 19, Avenue Road, Lewisham, S.E., and he will endeavour to get it done for you.—G. E. B.

III.—Questions Submitted to Readers.

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

Rhinoceros Tusk.—A. W. A. T. (*Plaistow*) has a rhinoceros tusk, and will thank heartily any reader, professional or amateur, to tell him of a good use to put it to.

Mail Cart.—Mail Cart writes:—"I should be obliged if some kind reader would furnish me with measurements and instructions how to make a mail cart suitable for two children."—[Much has already appeared in design and letterpress on mail carts. Consult back numbers.—Ed.]

Fret Monogram.—W. K. (*Pullocking*) writes:—"An old reader from the first would be obliged for monogram in fretwork of 'W. K.' from any fellow-readers of Work."

Furbishing Leather.—J. B. (*Dublin*) writes:—"I have a travelling-bag which was originally black, but has become brown through wear, and would be obliged if any kind reader would inform me of a means for renovating same."

Sensitive Metals.—J. W. (*Old Kent Road*) writes:—"Will any reader kindly inform me of a metal, or an alloy of metals, that is most sensitive to temperature, and how to make the same?"

Emigration.—Derwent writes:—"In April last you published in Work a letter from a resident in Ottawa, Ontario, in which he draws attention to the opening existing in that city for electricians. I have some idea of going out next spring, but should like some reliable data to go on. Could you oblige me with your correspondent's name and address, or put me into other channels of information, direct or through columns of Work?"—[Perhaps the Ottawa correspondent will reply.—Ed.]

IV.—Questions Answered by Correspondents.

Stained Glass Designs.—Mathews & Smith, of 39, *Tamworth Road, West Croydon*, write to T. B. (*Moss Side*) (see No. 172, p. 254):—"We will send you coloured design sheet, containing geometrical and foliage patterns, for 3s., post free."

Fancy Articles.—R. S. Donaldson (*Netherby, Cambuslang, Glasgow*) writes:—"I do not find that Cabinet-maker's Tool's inquiry in No. 157 for 'Fancy Articles Market' has yet been replied to. I am connected with the fancy goods trade, making and selling articles myself, and should be glad to act as Cabinet-maker's Tool's agent. Some of my customers have been inquiring for smokers' cabinets and hanging bookshelves. Such articles are made in Germany, I understand, and, perhaps, a few in Birmingham. Perhaps Cabinet-maker's Tool could write me on the subject."

V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—A. F. M. (*Liverpool*); E. D. (*Wandsworth*); D. M. L. (*Glasgow*); A. F. (*Ovenden*); Electro; C. B. (*Sheffield*); N. D. W. (*Steeton*); M. W. (*Stepney*); A Subscriber; P.B.H. (*Southport*); W. J. W. (*Heckmondwike*); W. H. (*Chilvers Coton*); J.M. (*Edenfield*); T. W. (*London*); C. C. (*Bathgate, N.B.*); E. R. (*Stockton-on-Tees*); Eddefra; A. F. (*Edinburgh*); E. J. (*Barnsley*); Cherry; S. M. (*Leeds*); Engineman; J.G. (*Crasshouse*); T. McC. (*Pendleton*); E. D. (*Hanley*); Horologist; A Reader of "Work"; J. W. (*Edinburgh*); Sapphire; J. S. (*Torphins*); Wheeler; W. C. (*Manchester*); Beck; A P. M. (*Streatham*); J. L. (*Aberdeen*); R.C. H. (*Nottingham*); Country Cabinet-maker; H. G. B. (*Clapham*); W. P. (*Cannock*).

"WORK" PRIZE SCHEME.

FIFTH COMPETITION.

"Domestic, Commercial, or Scientific Application of Electricity" Competition.

Continuing our scheme of Prize Competitions of a useful and practical nature, we propose to devote the present one to the subject of Electricity, in which our readers and the world at large take so keen an interest. We invite competition for the following prizes—

First Prize, £3;

Second Prize, £2;

Third Prize, £1;

for the three best suggestions of an original and practical nature, involving the application of electricity to some domestic, commercial, or scientific use. This application may be on a large or small scale, to take effect on land, sea, or in air—the main conditions being the newness and practical possibilities of the suggestion.

Conditions and Rules of the "Electricity Suggestion" 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, or decision, as determined upon by him is to be final.

All manuscripts intended for the "Electricity Suggestion" 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, December 17th, endorsed, "Electricity Suggestion" Competition.