WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. II.—No. 70.] SATURDAY, JULY 19, 1890. [PRICE ONE PENNY.

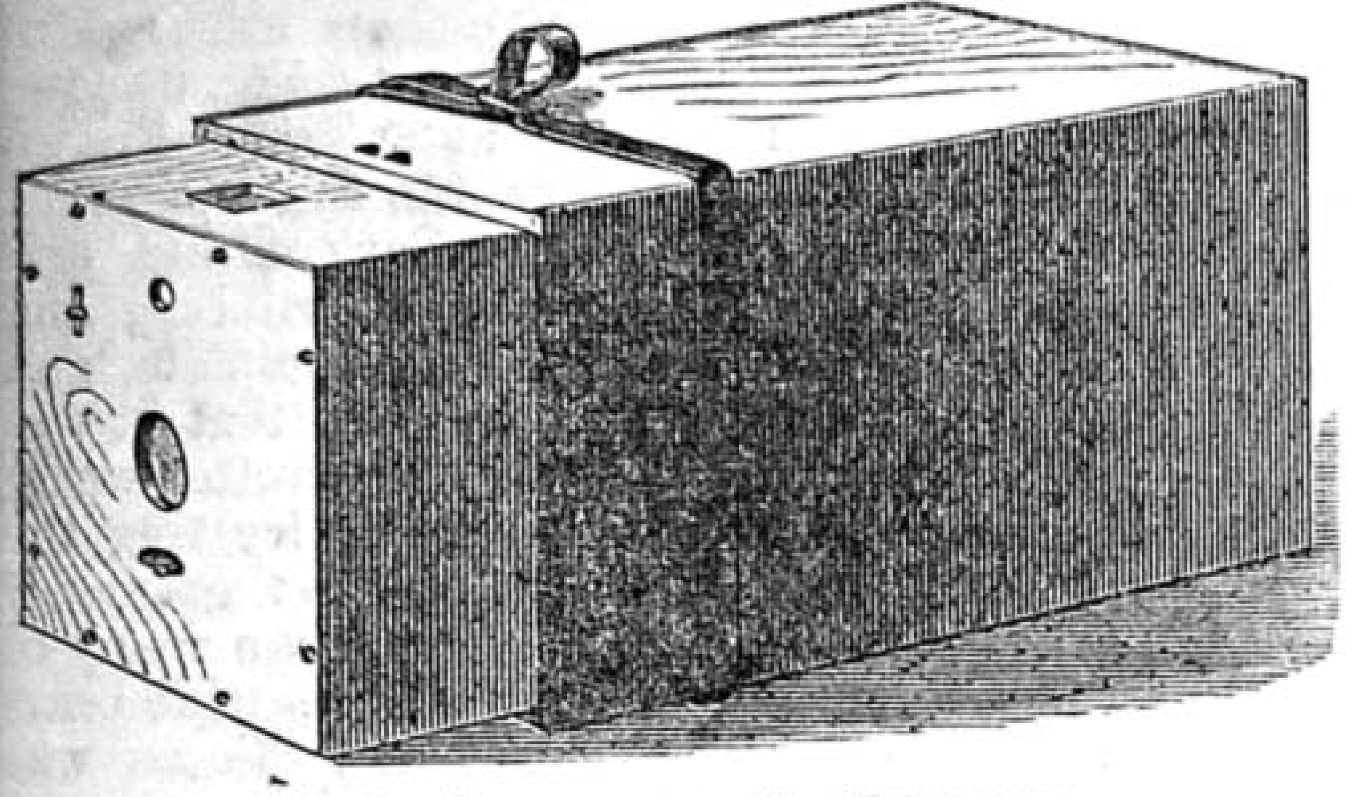


Fig. 2.—Camera open for Exposure.

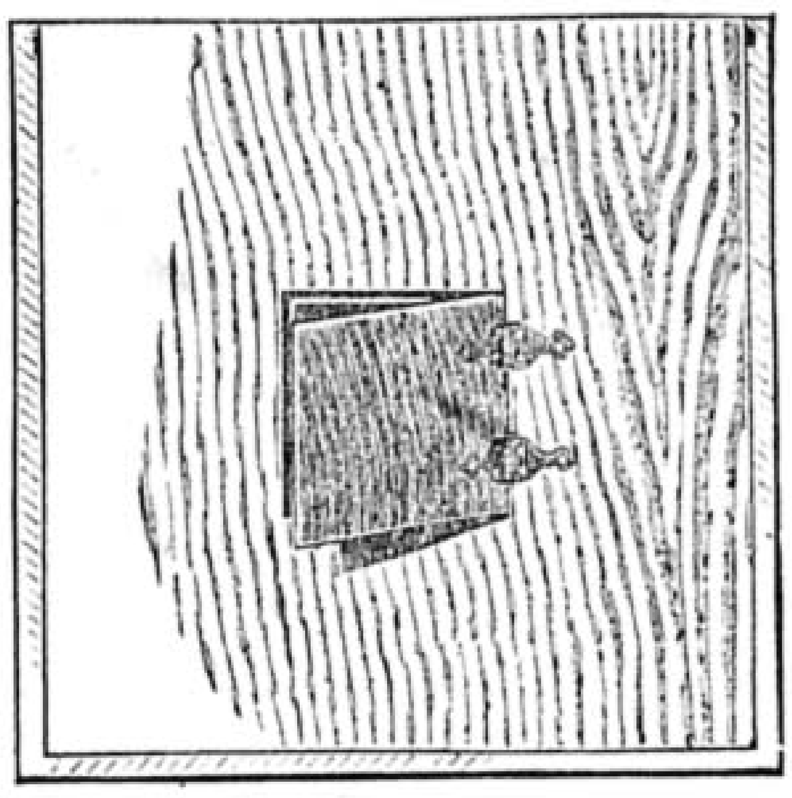


Fig. 5.—Showing Door in End.

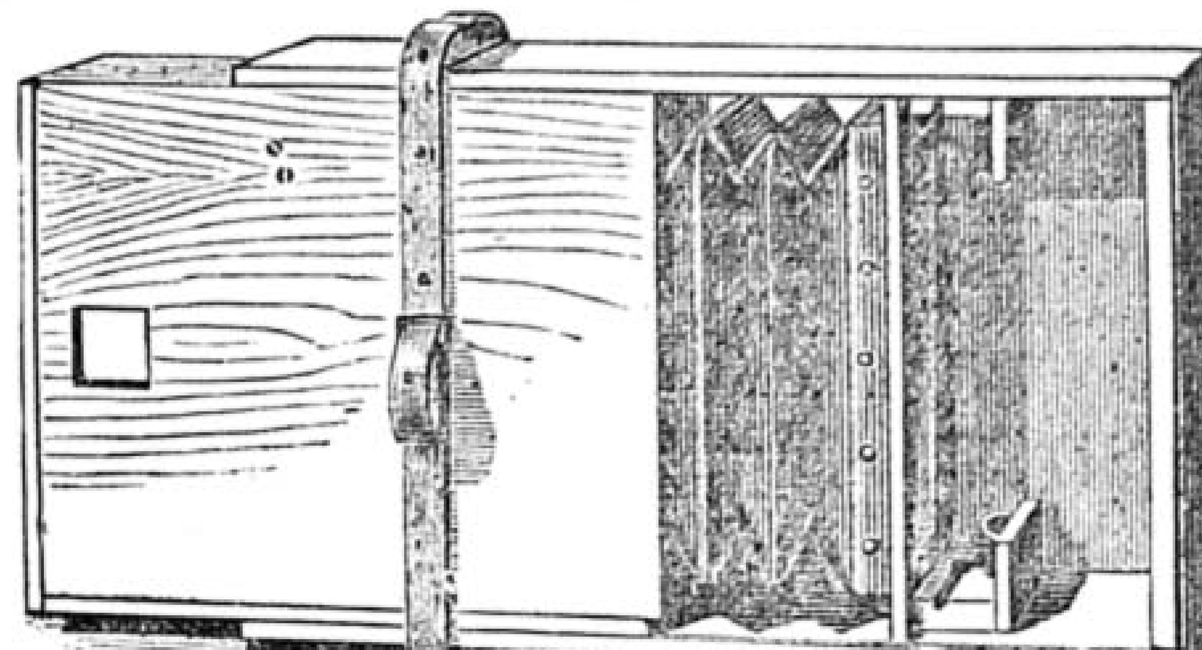


Fig. 3.—Camera with Top removed.

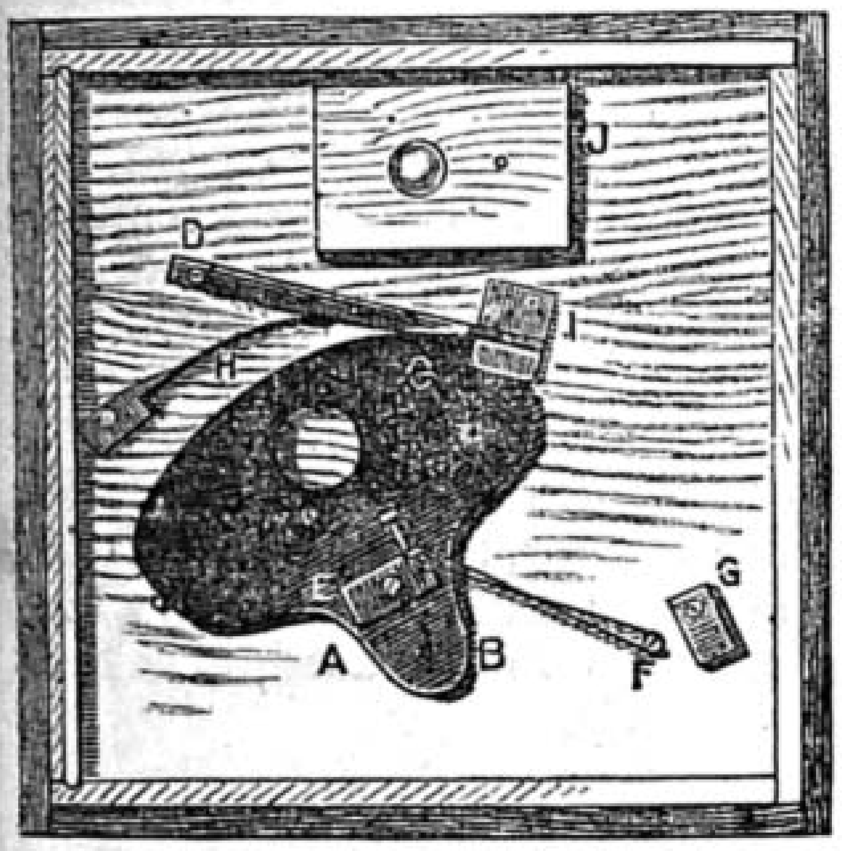


Fig. 6.—Shutter open for Exposure.

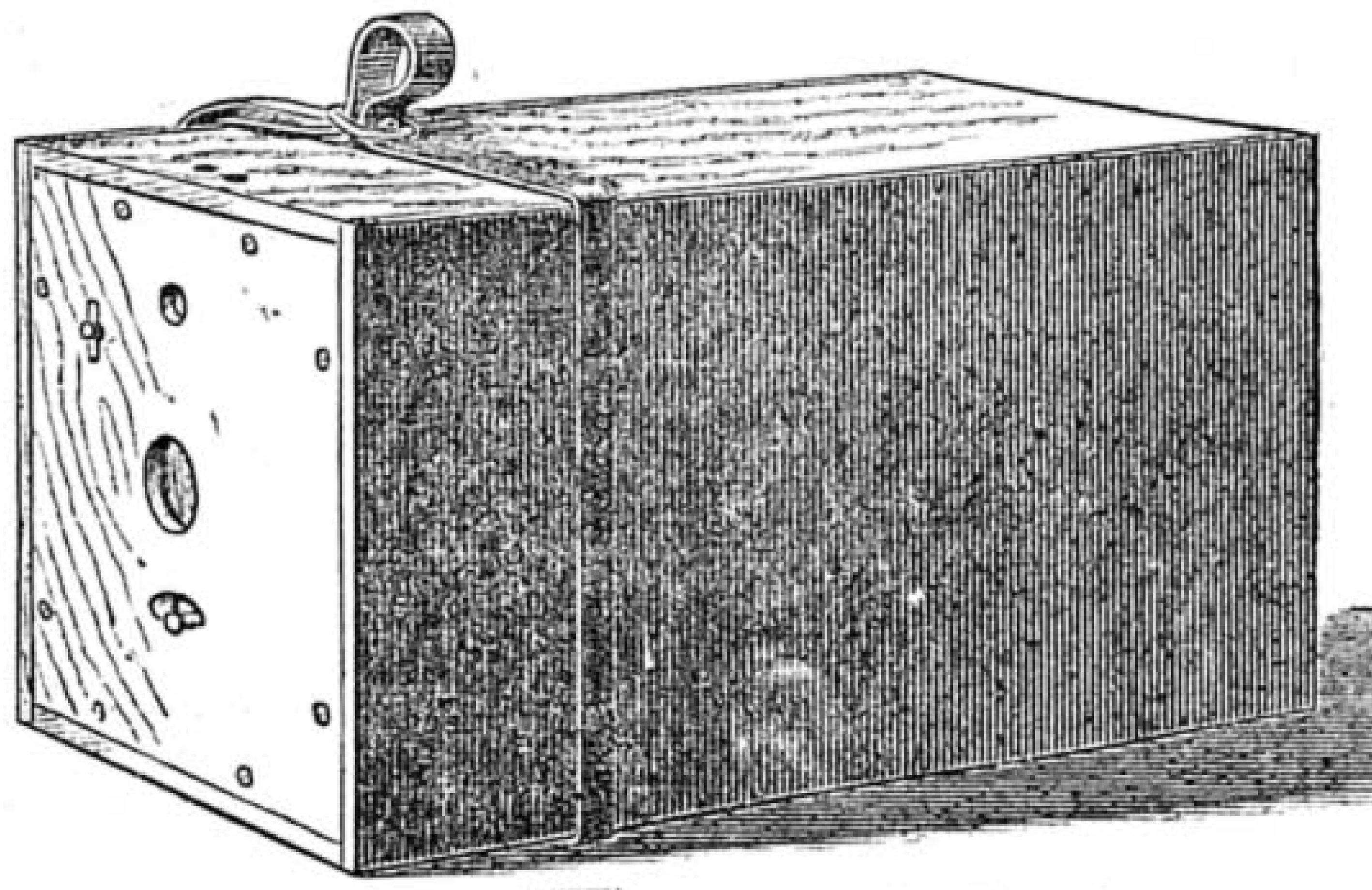


Fig. 1.—Camera ready for Carrying.

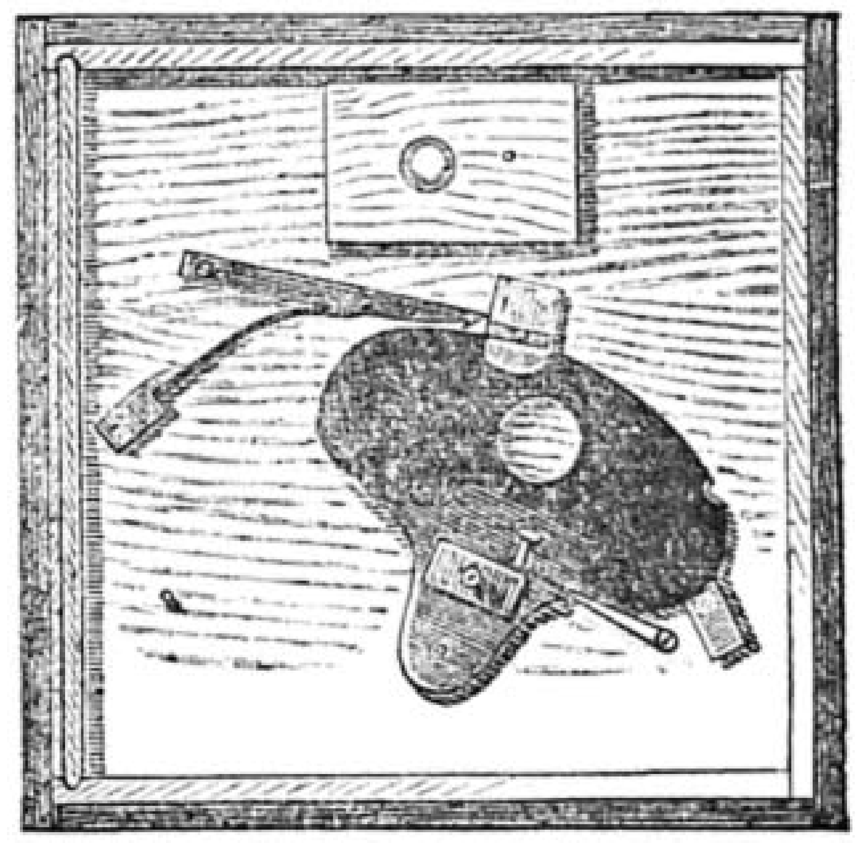


Fig. 7.—Shutter after Exposure.

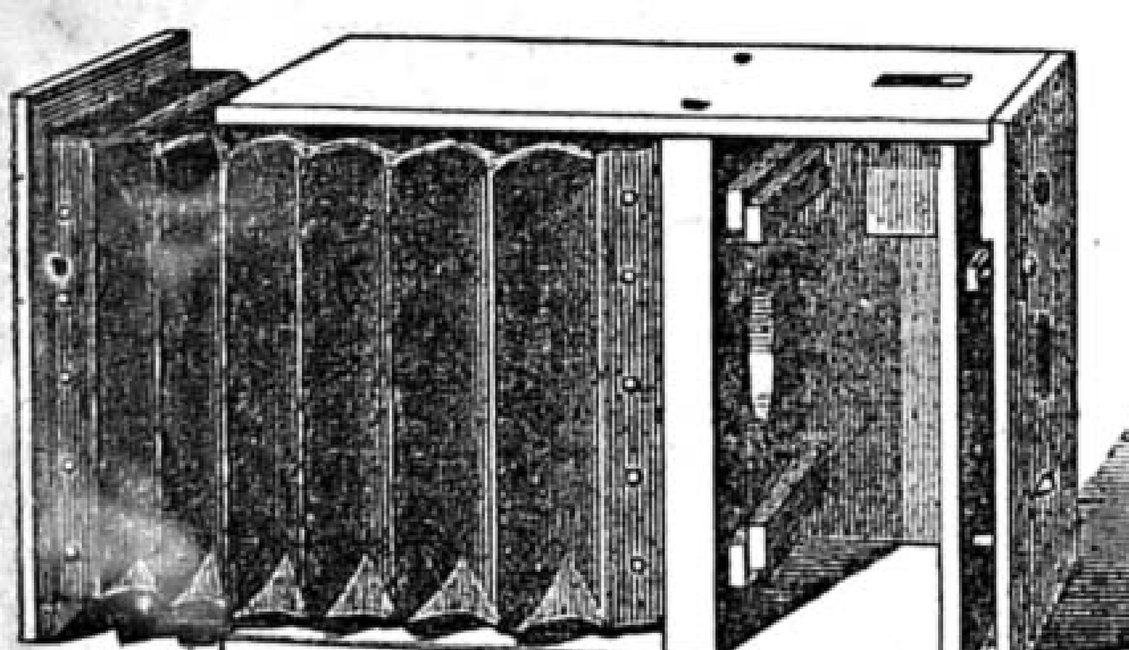


Fig. 4.—Inner Case with Side removed.

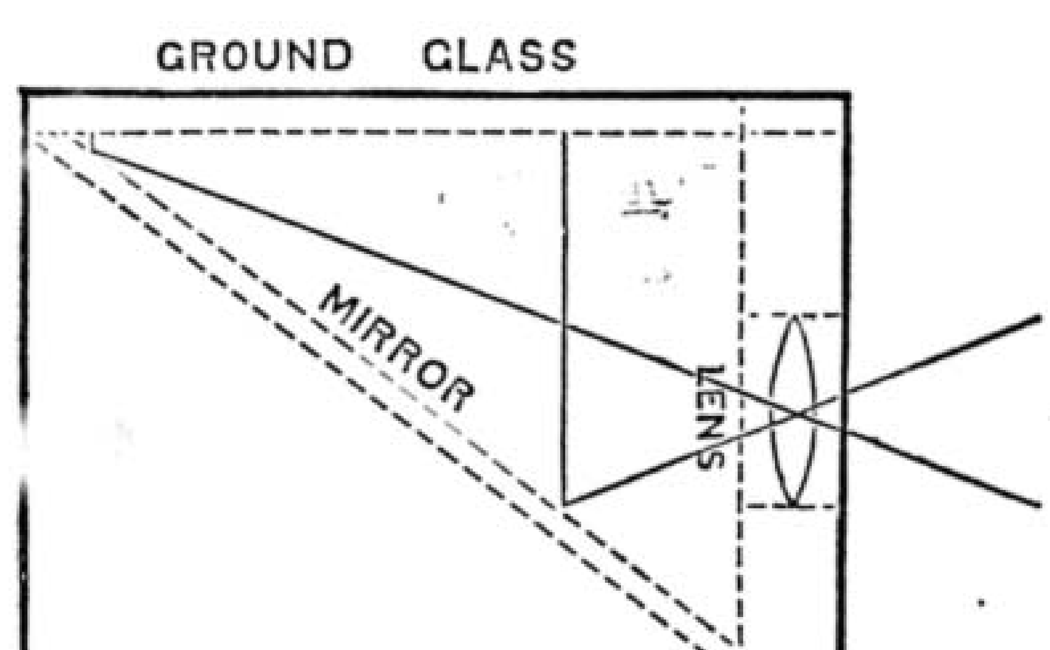


Fig. 9.—Finder.

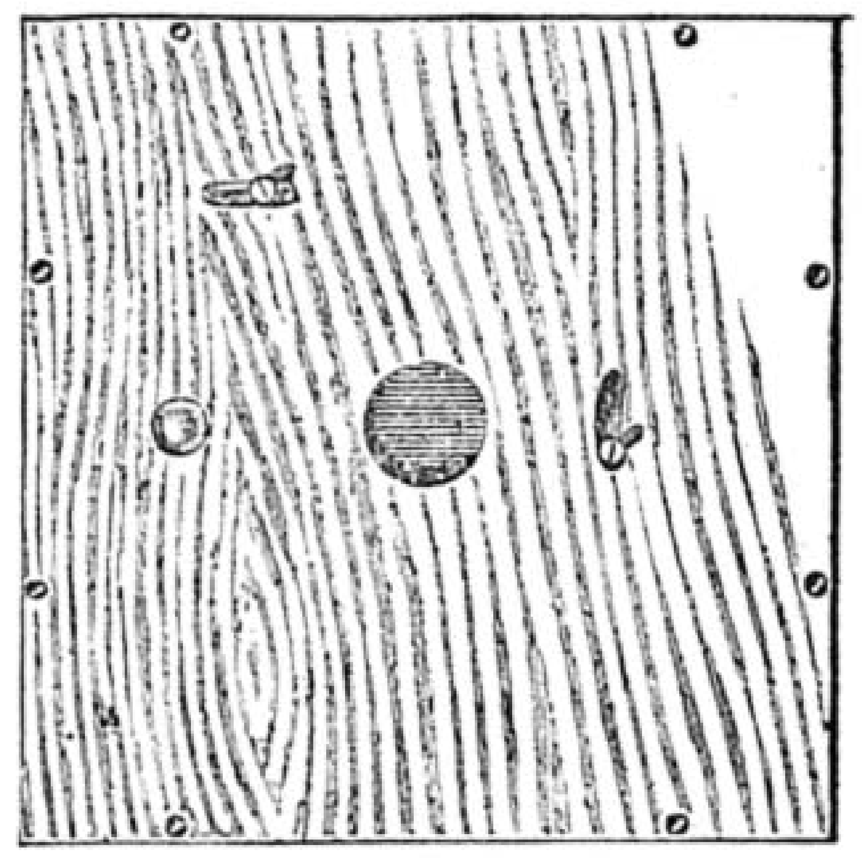


Fig. 8.—Front End of Camera.

A HOME-MADE HAND CAMERA.

BY FRANK S. MORTON, PORTLAND, MAINE, U.S.A.

EVERY amateur photographer who possesses only an ordinary tripod camera has occasion arise many times where a hand camera would be a great convenience. Some amateurs possess both, but many are not sufficiently rich in this world's goods to own more than one.

I was in the very position above named, as far as possessing but one camera, until the idea struck me to make a hand camera myself, using the lens of my tripod camera in both. This may not seem at first thought to be a very difficult undertaking, but my tripod camera was a 5 in. × 8 in., with a lens of 8 in. focus. A box to contain such a camera would be large and clumsy; and, besides, a 4 in. × 5 in. size is sufficiently large for the most uses a hand camera is put to. To make a smaller bellows and camera, and enclose it in a box, was my first thought, but the same difficulty as regards the length of the box still presented itself. To make a box long enough to allow the bellows to be extended 8 in., and then have room for all the other parts, would make an awkward affair, and such an arrangement would be decidedly hard to manage in making exposures. The notion presented itself that I might make use of the old-fashioned idea of a sliding box camera, and by combining that idea with others of later origin, I might get what I wanted. This I did, and met with the best success. My camera as finished was 12 in. in length, $7\frac{1}{2}$ in. wide, and $6\frac{1}{2}$ in. deep. Extended for exposure, it was three or four inches longer, according to the distance-off of the object to be photographed. Finished in oak and polished, it has a very neat appearance, and there are no working parts on the outside—the only parts visible being the screw for setting the shutter and the one for releasing the same, both being even with the surface. The only openings visible are the two slots these screws work in, and the holes for finder and lens. The arrangement is so simple, and the working of it so easy, that I will now proceed to describe it for the benefit of readers of WORK.

The camera consists of two wood cases

sliding into each other, and connected with each other by a bellows, as an extra precaution against the entrance of light. Fig. 1 shows the camera shut for carrying, and Fig. 2 shows it opened for exposure; Fig. 3 shows it with the sliding-top cover removed, and explains the method used in holding the plate-holder in place; Fig. 4 shows the inner case with the covering case and sliding-side removed.

I first made the outer case, which is 12 in. × $6\frac{1}{2}$ in. × $7\frac{1}{2}$ in., of $\frac{1}{4}$ in. oak, and for extra strength an additional end piece of $\frac{1}{2}$ in. pine was inserted. The top was made to slide in grooves, so as to be easily opened or removed. It is immaterial whether the top or side is made to open, the style of plate-holder used governing this. In the end a small door was cut, and the piece taken out and hung on with a couple of brass hinges (Fig. 5). Next the inner case was made. This was made of wood of the same kind and thickness as the outer case, but with a double end—one set in $\frac{3}{8}$ths of an inch from the end, and the other screwed on over the end, leaving a recess $\frac{3}{8}$ths of an inch deep between them. Fig. 4 shows how this was arranged. In this recess the instantaneous shutter was placed. In the inner case the side was made to slide, as the top in the outer case; and the whole was made to fit closely, but not too tightly, inside the larger case. The length of the inner case was 8 in.

Next the bellows was made. It was made over a box 4 in. × 5 in. square, the inner covering being of ordinary dark cloth and the outer of black rubber cloth, such as is easily obtained of any dealer in rubber goods. Between these, pieces of cardboard with bevelled ends were placed; and when dry, the whole was folded together to form the bellows. As the bellows is entirely out of sight in the camera, no special care need be taken with it other than to make it light-tight. Two frames of $\frac{1}{2}$ in. stuff were made to fit into the ends of the bellows, and were fastened there by rows of tacks. A piece of $\frac{1}{2}$ in. wood was next cut the exact size of the inside of the *inner* case, and a 2 in. circular hole cut through the centre. To this, one end of the bellows was fastened, and to the other end was attached a piece of $\frac{1}{4}$ in. board, cut to fit closely inside the *outer* case, and having a 4 in. × 5 in. opening cut in it. The bellows was then put in place as in Fig. 4, the end having the round hole cut in it being pushed forward in the inner case just far enough to allow the lens attached to the lens-board of the tripod camera to be pushed in front of it on cleats fastened to it, the front of the lens-tube coming close up to the double front of the camera. It was firmly fastened in place there by screws from the outside. It is, of course, unnecessary to say that all the woodwork should be blackened carefully on the inside, either before or after it is put in place. Three inches from the end, inside of the outer covering, small strips of wood were tacked, and back of them the end of the bellows having the 4 in. × 5 in. opening was dropped in place. Fig. 3 shows how it looked after this operation. These strips were to hold bellows when inner case was pulled out.

Close against the bellows-board, but not so close but what it would slide up and down, were placed the parts for holding the plate-holder. This arrangement is very simple, and consists of a piece of $\frac{1}{2}$ in. wood 1 in. wide and 5 in. long, and a piece of $\frac{1}{4}$ in. wood of the same width and length tacked on it at right angles. To the thin piece is fastened a thin brass spring, which presses the plate-holder against the bellows-board when it is pushed down in place. This is fastened to the side of the outer casing, and pushes the holder firmly in place. As an extra precaution against the entrance of light, the bellows-board is covered with thick black felt. The space back of all this will allow for two extra plate-holders. For focussing, a strip of ground glass is dropped down in slots made in the $\frac{1}{2}$ in. pieces, or a frame could be made to slide in place of the plate-holder. The narrow strip is sufficient, however, as it will show the focus, and the finder will show the proportionate size of the image. Fig. 3 shows the whole arrangement for holding the slide, and also the slot for the ground glass. If the lens-board of the tripod camera is too long and large to slide in on the cleats (as shown in Fig. 4), a thin piece of soft wood with a hole cut in it will hold the lens in place all right. The lens should fit closely up to the front of the camera. For plate-holders the form used in the ordinary detective camera is best. Many of these open the broad way, and will thus fit in from the top. If these cannot be obtained, those opening at the end will do; only the outer case must have the side made to open, and not the top. Before making the camera, the dark slide should be selected, as dimensions may have to be altered to make it fit.

The instantaneous shutter was next put in place. A simple and effective shutter was made (as shown in Figs. 6 and 7). Fig. 6 shows it open, ready for exposure; and Fig. 7 after it has been made. A piece of light thin wood was cut to the shape of A, Fig 6, and one side stained as near the colour of the outside of the camera as possible. A hole was cut for the exposure, and the piece was hinged on to the inner end of the front by a small screw at B. A notch was cut in its edge at C, and a trigger of brass made to fit into it and hung in place, with a round-headed brass machine screw in its end to serve as a button to release it at D. A small block of vulcanite was screwed on to the shutter at E, and in this was fastened another screw for opening the shutter, and also one to which to fasten a rubber band. The other end of the band was fastened to a small screw at F. A stop G, a spring H, to keep the trigger in place, and a brass guide I to keep the shutter true, completed the arrangement. To set shutter, pull it back by means of the screw E, until the trigger engages in the notch C in the edge of the shutter. To release, press down on the screw D in the end of the trigger. This releases the shutter, and the rubber band pulls it quickly across. The size and strength of the rubber band determine the speed of the shutter. For time exposures, work exactly as if setting the shutter for an instantaneous view, pausing as long as necessary when the two openings are opposite each other.

When all was in place, a hole was cut in the outer covering of the end for exposure, and slots were made for the setting and releasing screws. Then after the finder was in place, it was screwed on by screws put through three sides. The sliding side of the inner case was made to slide past the inner end piece and against the outer. Fig. 8 shows openings made in the front.

The finder was the last thing made. Every dealer in photographic goods keeps, or ought to keep, small finder lenses, which can be procured at a small cost. One of these was procured, and a small three-sided box made, the front having a $\frac{1}{2}$ in. hole in which the lens was fitted. A small piece of looking-glass was arranged at an angle inside the box, and on top a piece of ground glass was placed. A square hole cut in the top of the inner case, another in the inside end piece, in which to fasten the finder, and a small hole in the front piece, completed the preparation. When the finder was put in place, it threw a small reversed image of the object to be photographed upon the ground glass. A finder is so simple in construction that it seems needless, almost, to explain how it is made; but the diagram at Fig. 9 will explain how one of this style is put together. As the square hole where the ground glass is seen is likely to be cut either too large, or wrongly shaped to give an exact idea of the image on the large glass, pencil marks should be made on it to just include the image. Then snap-shots are sure to contain just what you aim at. Fig. 6 shows the front of the finder at J, and Fig. 4 shows where it projects into the camera.

After a good coat of dark filling and shellac varnish, and a good rubbing and polishing, the camera was complete, and ready for work. A trial proved that it was all that could be wished—the shutter working to a charm, and the finder locating the picture exactly. In carrying it on the street, it attracts much less attention than many of the regular cameras with their outside brass work and mysterious openings. Focus was made on objects of different distances, and marks made to indicate how far the inner case should be pulled out for different views. The door in the end allows of handy focussing, as the case shades the ground glass, and no cloth is needed. The camera can be worked as quickly and as easily as any camera using glass plates. Set the shutter, pull back the top, and remove the slide from the plate-holder, and, when a picture is wanted, slip out the inner case to the right mark, touch the trigger, slip back the case, and all is done. For an arrangement where a long focus lens has to be used, it is first-class and satisfactory.

MODERN FORGING.

BY J. H.

Drawing Down.

Before any examples of forging can be given, it will be necessary to describe the essential or primary methods by which forging is accomplished. After describing in some detail each of these methods, with the aid of a simple practical illustration, we shall then be in a position to take up illustrations of forged work, more or less elaborate, where each or all of these methods are employed.

Work of unequal sectional area is done either by drawing down, upsetting, or welding, or by a combination of the three methods. In a large number of cases, the choice between these three methods is not made because one is essentially superior to the other regarded simply as a question of ultimate results, but either because under given circumstances it involves less work, or economises material, or is the only way possible with material that happens to be in stock, or because there are odds and ends that it is desirable to use up; or, lastly, because it is the best method available with the tools and help at the disposal of the smith. The alternative, therefore, is commonly one of *expediency*, and as such we shall usually have to regard it.

It is often, however, a question of *relative* dimensions. If the difference between the enlarged and the reduced part is very great, neither drawing down nor upsetting would be resorted to unless for some exceptional reason, but welding would be employed. And the same holds good in other forging; as, for example, in the case of eyes. An eye having a small hole and much metal around it, as the tie-rod of an iron roof truss, would have that end forged solid, and the hole punched through. But an eye possessing more the character of a loop, having a large hole and relatively little metal around it, would be turned round and welded. An eye of medium relations may obviously be made in either fashion.

There are large numbers of instances which might be cited where no two smiths, though similarly circumstanced, would go to work on precisely the same lines, for different men will have different ideas as to the best methods of compassing the same ultimate results.

Then the different qualities of iron will often influence a man in the choice of methods. There is some iron which will not weld easily—the hot, short variety. Some iron is dirty and scaly, and this will not weld so readily as better qualities, and these affect methods of working also.

In the later examples, therefore, which I shall give of methods of forging suitable for adoption in certain cases, it must be borne in mind that these are given from my own knowledge of work done under a given set of conditions, and that, with a change in those conditions, there would, in some cases, be alternative and more suitable methods. I shall often point out these alternative methods, but, even when I do not, it will be understood from the remarks just made that, in smiths' work more, perhaps, than in any other craft, methods of work may and do vary in different shops, and by different men in the same shops.

To draw down a piece of iron proceed as follows:—Suppose the portion marked A, Fig. 20, has to be drawn down from a bar originally of the size of B. The bar is laid across the edge of the anvil in a slightly diagonal direction and nicked with a top fuller at C, Fig. 21. If both sides of the bar have to be drawn down, then a bottom fuller (A, Fig. 22) would be inserted in the anvil in opposition to the top fuller (B, Fig. 22), and the bar would be nicked as in Fig. 23. Observe that the chisels or sets are not used in such work, for these would divide the fibres of the metal, while the round-faced fullers simply alter their direction without breaking their continuity. The preservation of the continuity of the fibre is one of the first importance in forged work, so that what may appear to be roundabout methods which give much extra trouble, will often be resorted to in order to preserve that continuity. Fibre or "grain" should never be rudely severed. Few of the tools used by the smith for shaping to outline have absolutely square edges, but they are more or less rounding. The continuity of the fibre, however it is bent and twisted, is thus preserved. How entirely fibrous is that structure is readily seen. Let a bar of iron be held in the vice and bent round until it is doubled up, then on the outside radius the torn ends will look exactly like bundles of vegetable fibre, or not unlike torn animal muscle. Or let a specimen torn asunder in a testing machine be examined, the fibrous structure will still be apparent, though not so fully as in the bending process, and the outer skin will present a most characteristic striation or shrivelling in the longitudinal direction. Yet the fibrous iron may readily be changed into a weak crystalline material by nicking with a sharp tool, or by too much hammering. Take that same bar of iron and nick it round and break it off suddenly, then the fractured surfaces are as highly crystalline as those of cast iron. This clearly shows the necessity of making fullers and other shaping or moulding tools with rounding—not keen—edges.

When the work is set down with the fuller, or fullers, the metal along A (Figs. 21 and 23) is drawn or thinned down by a succession of blows from the hand hammer or sledge, with or without previous fullering. When fullering tools are used, the top fuller would be employed singly if only the one face requires reduction, or in pairs like Fig. 22 if both faces have to be drawn down. The effect is that a succession of ridges and depressions are formed upon the surface of the spread-out work. These have then to be obliterated with the hammer.

The fullering and hammering not only elongate the bar, but also spread it out sideways. If the bar is to be equal sided, the widening has to be prevented by hammering the sides alternately with the faces. This is done very rapidly. After every three or four or half a dozen blows are given on the faces, the smith turns the bar quarter round during the brief interval between a couple of blows, and the iron receives several blows upon the edges as a corrective to those on the faces, and its equal sidedness is thus preserved simultaneously with the process of drawing down. By practice this rapid changing of the faces on the anvil is accomplished without spoiling the rectangular form. A novice is apt to develop a rhomboidal form.

Note that in this drawing down, whether done with fullering tools, or with the hammer alone, as is frequently the case where the reduction in area does not amount to much, the process of thinning down always commences at the end of the iron *farthest* from the smith, and proceeds towards himself. It is also done in sectional detail, not taking the whole surface at once. One inch and a half or two inches at a time is done, and the work is thus rendered easier than as though a larger surface were taken at a time.

When the iron is roughed down, its surface will not be perfectly smooth, yet a good smith can impart a very fair finish to a flat surface by the hammer alone. The hammers should be used in such a manner that the work should be bruised as little as possible. There is a knack in so using the hammer that its edges will not mark the work, the central rounding portion of the face striking the work. Striking fair on the middle of the hammer face, each mark serves to partly obliterate others, as a succession of cuts with an adze in the hands of a skilful carpenter leaves a very smooth and only slightly perceptible wavy surface. This "battering down" is all that a smith working single-handed can effect by way of finish. With the assistance of a hammerman the surface can be smoothed more effectually by means of a flatter (Fig. 24). This is held in the right hand of the smith and slid in turn all over the surface of the work while the hammerman strikes it with the sledge. When thus finished the work is left beautifully smooth.

In drawing down a round bar the process is the same in principle, but slightly different in detail. The rod will be nicked round with a fuller and drawn down under the hammer, beginning the drawing down as before at the end situated farthest from the hand. A fullering tool would not be used for extending the metal, but the hammer only, and the rod is rotated all the while between each hammer blow. Toward the close of the operation, finish is imparted by means of swage tools, the work lying in a bottom swage of nearly semi-circular form (Fig. 25), which shows an anvil swage fitted into the hole in the anvil, while blows are struck upon its upper surface with a hand hammer if the smith be single-handed, or with the sledge upon a top swage (Fig. 26), the counterpart in form of the bottom, if the smith has a striker.

Fig. 27 is a sectional view through top and bottom swages, A and B, with the bar of iron, C, between them; D is the anvil.

By means of spring swages, suitably rigged up (Fig. 28), a smith, working single-handed, can sometimes make use of the top as well as of the bottom tool.

Where there is a steam hammer this work of drawing down and finishing is very much simplified. It is then not even necessary to use top or bottom fullers, for, having marked the position of the shoulders on the bar, the smith lays the bar on the anvil of the steam hammer and draws down the work directly between it and the tup, turning the bar quickly round during each period of ascent of the tup. If the bar is of large size and of considerable length, the drawing down will still have to be done in detail, two or three inches from the end being drawn down first, and the bar being then thrust farther along, and the succeeding portions drawn down. But the bar is always held perfectly flat, and the hammer finishes at once if the work is flat.

If the work is circular, then top and bottom swages of the spring type are placed under the tup at the finishing stage. The bar is first drawn down roughly between the anvil and the tup, being rotated rapidly between each blow, a rudely circular form being imparted or preserved simultaneously with the process of drawing down. Before the reduction to size is quite complete, the spring swages (Fig. 28) are placed on the anvil, held by an attendant, the work inserted between them, and a few final blows of the tup on the top swage—the work still being revolved during each period of ascent of the tup—rounds and finishes the work perfectly.

The swages in Fig. 29 are two common forms used with the steam hammer. The difference in the two is that A is only made to take one diameter of iron; B will take three different sizes. The top and bottom faces of both, it will be noted, are made flat for use with the hammer, while in Fig. 28 the lower swage has a pin to fit into the anvil, and the upper swage is formed to receive sledge-hammer blows.

Simultaneously with these processes there is a matter which must not be lost sight of. Scale—*i.e.*, an oxide—forms rapidly on iron at a red heat. The larger the forging, the greater the quantity of the oxide formed. This should be brushed away at once, otherwise it will become driven into the surface of the work by the hammer blows, and form a rough scale upon the surface, which is both unsightly and a hindrance to easy tooling in the vice or lathe. A switch of brushwood is used for the purpose of brushing the scale off the forgings as fast as it forms. Where the forgings are large, a man stands by the steam hammer and brushes them away after every half dozen or so blows. At the anvil the striker or the smith knocks the scale off immediately the iron is removed from the fire, and as often as it may be required afterwards.

To judge of the length of iron to be allowed for drawing down is not difficult for a practised smith. Few go to any trouble in calculating in figures the length required. Yet in the best and most expensive qualities of iron and steel it is as well to bear in mind a rule of simple proportion. It is evident that the original section of a bar bears the same proportion to a given reduced section that the length of the latter bears to that of the former. Thus if a bar originally 3 in. square has to be reduced to an inch square for a length of nine inches, then the length of the 3 in. bar required for such reduction will be 3 in. × 3 in. = 9 in. : 1 : : 9 in. : 1 in.—that is, one inch in length of the 3 in. bar will be taken for reduction to a 9 in. length of one inch square. If the reduced portion is tapered, or of unequal and varying dimensions, then the *mean* of the various sectional areas must be taken.

Of course, additional allowance must be made for ragged and perhaps burnt ends, and a trifle for inaccuracy in cutting off. How much must be a matter for judgment. Generally practice enables a man to judge pretty accurately about these things.

There is a great difference in the time different smiths will be occupied over a given piece of work. A smart smith will, of course, try to do as much work as possible upon a forging in a single heat. Forethought is of as great, or greater, value in smiths' work than in wood or most metal work. An opportunity missed by not having the proper tools handy at the exact moment when wanted, by the neglect of some little precaution, by miscalculation, by slow movement, means another heat. While his iron is in the fire the smart smith will go mentally through the sequence of operations, and see that whatever is required is at hand, and when the iron is out, he will strike smartly while the iron is hot, and make every blow tell. Yet, as a false or too hasty movement will spoil the work, or give after trouble in rectification, everything must be performed with the most cool

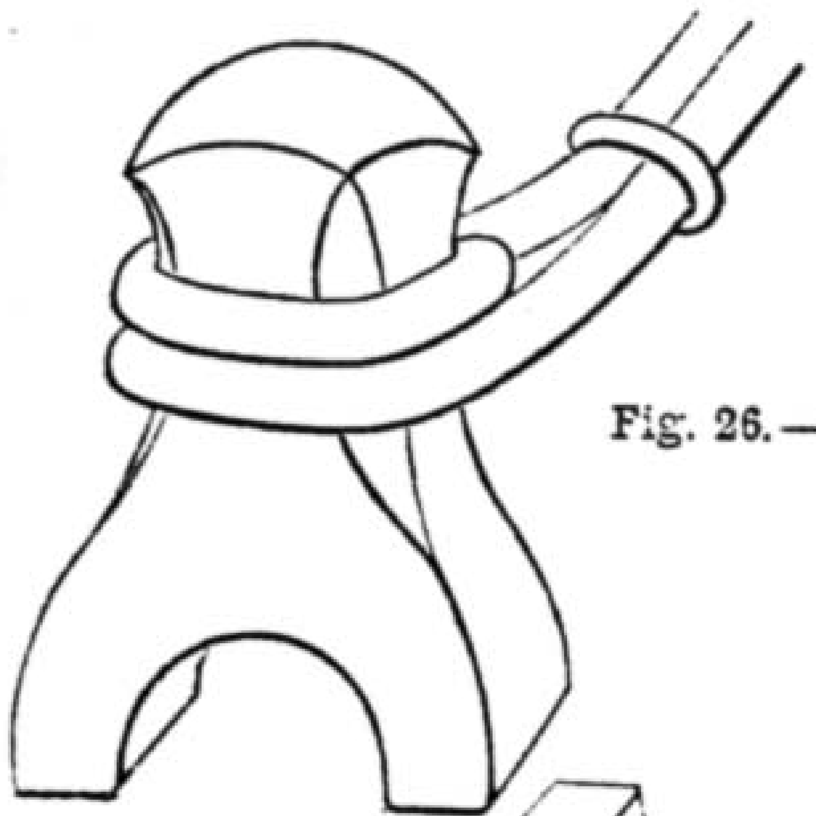


Fig. 26.—Top Swage.

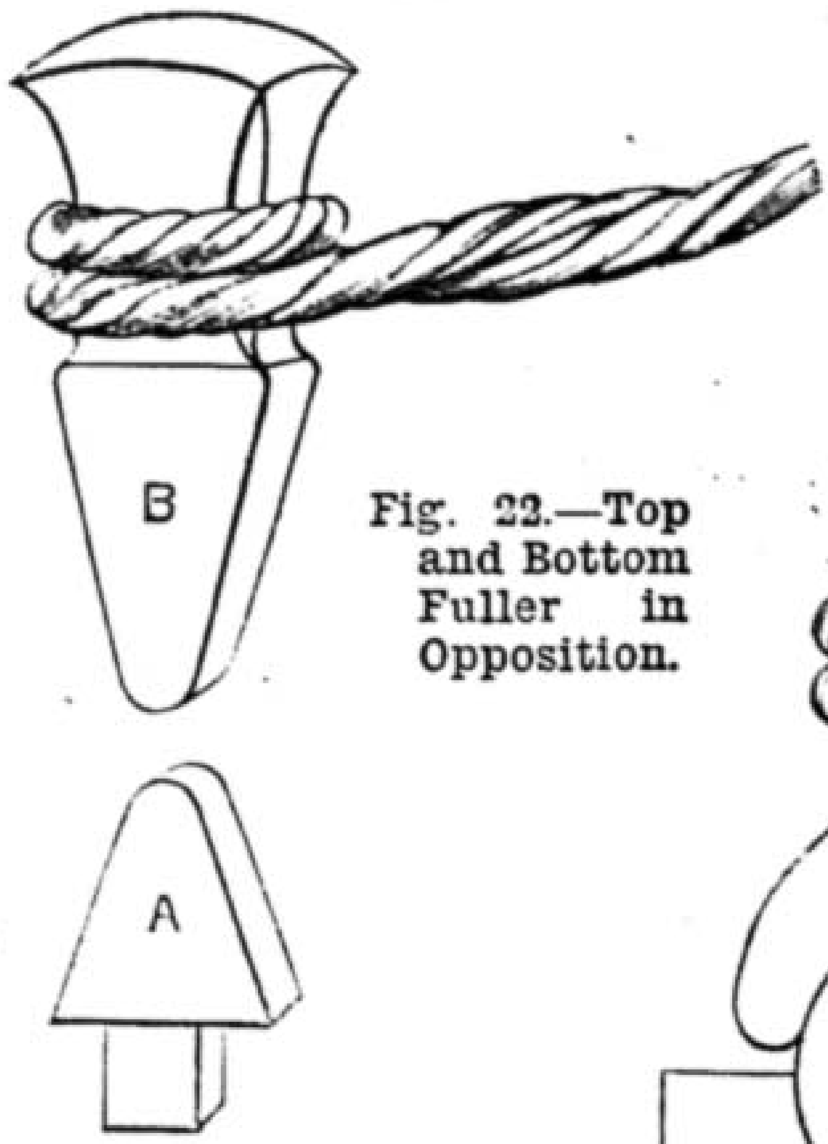


Fig. 22.—Top and Bottom Fuller in Opposition.

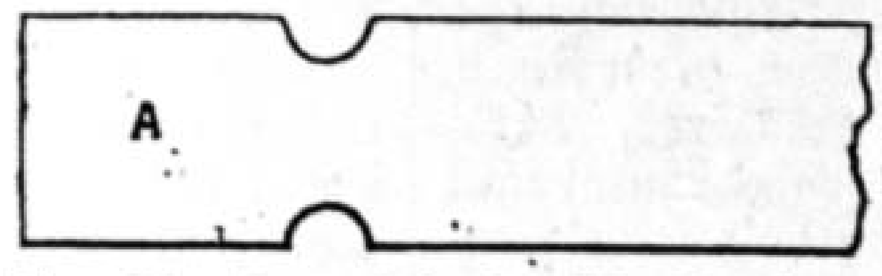


Fig. 23.—Bar nicked with Top and Bottom Fullers.

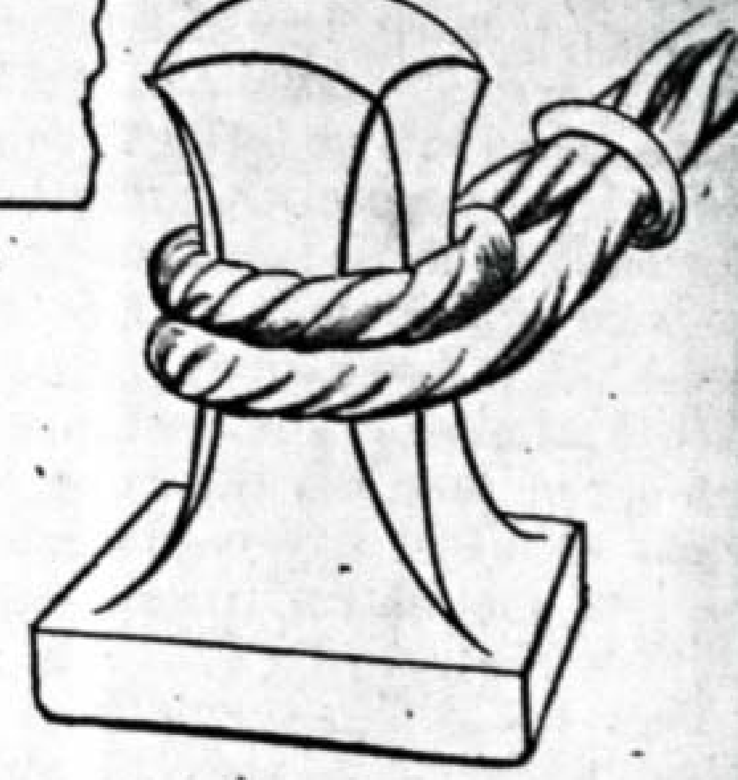


Fig. 24.—Flatter.

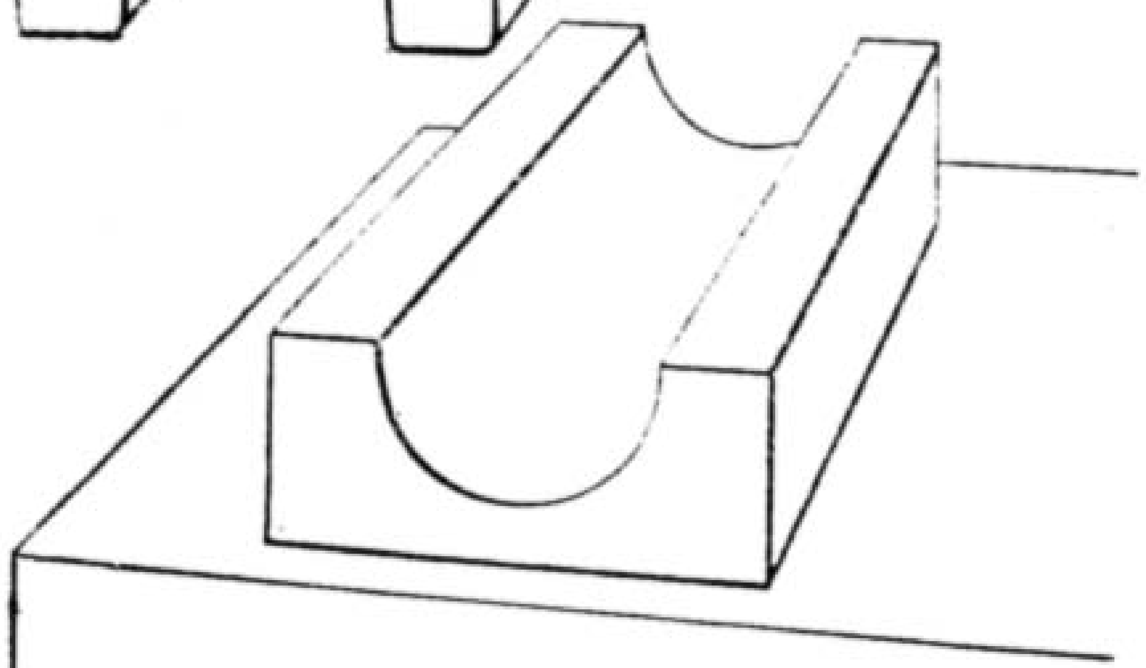


Fig. 25.—Bottom Swage.

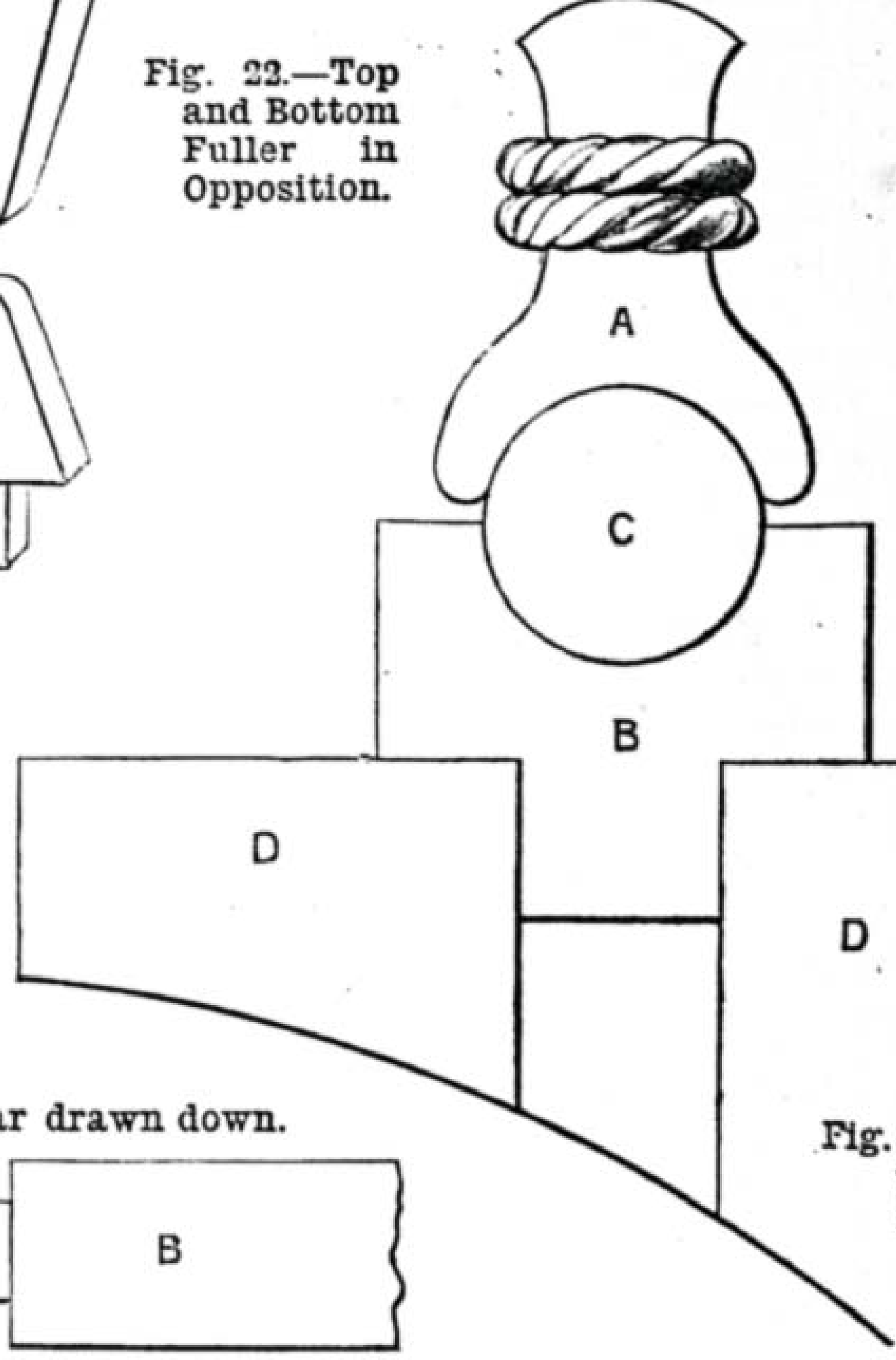


Fig. 27.—Top and Bottom Swage finishing Round Bar.

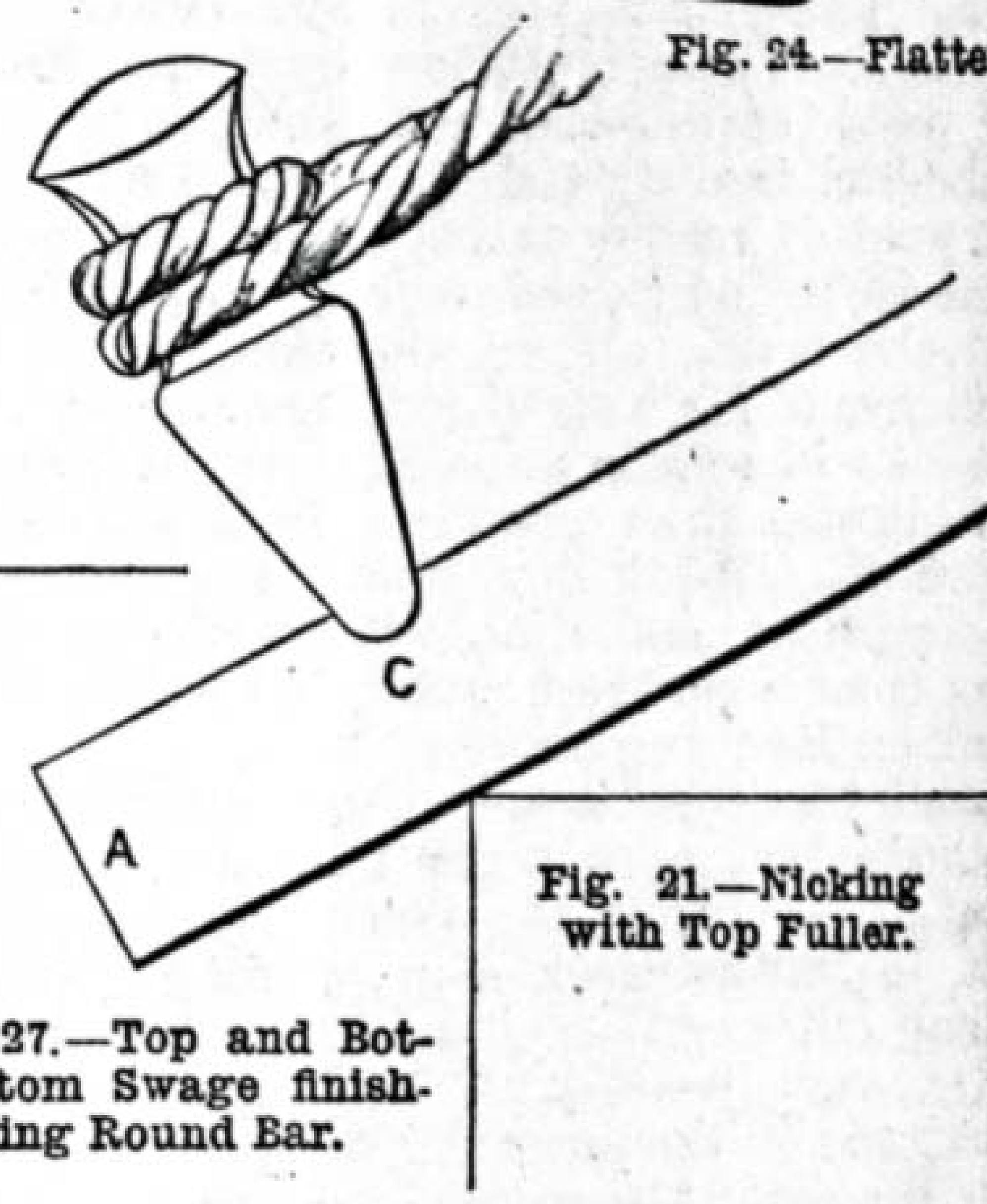


Fig. 21.—Nicking with Top Fuller.

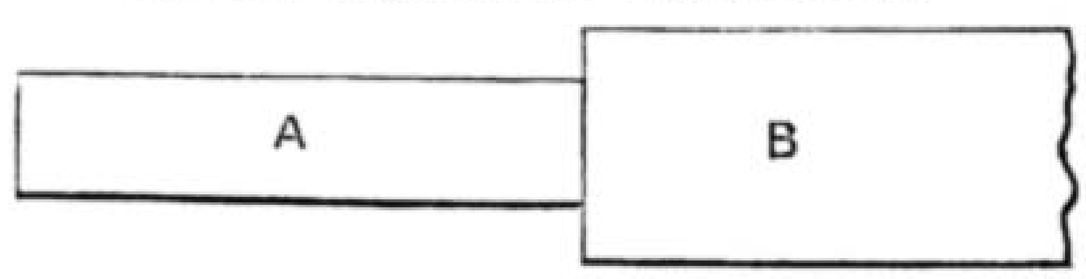


Fig. 20.—Square Bar drawn down.

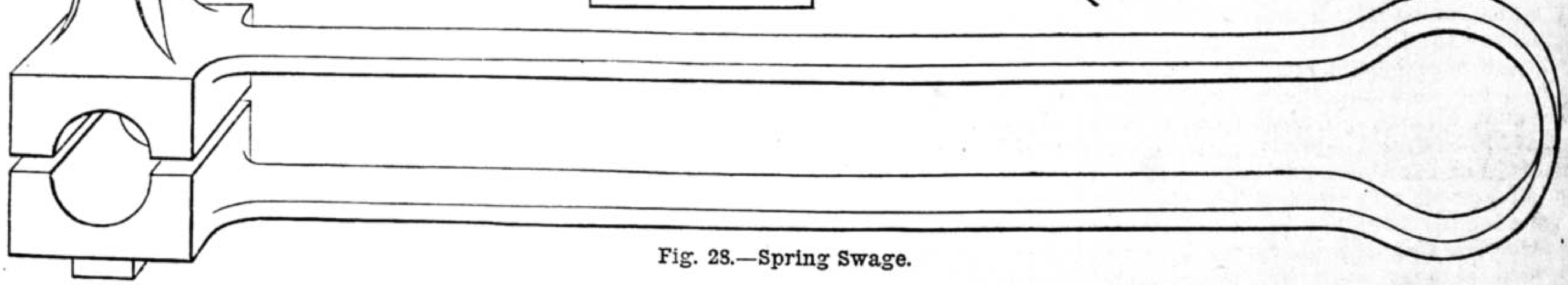


Fig. 28.—Spring Swage.

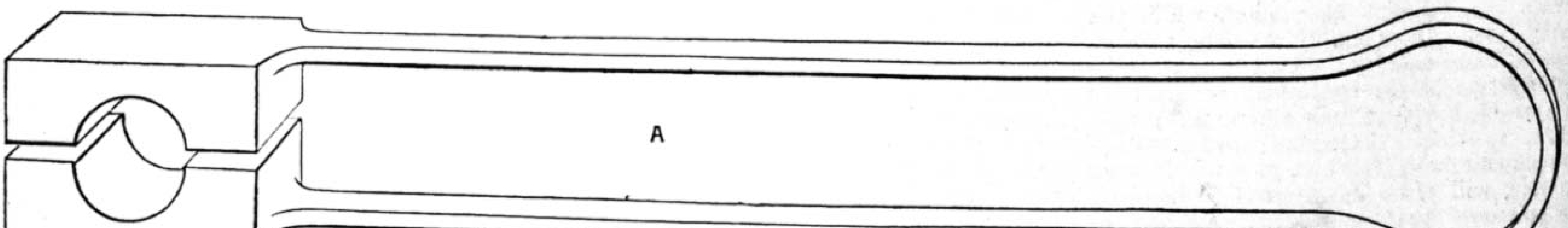
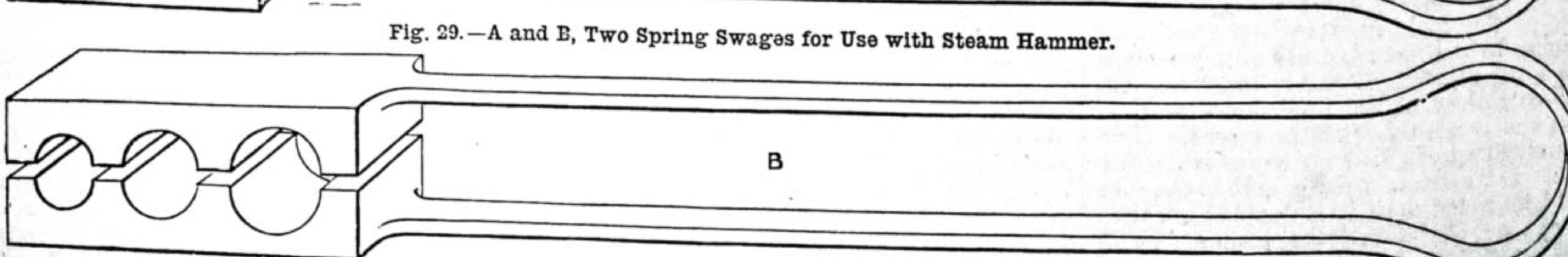


Fig. 29.—A and B, Two Spring Swages for Use with Steam Hammer.



calculation and foresight of consequences. But an unskilful and slow man will quite commonly require to take two heats to the one of a good and quick man, and will produce no better, and very likely not so good, results. In some examples to be given I will state approximately the number of heats in which such work ought to be done.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

Foundation—Curlin Cutter—Woiblet Spur Embedder—Parker's Foundation Fixer—Abbott's Foundation Fixer—Clarke Smoker.

That which has revolutionised bee keeping more than anything else, perhaps, is the invention of foundation. Without it, movable frame hives would be unknown, and the ancient bee residences would, alone, be found in our apiaries. Foundation mills would be beyond the scope of the present series of articles, as I imagine ten thousand amateurs would make hives and their belongings to the one who would attempt to make a foundation mill. I will, therefore, confine my attention to the cutting and fixing of the foundation in the frames and sections.

One of the best means of cutting the sheets of foundation is the Curlin cutter, illustrated in Fig. 1. It is very easily made, and consists of a disc of tin or steel, sharpened at the edge, and able to revolve in a handle. My cutter is of tin, two inches in diameter, and sharpened at the edge—first with a file, and then the whetstone.

The handle ought to be turned out of a piece of hard wood, and it should be, at least, six inches long, to keep the fingers well away from the revolving sharp edge. The end had better be very round, like a hemisphere, to fit comfortably into the hollow of the hand. A cut with a tenon saw will afford space for the wheel, and a thin screw or nail passed through serves as a pivot. By means of this, and a flat board, the foundation can be cut very rapidly.

When wired frames are used, the foundation is attached by means of a Woiblet spur embedder, a diagram of which I give in Fig. 2. This I made myself from the picture in Cowan's book, and it works very well. The little wheel is half an inch in diameter and an eighth thick; it has a groove turned out of its edge, as shown in Fig. 3, and is attached to a piece of wire an eighth thick, which acts as a handle. The wire is turned at right angles to itself for a quarter of an inch at one end, and the piece thus turned is filed to fit a hole drilled in the centre of the wheel. The teeth are filed out with an ordinary saw file. At the opposite end I turned the wire into a loop to serve as a temporary handle, intending afterwards to put a wooden one to it, but I have never done so since it was made, and, probably, never will. In conjunction with the spur embedder a guide is necessary. This is a board three-eighths thick, and furnished with a couple of cleats at the back. It is large enough to fit comfortably inside the frames, about thirteen inches by seven and three-quarters. To affix the foundation, the sheet is laid on the guide; the frame, which is wired—that is, has five or six No. 30 tinned wires run from the centre of the top bar to that of the bottom bar—is laid over the foundation; the embedder is heated in a spirit lamp, the groove placed on one of the wires in the frame, and the wheel runs along the wire. It melts the wax as it passes along, and sinks the wire into it. Combs thus treated are very strong. The foundation is sometimes affixed to the sections with a guide somewhat similar to that used for the frames. I give a drawing of such a guide in Fig. 4. The height should be an inch slack, for sections two inches wide. It is used by putting the section over it, the piece of foundation in its place—one edge being against the wood of the section—and running a little melted wax along the line of contact. I often use a large camel-hair pencil to lay the melted wax with, but a smelter, which I will describe later on, is the correct thing.

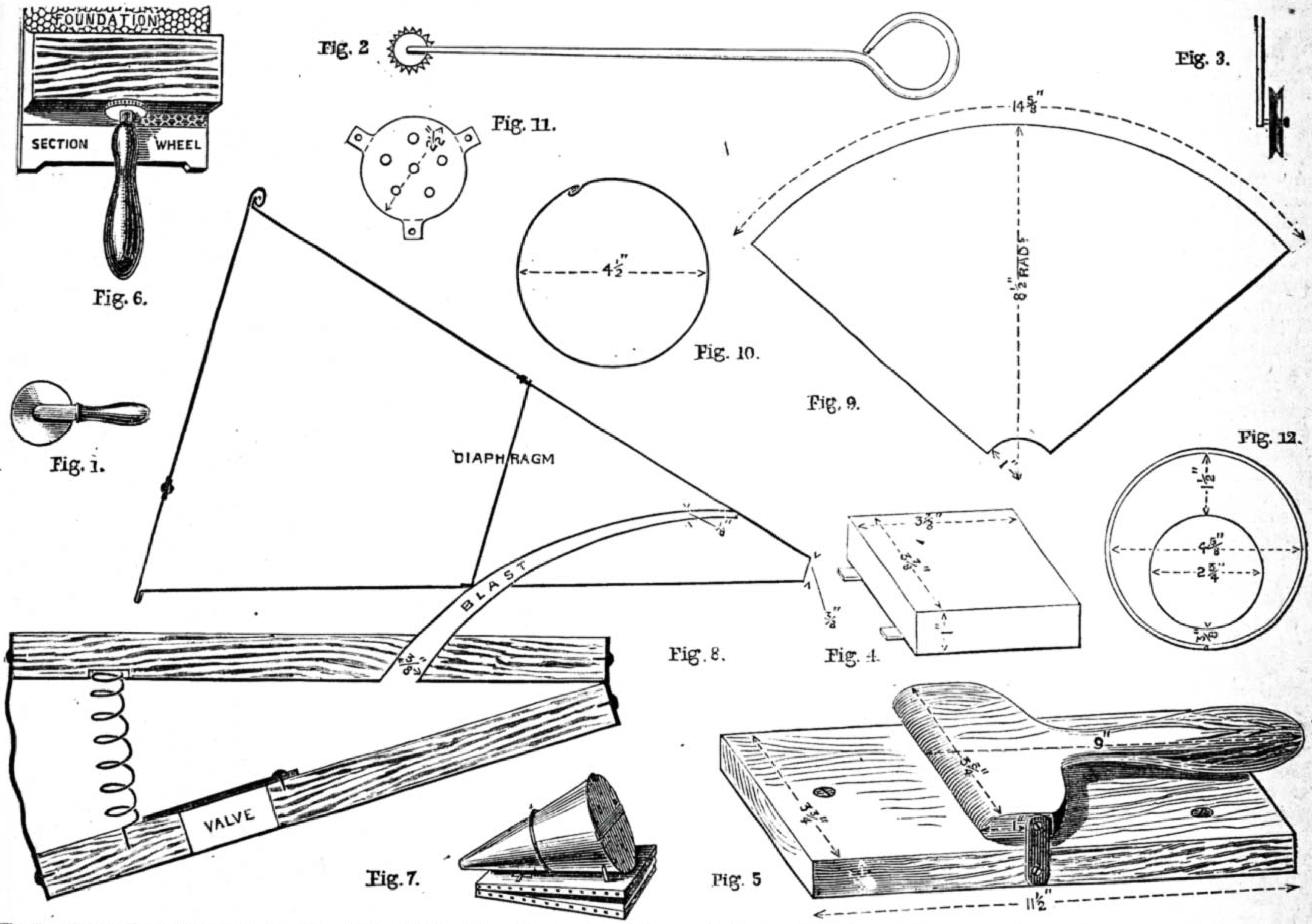


Fig. 1.—Curlin Foundation Cutter. Figs. 2, 3.—Woiblet Spur Embedder. Fig. 4.—Guide for fixing Foundations in Sections. Fig. 5.—Parker's Foundation Fixer. Fig. 6.—Abbott's Foundation Fixer. Fig. 7.—Clarke Smoker Complete. Fig. 8.—Section of Clarke Smoker. Fig. 9.—Pattern for Funnel. Fig. 10.—End of Funnel, showing Joint. Fig. 11.—Diaphragm with Tongues. Fig. 12.—Bottom of Funnel.

By far the quickest plan of attaching foundation to sections is by means of the Parker machine.

This may vary much in detail, if the general principle is observed. It is simply a lever with which the wax is pressed hard into the grain of the wood, and it then sticks to it something like putty would. Fig. 5 is a drawing of my Parker machine.

It is made of oak, of which it will require a piece twenty inches by four by one. The base is eleven inches long, and simply planed true, and two holes bored for screws to fasten it to the bench with. The handle is turned to the shape shown, the whole, including the flat part, which is three, being nine inches long. The lower part of the front of the handle has a small bevel, and the upper a good bold one, as shown. The links which connect the two together are made of inch hoop iron, the holes being an inch and an eighth apart. The screws which fasten the handle and links together are an inch and a half from the front edge of the handle, and thus an inch intervenes between the front edge of the handle and that of the link. When finished, the handle at its widest part would fit into a section, and the links would act as an efficient stop to prevent its going in farther than one inch.

To use this machine, the under bevelled edge of the lever or handle should have a little honey or butter smeared on it to prevent it from sticking. The section would then be slipped under the lever, a piece of foundation put under lever end for about an eighth of an inch, the handle raised, and with a slight drawing motion, a knife edge will be formed on the edge of the foundation, which should be raised at right angles to the section. This will fasten it very firmly if the foundation is not too hard, which it seldom will be in the summer.

The maker should not be satisfied if his machine does not work perfectly. It will usually be the under bevel, if anything, which is wrong. The point should be very slightly rounded, so as not to nip the foundation in two, and the front edge should press rather more than immediately behind it. In case the inch and a half sections are used, a stop would be tacked to the base a little in advance of the links, so as to bring the point of the lever to the centre of the section.

A machine on practically the same principle is Abbott's foundation fixer (Fig. 6). In it the foundation is fixed into the fibres of the section with a little revolving wheel, a block serving both as a guide for the wheel and for the position of the foundation. In my block a couple of pins sticking out an eighth of an inch underneath catch the edge of the section, but Mr. Abbott uses, I believe, a couple of shoulders, which prevent it from entering the section further than an inch. The handle I used for this fixer is a large bradawl handle, and the wheel a little cast iron one, which I picked up among my odds and ends. It is three-quarters of an inch in diameter, and a quarter wide, and is affixed to the handle with a wood screw passing through a hole in the centre on which it revolves. The front edge is rounded so as not to nip the foundation in two, and the entire wheel is tapered from the end next the handle. It is, in fact, a frustum of a cone. A tiny castor wheel, which I afterwards found would be just the thing—indeed, a small castor run along the guide—would affix the foundation as well as anything else almost.

I asked one of the cottagers in this neighbourhood how she fixed the foundation in her sections, and she told me that she melted a cupful of wax, and dipped the edge of the scrap of foundation in it, transferring it, while still hot and sticky, to the side of the section. I tried this plan, but found that it made an ugly smudge of wax at the line of juncture. I mention it now for the sake of those who may not have any alternative.

I now pass on to the indispensable smoker, and as the Clarke is, I think, the easiest to make, I will speak of its construction first. Fig. 7 is a general view, and Fig. 8 a sectional drawing of the Clarke, which I took asunder in order to describe it in this paper. This violent proceeding was necessary as I never use the Clarke myself, and am more intimately acquainted with the internals of the Bingham.

The bellows boards are four and a half inches by six and three-quarters, and nearly half an inch thick. An inch hole is made through one, its centre being two and a half inches from one end of the board, and midway across it. This is for the valve—which is simply a piece of stoutish leather nailed on one side and free to rise on the other, after the manner of a butterfly valve. An inch and three-quarters from the other end of the other board, a half-inch hole is bored through, sloping from the front as shown in Fig. 8. This is to take the blast pipe.

The boards are kept apart by a strong steel spiral spring, which is placed at the side of the valve, and more towards the back, just where the pressure of the hand goes. The boards at their widest part are three inches apart, and at the narrowest an inch.

The entire bellows could very easily be made by cutting out and planing the boards, boring the holes, and tacking on the valve as I said, then the points could be brought together, and a slip of leather, four inches long and an inch wide, tacked along them. The spiral spring, which could be made of hard brass wire, about eighteen gauge, could then be put in place, being affixed to the boards, either with a straight piece of wire left at both ends, or the ends of the spring could fit into holes bored partly through the boards. A bit of wire could then be bent so as to keep the boards three inches apart at the wide end while the leather was being glued and tacked on. Basil leather, which can be got for little or nothing from the saddler, would do very well, although not quite the correct thing. It should overlap the piece already tacked to the front by about an inch.

The fire box ought to be made of good stout tin. I give the pattern for it in Fig. 9. The circles there shown should be carefully scribed with a compass on the sheet of tin, and then cut out with a pair of snips. The straight edges should then be turned over a quarter of an inch, one up and the other down, and the piece bent into the shape of a funnel. The parts turned over will then catch into one another (Fig. 10), and should have a little solder run along them after they have been hammered tightly together. The solder is to hold everything tight during the process of manufacture. An eighth of an inch of the wide end of the funnel is now to be turned straight out so as to take the bottom, which is attached to it just as a tinman fines a bottom to a can, except that after it is turned over once it is left standing out from the funnel, as seen in Fig. 8. Before the bottom is fastened, it would be as well to make the diaphragm and affix it to the funnel. This is two and a half inches in diameter, of tin, and punched with a number of eighth of an inch holes. In bought smokers it is fitted in a kind of bead moulded on the funnel; but in ours we would require to leave three or four projecting tongues, which could be turned over and fastened to the funnel with little rivets. Fig. 11 shows this diaphragm, as Fig. 12 does the bottom, with its fire door cut out. The outer dotted line in this figure shows the part which will be turned over to embrace the funnel end.

The door is a piece of tin large enough to cover the hole and pivot on the rivet shown in Fig. 7. Its edges are turned over so as not to cut or scratch the hand of the operator.

The blast pipe is made of tin, four and a half inches long, and tapering in size from three-eighths to a little over an eighth of an inch bore. It is bent into the shape seen in Fig. 8, and extends to within five-eighths of an inch of the front of the fire holder.

The whole thing is attached to the bellows with two screws, holes for which, two and three-quarter inches apart, must be punched within five-eighths of an inch of the base of the funnel. The blast pipe is hooked into the hole in the bellows made for its reception, and the screws are put in at the back, a couple of bits of tin tubing, an inch long, through which the screws pass, preventing the bellows and fire box coming in contact with each other.

As I have now reached the limit of this paper, I will defer the consideration of the Bingham Smoker to the next.

HINTS TO WATCH WEARERS, AMATEURS, AND OTHERS.

BY HERR SPRING.

In my last article I dwelt upon some of the qualities of the oil used in watches, and also upon the fact that every watch wearer is, to a very great extent, a law unto himself.

The hypothesis upon which I am proceeding is this: in a high-pressure state of society, exact time is a most potent factor. Without a very large degree of accuracy in timekeepers of all sorts, modern society, with its infinitude of conveniences, its swift interchanges, its rapid transitions, must cease to exist.

It would be useless to publish Bradshaw's Railway Guide if there were only sun-dials in the land; if men had to depend upon timekeepers like the old verge watch, our railway system would practically collapse. My contention, therefore, is that modern civilisation depends to the largest possible extent upon the accuracy of our timekeepers, and that even small inaccuracies, when they occur daily and hourly among millions of watch wearers, must have, in the net result, no inconsiderable influence upon the world. If by the wave of a magician's wand every clock and every watch in the world should hereafter maintain perfect accuracy and beat exact time with Greenwich, who can say what benefits would result? In the course of a single year millions of disappointments would be avoided. In commerce, in social affairs, in love, the error of a single minute is constantly altering the destiny of human life. "Time wasted is existence; used, is life," hence it is necessary that people should learn some of the simple secrets concerning watches as they know some of the simple secrets of human health.

In my former contribution I alluded to the popular fallacy concerning the cleaning of watches, and perhaps it would be well to supplement my previous remarks with a word or two of advice.

The process of cleaning is the most important and most frequent process to which a watch is subjected during its lifetime. The future of a watch is almost, if not entirely, in the hands of the man who cleans it. A first-class watch, if cleaned but once by a common workman, is nearly certain to be irreparably damaged, while a common watch, if cleaned by a first-class workman, is nearly as certain to be improved. If a sound watch is regularly every eighteen months given for cleaning to a highly skilled mechanic, it ought practically to last for ever.

Cheap workmen and low prices are more fatal to watches than to any other form of machinery, because, obviously, watches require leisurely and delicate handling, constant vigilance, and a fairly keen sense of logical reasoning. I will give a practical illustration, drawn from actual experience, of the rough method of cleaning watches and the highly skilled method.

We will take the case of a workman who occupies private chambers, and is employed by the trade at low prices—I was nearly going to say at "sweating" prices, but that would not be accurate, because the cheap workman often earns more money than the dear one. The cheap workman regards his occupation in a purely commercial aspect. His sole object is to get as many watches as possible through his hands from Monday morning till Saturday evening. The price he is paid forbids him, even were he so inclined, to waste any time in examination or experiment. He may possibly have fifty watches on Monday to get out of hand during the week, and the instruction he receives with each is almost invariably the same: namely, "to be cleaned." He will probably employ an apprentice, or perhaps two apprentices. He takes one of the watches in hand, gives it a rapid glance, takes it hurriedly to pieces, and gives it over to an apprentice to be "brushed out." The apprentice rubs a coarse stiff brush across a piece of chalk, probably sending a cloud of dust in all directions. He picks up a piece of the watch, holding it in tissue-paper, and brushes away at it until it looks clean, renewing his application to the piece of chalk every now and again. Plenty of elbow grease, plenty of dabbing and scraping backwards and forwards, soon make all the pieces look bright and clean, and then they are handed back to the master, who puts the pieces together again, and oils the watch from an oil-pot containing oil which has been exposed to the dust of the room and to the clouds of chalk produced by the brush. Being together and once more in motion, the watch looks clean enough to the superficial eye. But it is scarcely an exaggeration to say that it is very little cleaner than it was before it was taken to pieces. It stands to reason that this process is not an efficient one. The original dirt, mixed with the thickened oil, is brushed up and down the pieces of the watch until it appears to have been removed. But is it removed? Try the same experiment on a larger scale. Take a dinner-plate covered with the fat of a mutton chop which has been allowed to go cold. Brush across the plate vigorously with chalk; then carefully examine the plate, and see how much scum you will discover, and small patches of clinging matter. Moreover, how much chalk dust remains in secret places in the watch to grind together with the oil at vital points of friction; and also, how much damage is done by the severe brushing.

Let us now take the most effective of the high-class methods of cleaning, and compare it with the other. In the first place, the skilled workman, inspired by a professional pride in his craft, carefully examines the watch before taking it to pieces, searching inductively to establish a cause for stoppage. Having made a number of observations—very trifling, perhaps, but yet important in the result—he proceeds to take the watch to pieces with great care and without undue haste. Then, having laid out all the pieces before him, he washes them in a basin of hot water, using a perfectly clean, very soft, and well-soaped brush. He does not brush backwards and forwards, and thus carry the dirt backwards and forwards with the brush, but he simply dabs at the article in his hand, and after every few dabs dips his brush into the hot water and takes more soap. Then he rinses the article well, so as to remove all soap, and drops it into a wide-necked bottle containing spirits of wine, which removes all the water, and renders even the most delicate steel pieces safe from rust. This completed, he takes the pieces out of the spirits of wine and brushes them with a fine white brush, charged—not with chalk, but with burnt bone. If a good sound beef bone is put into the fire and burnt until it becomes a white chalky substance, it will be found by far the best thing to use for this purpose. It is much finer than chalk, it does not come off in clouds under the friction of the brush, and as parts of the bone remain in a perfectly pure but cinder-like condition, any harshness in the brush is removed by contact with the grater-like points of the cinder.

A watch cleaned by the first process would be found, under inspection through a powerful magnifying-glass, to be covered with patches and scum; while in the second process it would be discovered to be absolutely pure and clean.

I have taken it for granted that the highly skilled workman has examined every pivot and every hole in the watch before beginning to wash it, and if there be any defect, or any sign of approaching defect, has repaired it. Then having carefully put the watch together, he oils it from an oil-pot which has been kept sacredly covered from all dust, and with oil which has been not longer in the pot than one or two days. The watch now going, perfectly clean, and lubricated with pure oil, is hung up for timing, and closely observed for several days, slight alterations being made here and there when thought necessary. Of course, the best process occupies a longer time than the rough one. But it is much the cheapest for all concerned in the long run. The manner in which the oil is applied is of vital importance, and therefore I shall conclude this article with a few words on that point.

The instrument used for oiling is also important. One of the best things to use

Instrument for applying Oil to Watches.

is a piece of steel of the thickness of an ordinary needle, and, say, about three inches long. Fasten a little sealing-wax round one end as a handle, and the other end file down thin, and hammer out a small blade, as in making a fine drill.

The blade should be very small, and should spread out at the extreme tip of the steel only, so as to hold the oil in a single small drop without the oil running up the neck. The point of the blade should be rounded, so as to avoid scratching. The chamfers of all the large holes should be pretty freely supplied, being fed several times with the oiler rather than at one time with a single large drop. But the most particular point is the oiling of the balance holes, which should be most carefully performed. Put a very small drop into the balance holes to commence with, and look with the glass if it runs down. Most frequently the oil does not run down the hole, but spreads out over the surface and runs down the side. To avoid this, the first drop of oil at least should be poked down the hole with a fine steel pointer, and then the hole supplied till it is full, but without overflowing the chamfer. Some workmen use a pointed peg for poking the oil down, but wood is not a reliable substance for the purpose, because it often contains a certain amount of resinous sap.

MEANS, MODES, AND METHODS.

BY VARIOUS HANDS.

I SHOULD very much like to receive more contributions than I do for this section of WORK. It is the portion set apart as a receptacle for all and any tried and approved recipes and useful wrinkles. Surely among the many thousands who read WORK there must be a considerable percentage who could thus give valuable assistance.—ED.

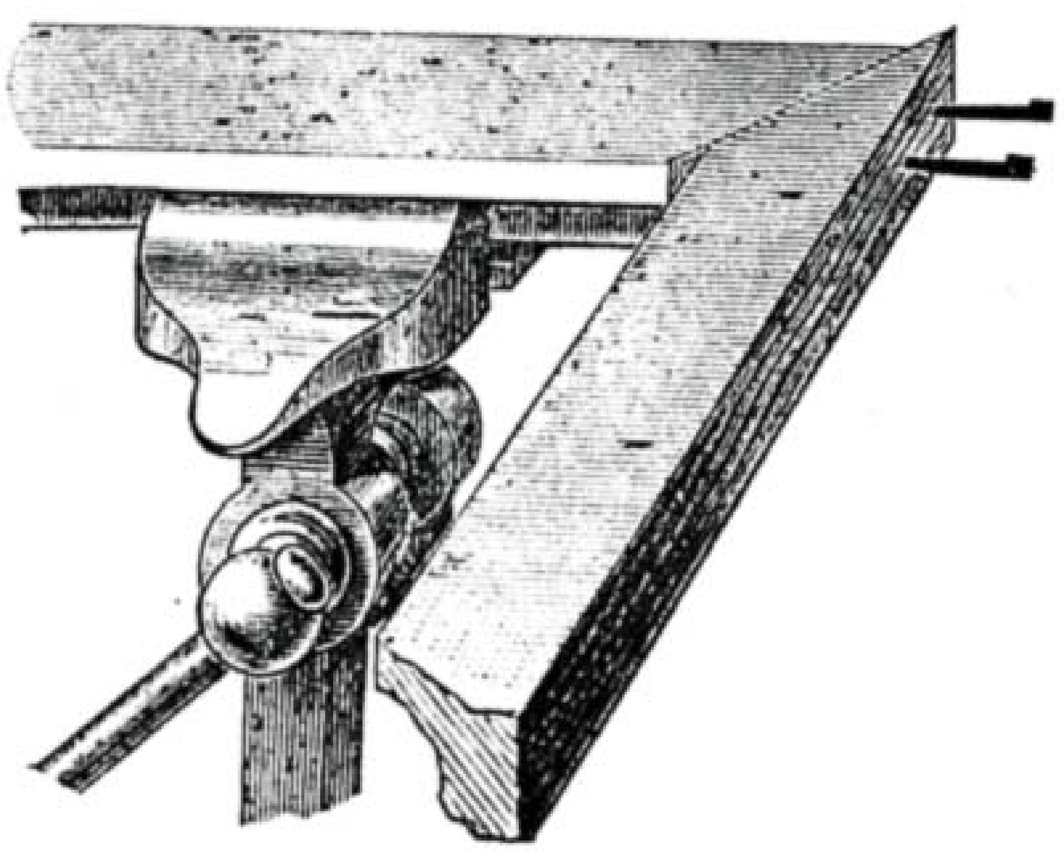
PAINT FOR OUTDOOR WORK.

For rough outside work, paint mixed with ordinary paraffin oil will often be found very useful, as, besides the saving in expense, such paint will "take" to a rough surface much more easily than when made with boiled oil, and my experience is that it lasts for years, stands the weather well, and preserves the timber. But perhaps its best quality is, that insects of all kinds keep clear of any woodwork treated with paraffin paint; at least, this is my experience, as I have a workshop which used to be infested with wood-lice, ear-wigs, *et hoc genus omne*, but since the house was painted with paraffin, three years ago, I have not found one single insect of any kind within the four walls. It will also be found useful for garden work, such as summer-houses, flower-stakes, frames, etc. etc., and especially for trellis-work, as, owing to the insinuating and penetrating character of paraffin, this paint finds its way into the numerous joints where ordinary paint will fail. The stainers should be ground in oil in the usual way, and thinned to the proper consistency with common paraffin oil, which costs about 7d. or 8d. per gallon.—OPIFEX.

PICTURE-FRAME MAKING.

I have always looked upon picture-frame making as a very simple job. But I see by the number of different mitre cramps, corner cramps, and modes of fixing corners of picture-frames described in "Shop," that to some of the readers of WORK it must be a puzzle to make a good frame. All these means can be cast aside, for with a good vice you are able to make the best of frames, providing you have a good mitre shoot; or what is much better for amateurs is a mitre-cutting machine, for with that no one need fear that he will not make a good frame if he goes to work the right way. One great point is to cut your sides exact, measuring the two pieces by placing rabbet to rabbet. But now, here comes the most particular part: bore all four of the right-hand corners with a bradawl the size of the brads used (if left-handed, as I am unfortunately, bore the left-hand corners), bore the holes at right angles to the side of the moulding, place one piece of moulding in the vice with the rabbet towards you—an iron vice is best for the purpose—but take care you do not damage the moulding, and to prevent this place three or four folds of paper round it, and screw it up tight in the vice; you will then have the end to the right, in which there are no holes.

Now place the piece of moulding that is to go on that side in its position, and mark with the bradawl the place for the nails; remove it, and bore straight holes in the moulding in the vice $\frac{1}{8}$ of an inch or more away from the marks to the outside; the holes bored must be exactly parallel to the marks. Next rub a little hot glue on the end of each piece; place the nails in the first



Mode of Nailing up Picture Frames.

holes, letting them come through a little. You will now be able to place them in the holes that were made for them, and drive them in with a hammer. You can now knock them up to a perfect and strong joint, and with a little practice you will be able to dispense with all the modern inventions for cramping the corners.

There must be two nails in each corner, suiting the size of the nails to the width of the moulding, but if the holes are bored at right angles there is no fear of having them too long, it is the thickness that must be looked to. I hope the accompanying illustration will make what I have said perfectly clear to all readers.—F. H.

DESIGNS FOR A PAIR OF SEMI-DETACHED COTTAGES.

BY W. BENNETT.

INTRODUCTION.

THE designs submitted are for a pair of labourers' cottages on a gentleman's estate. It frequently occurs that when cottages are erected in the country or suburban districts they are built in pairs, which, for several reasons, is a very great advantage, and especially so in this case, as there is a saving of one flank wall, and should there be no water supply, one well will be sufficient to supply both cottages, which is often a very important item, especially when there is a great depth to be reached before a supply of water is obtainable.

In the illustrations it will be found that the cottages are both economically and comfortably arranged. The parlour (B) is about 12 ft. by 12 ft., kitchen (C) 14 ft. by 12 ft., scullery (D) 10 ft. by 8 ft., in which is provided a setpot, which is very convenient in such a dwelling.

It will be seen by referring to the chamber plan that there are provided three bedrooms (A), which are each supplied with a fireplace. The mullion windows are to be provided with sashes, which are to be hung on butt hinges, to open inwards.

It will be useful to give the references by letter in the ground plan (Fig. 3) and the chamber plan (Fig. 4) here in their proper sequence:—A, Bedrooms; B, Parlour; C, Kitchen; D, Scullery; E, Staircase; F, Entrance Door; G, Verandah; H, Pantry; I, Coal Cellar; K, Privy; L, Dust-bin; M, Yard.

The cottages are designed in the half-timber style, generally called Old English, which, when erected, would present a very picturesque appearance, with its low gables and moulded bargeboards projecting over the face of the battened and panelled wall.

SPECIFICATION OF WORKS.

Trenches for footings. Make perfectly level the bed of all trenches for footings, and consolidate the earth about the same and against all walls, drains, etc.

Concrete foundations. To make an artificial foundation to the entire buildings, the same to be composed of one part of the best fresh quick stone-lime, to six parts of unscreened coarse stone ballast, mixed thoroughly with each other.

BRICKWORK.

Brickwork, general course. The whole of the exterior brickwork to be the best red pressed bricks laid on mortar compounded of one-third well-burnt stone-lime and two-thirds of clean sharp sand; the bricks are to be properly bonded together in English bond.

Damp-proof course. Lay throughout the length and thickness of all walls, jambs, a course of pitch or asphalt $\frac{1}{4}$ in. in thickness, to prevent the damp from rising.

Gauged arches. All windows to have the best gauged arches abutting on proper skew-backs, the soffits and reveals being $4\frac{1}{2}$ inches.

Brick fire-places. Properly form all fire-places with camber arches over same, and trimmer arches where required for front hearths; carefully carry and gather in the chimney throats, and carry up flues of not less than 14 in. by 9 in. in the clear.

Chimney-bars. Put chimney-bars of wrought iron, $2\frac{1}{2}$ in. by $\frac{1}{2}$ in., and 18 in. longer than the opening, properly caulked at the ends.

Bedding, pointing, and backing. To bed in mortar all bond timber, plates, lintels, wood-bricks, templates, stone and other work required to be set in lime-and-hair mortar; all doors and window-frames to be pointed round with ditto.

Yard paving. Pave the yard with cement laid on 6 in. of concrete.

Privy drain. Put from privy a drain of 4 in. glazed stoneware pipes, to be carried straight away to main drain.

Drains. All drains to be laid to the proper fall, and all socket joints to be well filled in with Portland cement.

STONEWORK.

Door-steps. To put to all exterior doorways two 12 in. by 6 in. plain solid tooled steps of Whitbystone.

Window-sills. To put to all windows finely-rubbed sills of Whitby stone 12 in. by 6 in., sunk, weathered, and throated. The sills to be 4 in. longer than the openings.

Chimney-stacks. The chimney-stacks to be capped with a 6 in. stone, moulded.

SLATING.

Common slating. Cover the roofs with good Countess slates on slate-boarding, to give the slate a 3 in. lap, nailed to boarding with best copper nails, two to each slate.

PLASTERERS' WORK.

Battened walls. Cover the battened walls of chamber floor with rough stucco laid on laths.

Brick walls. To cover the brick walls with simply two coats of common lime-and-hair plaster.

Ceilings. Lath, float, and set the ceilings with one coat of ditto.

CARPENTERS' WORK.

Bond lintels. Provide all necessary wood-bricks and templates of sound red pine, with every required preparation for fixing grounds, battens, and joinery; also lintels of red pine over all windows and doors, the lintels to have a vertical depth of $1\frac{1}{4}$ in. for every foot of bearing.

Ground joists. Ground joists to be of sound old pitch pine, $4\frac{1}{2}$ in. by 3 in., 12 in. apart; wall-plates to be $4\frac{1}{2}$ in. by 3 in.

Ceiling battens. The joists of floors to have ceiling battens $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. and 12 in. apart.

Roofs. The roof over buildings to be supported by trusses, as shown on drawing; these trusses to be not more than 8 ft. apart; all scantlings to be of pitch pine, properly bolted together where required.

Windows. Provide all mullions and sashes to windows, also window-boards and architraves, and fix same.

Projecting eaves. Provide and fix all carpentry necessary to form the projecting eaves.

Floors. Cover all floors except kitchens with $\frac{1}{2}$ in. deal floor-boards.

Doors, etc. Provide and fix all doors, plinths, joists, lintels, walls, and bond timbers where required in the erection of the cottages.

PAINTERS' WORK.

The whole of the outside work to have three coats in oil and turps; the inside work to have two coats of ditto.

PLUMBER AND GLAZIER.

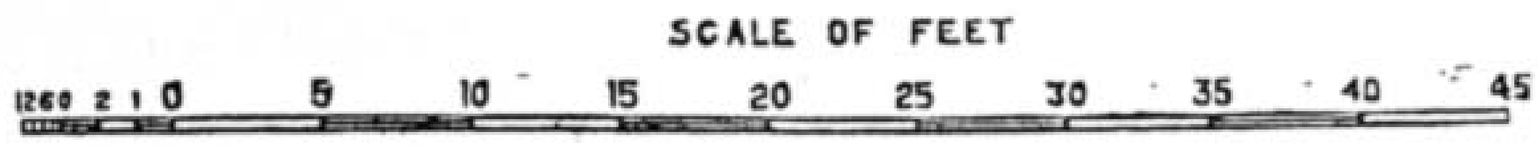
Windows. Glaze all windows with crown glass properly secured to sashes with beads.

Eaves Spout. Provide and fix 6 in. by 4 in. eaves spout securely fixed to fascia.

Fall Pipes. Provide and fix all fall pipes where necessary, with proper bands to same.

The cost of the pair of cottages, exclusive of site, will, in all probability, not exceed the sum of £400, but prices will, of course, vary in different parts of the country, owing to differences in the cost of materials and labour.

⁂ *Owing to the requirement of considerable space for the announcement of our coming* "WORK" EXHIBITION OF JANUARY, 1891, *in this number (see page 290), "Our Guide to Good Things" must of necessity be omitted.* —ED.



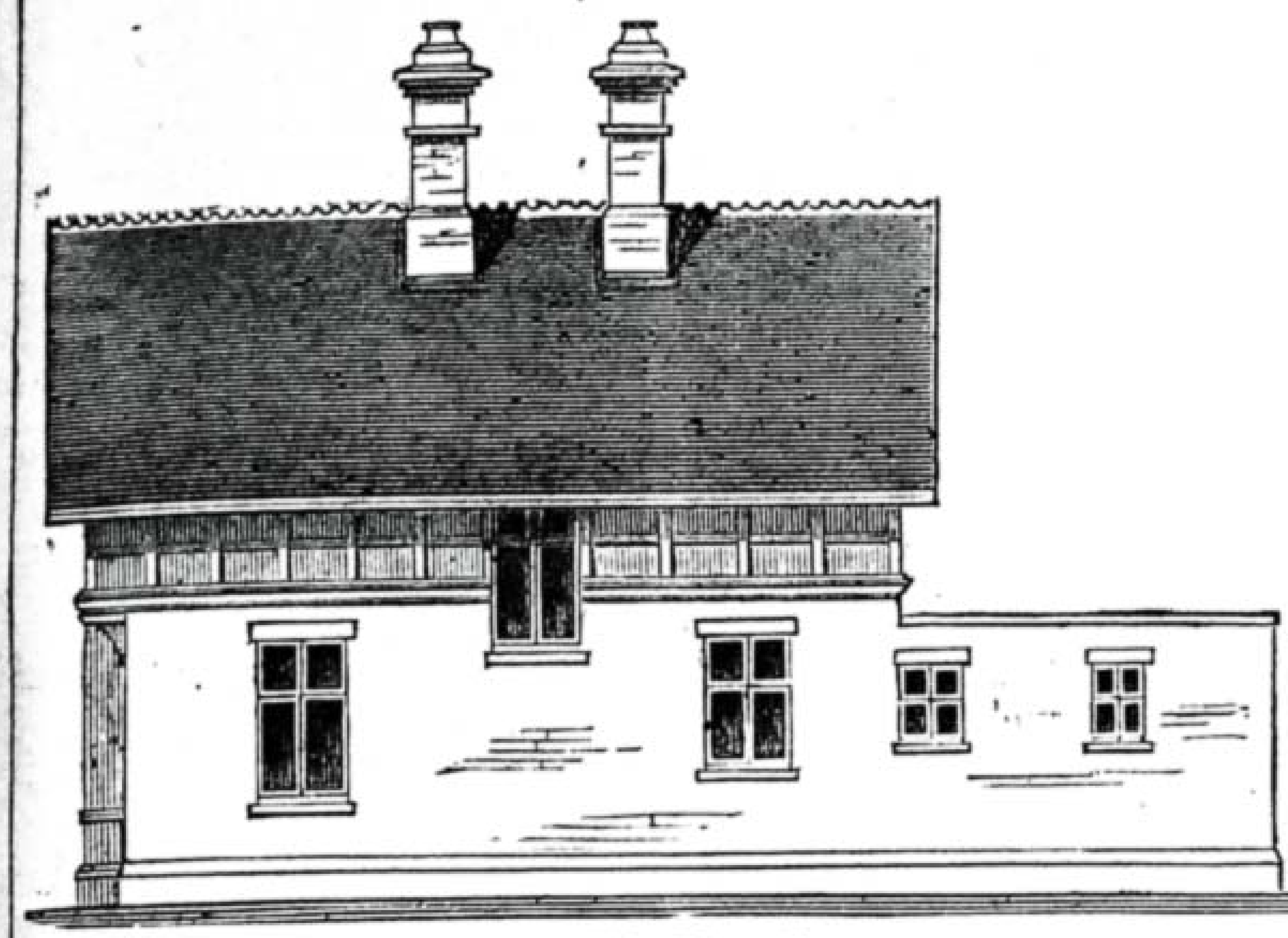


Fig. 2.—Side Elevation.

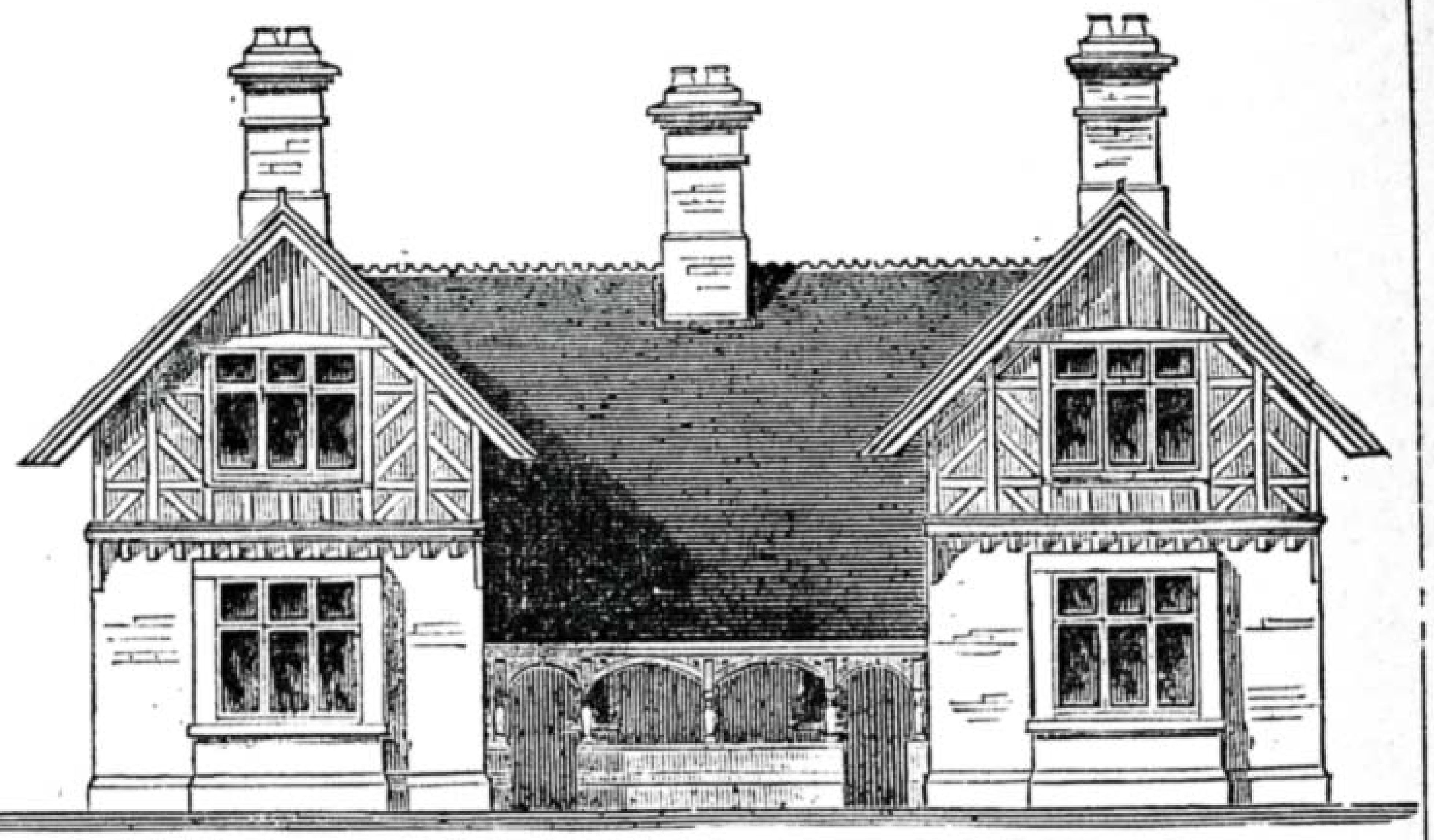


Fig. 1.—Front Elevation.

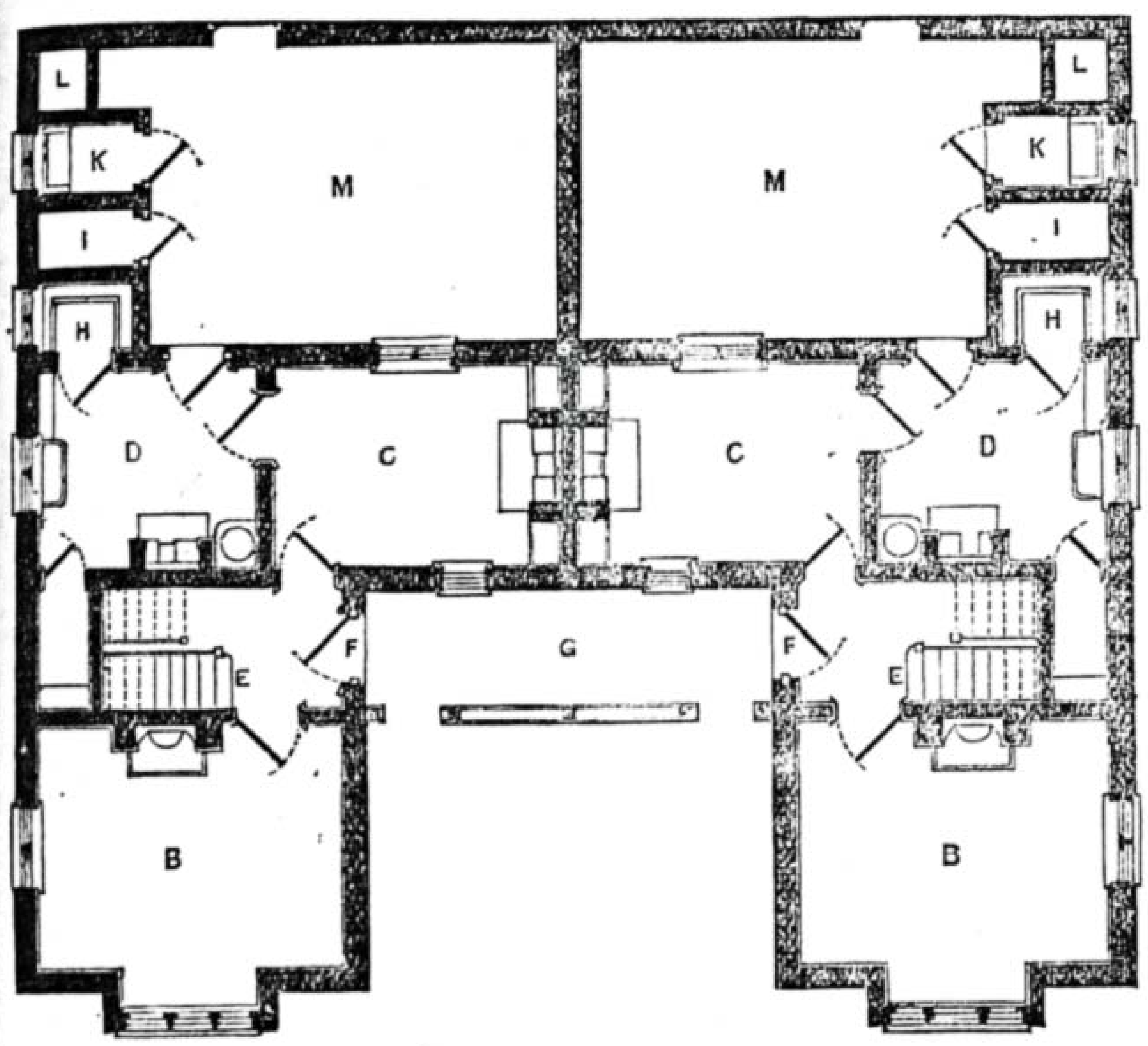


Fig. 3.—Ground Plan.

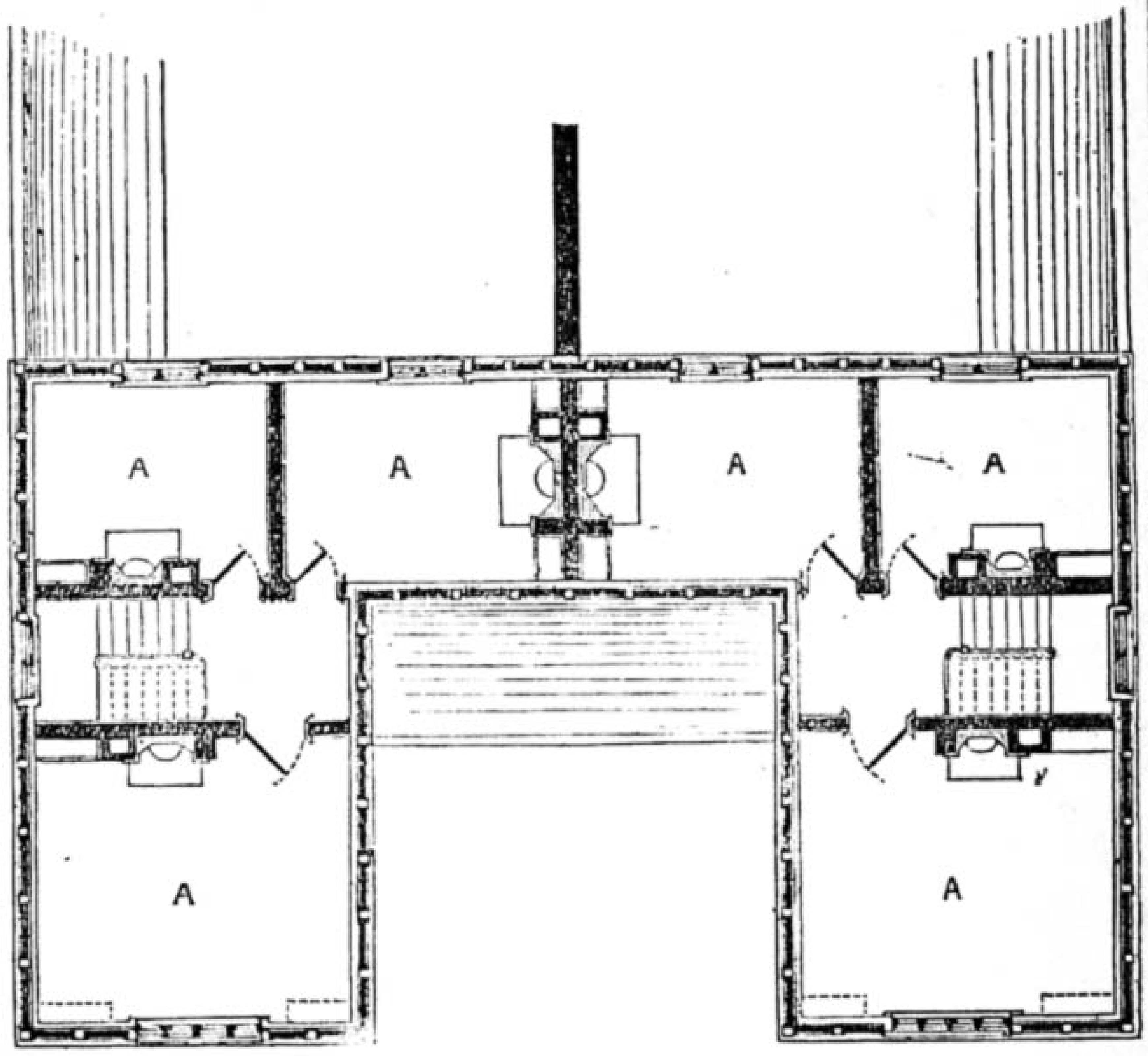


Fig. 4.—Chamber Plan.

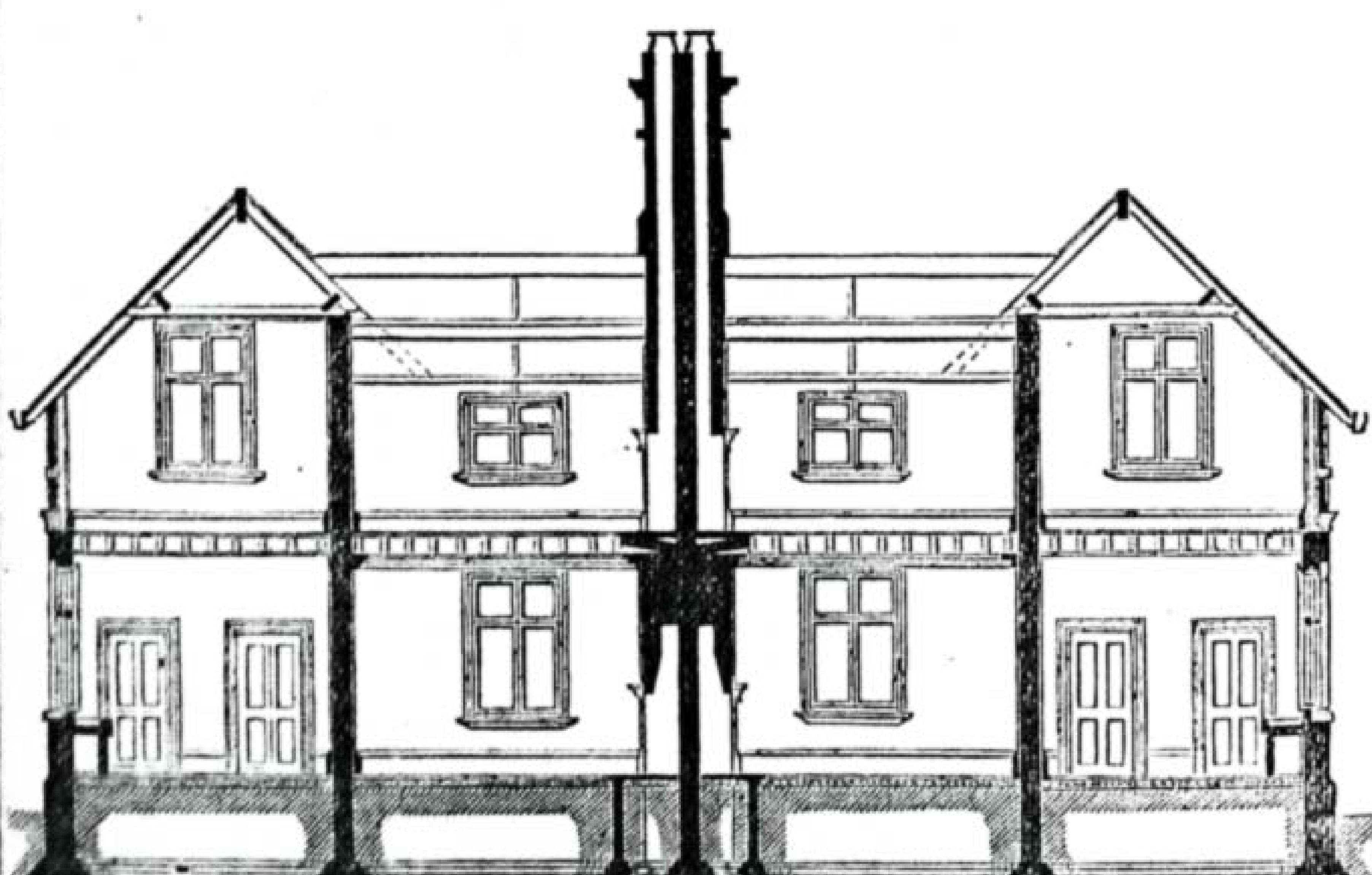


Fig. 5.—Longitudinal Section.

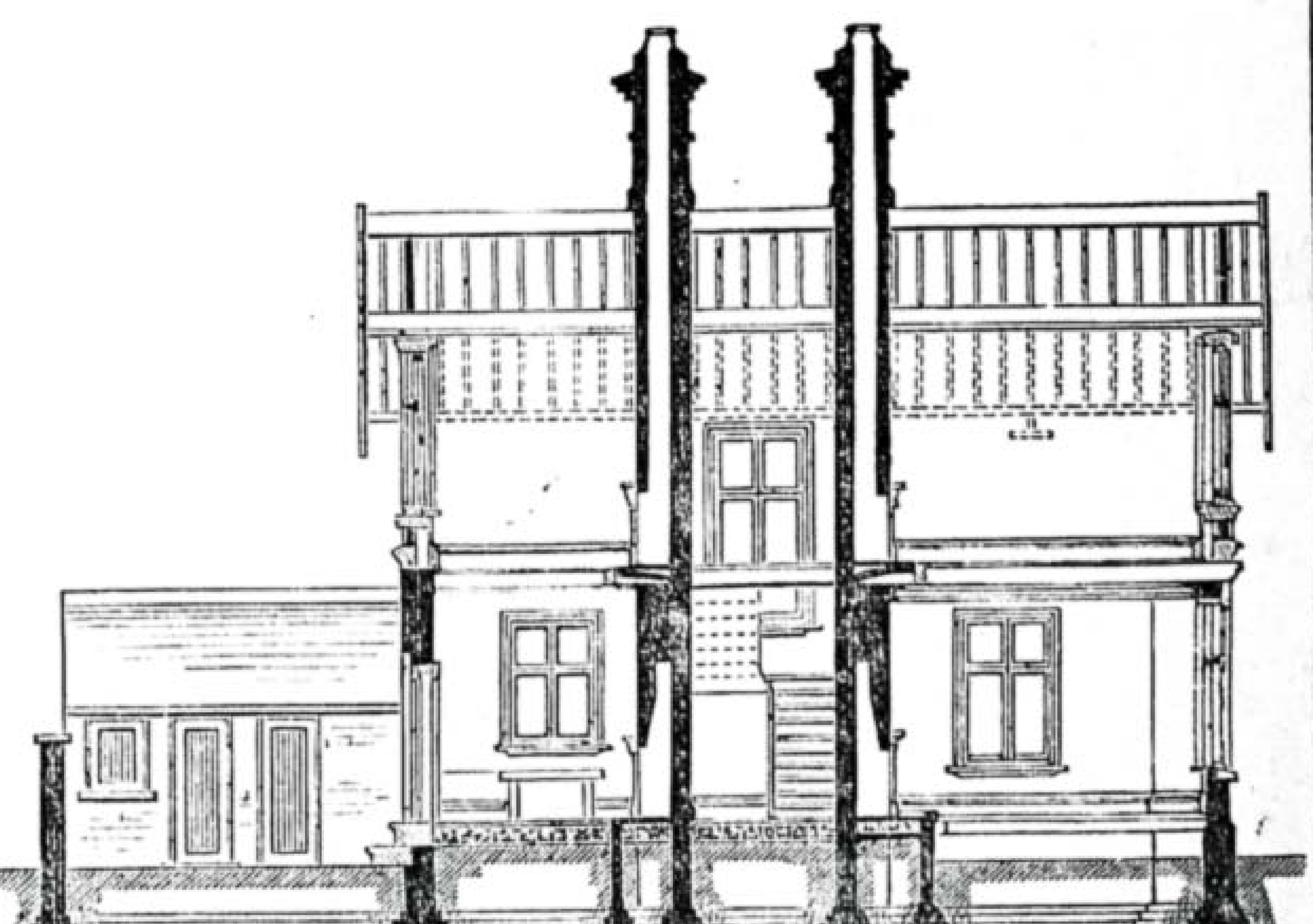


Fig. 6.—Cross Section.

DESIGNS FOR A PAIR OF COTTAGES. Drawn expressly for "WORK" by W. BENNETT.

"WORK" EXHIBITION, 1890-91.

Classification of Exhibits for which it is intended to offer Prizes, Medals, and other awards, to readers of Work (the illustrated magazine of theory and practice for all workmen, professional and amateur), to be held at the Polytechnic Institute, Regent Street, from December 29th, 1890, to January 10th, 1891, inclusive.

Group I.—WORK in Wood.

Furniture, Cabinet Work, Carving, Pattern-making, Turning, Carriage and Cart Building, Wheel-making, Pulley-block-making, Carpentry, Marquetry, Parquetry.

Group II.—WORK in Metals.

Casting, Forging, Stamping, Die-sinking, Medal-striking, Finishing, Turning, Screw-cutting, Repoussé Work, Arms (Guns, Rifles, Pistols, Swords, Bayonets, Lancets, Armour), Armour Plating, Iron Ship-building, Amalgams, Mixed Metals.

Group III.—Tools for WORK.

Hand Tools, Machine Tools, Tools for Sharpening Tools, Photo-micro and Electric Apparatus (except Lighting and Telegraphy), as Cameras, Magic Lanterns, Slides, Microscopes, Surgical Instruments, Mathematical and Drawing Instruments, etc.

Group IV.—WORK in Design only. *Exhibits to take the Form of Drawings or Models.*

Designs for Decorative Purposes (including Stained Glass). For Architecture (including Ventilation). For Mechanical Purposes, such as Boilers, Engines, Machines. For Engineering, Forts, Ships, Roads, Bridges, Canals, Sewers, Railways, Trams, Balloons, Parachutes, Ambulances, Tents, etc.

Group V.—WORK in Printing.

Letterpress, Type Founding, Press-work, Machine-work, Lithography, Drawings on Transfer Paper, on Stone, on Wood, on Zinc; Engraving on Steel, Copper, and Wood; Colour Work, Photography on Stone, on Wood, Photographic Printing, Bookbinding, Music Printing, Transferring, Stereotyping, Electrotyping.

Group VI.—WORK in Domestic Appliances.

For Decorative Purposes. For Cooking (Hardware, Glass, Pottery, Faïence), Heating, Washing, Drying, Lighting, Cleaning, Sewing, Bathing, Teaching; Home Recreation, Games, Gymnastics; Hygiene; Toys, Dolls, Wax-work (Figures, Fruit, and Flowers); Telegraphy, Telephones; Watches, etc.; Basket-work.

Group VII.—WORK in Wearing Apparel.

In Tailoring, Hat-making, Boot and Shoe-making, Mantua-making, Millinery, Beading, Dress-making, Baby Linen, Lace-making, Knitting (Machine or Hand), Needle-work (Machine or Hand), Button, Cotton, Silk, and Thread-making, Hose, Gloves, Wigs, Theatrical Costumes, Court-Dresses, Uniforms, Liveries, Belts, Buckles, Fans, Feathers, Artificial Limbs, Eyes, Teeth, etc., Abdominal Belts, Trusses, Surgical Bandages and Appliances, Electric Belts and Bandages, Jewellery, Hair-dressing.

Group VIII.—WORK in Painting and Decorating.

House Painting; Decorative Painting in Oil, Distemper, Flatting and Fresco; Gilding, Graining, Marbling, Sign and Facia Writing, China Painting, Carriage Painting, Heraldic Painting, Scene Painting, Stained and Painted Glass and Imitation ditto, Plaques, Panels, Appliances for Painting and Decorating.

Group IX.—WORK in Textile Fabrics and Leather.

Curtains, Carpets, Blinds, Rugs, Upholstery, Screens, Brackets, Frames, Harness, Saddlery (Civil and Military), Bags, Trunks, Portmanteaux, Travelling Bags and Trunks, Dress Baskets, etc.

Group X.—WORK in Musical Instruments and Music.

1. Organs, Pianofortes, Harps, Violins, Banjos, Mandolins, Guitars, Cornets, Trombones, Clarinets, Oboes, Drums, Flageolets, Flutes, Piccolos, Fifes, Bagpipes, Triangles, Cymbals, Metronomes, etc. 2. Musical Compositions, Systems of Teaching, Appliances for Learning.

Group XI.—WORK in Watches, Clocks, Alarm Bells, etc.

1. Design of any of the above (including Musical Boxes and Mechanical Contrivances). 2. Actual Models or Finished Working Specimens, Clockwork for Lighthouses, Burglar Alarms, Electric Signals.

Group XII.—WORK in Building Appliances and Material for Building.

Bricks, Tiles for Floors and Mural Decoration, Stone Masonry and Carving, Terra-cotta Chimney-tops, Drain Tiles and Pipes, Sanitary Stoneware and Pottery, Mosaics, Hot and Cold Water Appliances, Baths and W.-C.'s.

Group XIII.—WORK in Chemical Processes and Products.

Stains, Dyes, Colours, Inks, Varnishes, Soaps, Cleansers, Disinfectants, Food Compounds, Drinks, Igniters, Fuels, Explosives, Manures, Detergents, Antiseptics, Anodynes, Electric Lighting, etc.

Group XIV.—WORK in the Utilisation of Waste (Novel and Original Feature).

Utilising Waste Space in crowded Cities and Towns.
" " " in Agricultural Districts.
" " Heat.
" " Water.
" " Sewage.
" " Products hitherto unused.
" " Labour, manual and mental.
" " Time.
" " Capital (including legacies not applied for by claimants).
" " Charity Funds, which have exceeded testators' expectations.
" " Power, of Combination for legal purposes, Purchasing power, Co-operation, Power of oppression by sweating.

Exhibits in this Group to take the form of Essays, Plans, Précis of Experiments, and even Suggestions.

There will be three classes of Exhibitors, viz.:—

1. **Workmen** or Workwomen actually employed and gaining their livelihood in and by the craft under whose name they exhibit.
2. **Apprentices**, *bonâ fide*, serving an apprenticeship to the craft or calling under whose name they exhibit (whether indentured or otherwise).
3. **Amateurs** or connoisseurs who either do not practise any craft as a means of subsistence, or who exhibit in any group other than their own craft.

The Exhibits will be judged in accordance with the above classification of Exhibitors.

The Jurors will judge all Exhibits in Groups I., II., III., X., according to workmanship alone, irrespective of design, which may be new or old.

The Jurors will judge all Exhibits in Groups V., VI., VII., VIII., IX., XI., XII., according to merit in design associated with meritorious *workmanship*.

The Jurors will judge Exhibits in Groups IV., XIII., and XIV., solely as to novelty, originality, and improvement upon known and existing forms, formulæ, and processes, designs, or inventions, irrespective of workmanship in their execution.

The Jurors will be practical and competent experts.

Exhibitors may declare their Exhibits as not in competition.

Conditions and Regulations.

1. Any *bonâ-fide* subscriber to Work shall be eligible to exhibit on the Conditions and under the Regulations stated below.

2. All intending Exhibitors must make the prescribed entries upon the printed form (hereto annexed) and sign the same in the presence of a reliable witness, who shall also sign and give his address and occupation. N.B.—Any false or fraudulent statement will disqualify.

3. Every Exhibitor is to pay the carriage of his Exhibit to and from the Exhibition. The Proprietors of Work will supply printed labels for attaching to packages. It must, however, be distinctly understood that the Exhibit will be entirely at Exhibitor's risk. No package will be received unless it bears the official label.

4. Every Exhibitor must fill in, on the Application Form, the value or price he places upon his Exhibit, and of any separate portion thereof, so that in case of sale and for insurance purposes, no dispute may arise.

5. The Secretary will advise, on printed forms, the receipt of an acceptance of all Application Forms which are correctly filled up, and will return any for correction which are not filled up correctly. All correspondence must be addressed prepaid to the Secretary, "Work" Exhibition, La Belle Sauvage, Ludgate Hill, E.C. *All letters requiring an answer must be accompanied by a stamped and addressed envelope.*

6. The Awards of the Jurors shall be final and binding without appeal.

7. The Proprietors of Work reserve the right to decline any Exhibit which they may deem unsuitable or unworthy, and the Secretary will advise the Exhibitor of such decision.

8. All Exhibits must be forwarded so as to arrive on the 19th or 20th December, and not before. Applications for space must be filled in and forwarded AT LATEST BY THE 30TH DAY OF OCTOBER, after which date they cannot be received, and no labels for carriage will be thereafter issued. It is intended to open the Exhibition on Monday, December 29th, 1890, and to keep it open till Saturday, January 10th, 1891.

9. Every Exhibitor will be entitled to a free Admission Ticket, not transferable, available during the Exhibition. Exhibitors at a distance unable to come to London, may have such ticket transferred to a London friend on nomination by previous arrangement with the Secretary. Applications for Free Tickets for Attendants should reach the Secretary not later than the 10th of November.

10. No articles must be removed till the close of the Exhibition.

11. The Proprietors of Work reserve the right to remove the Exhibit of any one who does not conform to the regulations, and also the right to alter, add to, or cancel, any of these Rules.

12. Awards, Medals, Prizes, etc., will be forwarded, post free, to all Exhibitors who do not present themselves at the Distribution of Prizes, the date of which will be duly announced in Work.

PRIZE LIST.

Group Prizes.—Gold Medals.—A Gold Medal will be given for the best Exhibit in the whole Exhibition, together with a First Class Certificate (except Group XIV.). A Gold Medal will be awarded with a First Class certificate to the best Exhibit in Group XIV.

Silver Medals.—A Silver Medal, a Money Prize of One Guinea, and a First Class Certificate, will be awarded to the best Exhibit in each of the Groups as classified above, except Group XIV., where a Gold Medal will be awarded.

Class Prizes.—Bronze Medals.—A Bronze Medal, a Book Prize of Half-a-Guinea, and a Second Class Certificate, will be awarded by the Jurors to the best Exhibit in each Class or Sub-Division of Groups.

Special Prizes.—Special Prizes, of which details will be announced later on, will be given to the best Exhibit from actual Working Drawings published in "Work."

Certificates of Merit.—A First Class Certificate and Book Prize of One Guinea will be awarded (1) To the Second Best Exhibit in the Exhibition, (2) To the Second Best Exhibit in Group XIV.; and if recommended by the Jurors, a special extra Silver Medal will in either case be given. A Second Class Certificate will be awarded (1) To the Third Best Exhibit in the Exhibition, (2) To the Third Best Exhibit in Group XIV. N.B.—The Proprietors of Work reserve to themselves the right of

Forms of Application for Space will be sent, post free, in response to letters addressed to The Secretary, "Work" Exhibition, Messrs. Cassell & Company, Limited, La Belle Sauvage, London, E.C.

publishing in the pages of that Magazine any Essay or Suggestion for which a Prize shall have been awarded.

SECOND CLASS CERTIFICATES will be awarded to the Second Best Exhibit in each Class or Sub-Division of Groups.

THIRD CLASS CERTIFICATES will be awarded to the Third Best Exhibit in each Class or Sub-Division of Groups, and if specially recommended by Jurors, Second Equal Awards in case of Ties of Merit.

Limitation.—It shall, however, be understood, that the highest Prize Medal only shall be given, in lieu of minor honours; but all honours obtained shall be recorded upon the Certificate in each case. *No Prize will be awarded except on the Jurors' recommendation as to merit.*

Exhibitor's Certificate. — Every Exhibitor, whether a Prize Winner or not, will be entitled to a separate Certificate that he has exhibited.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

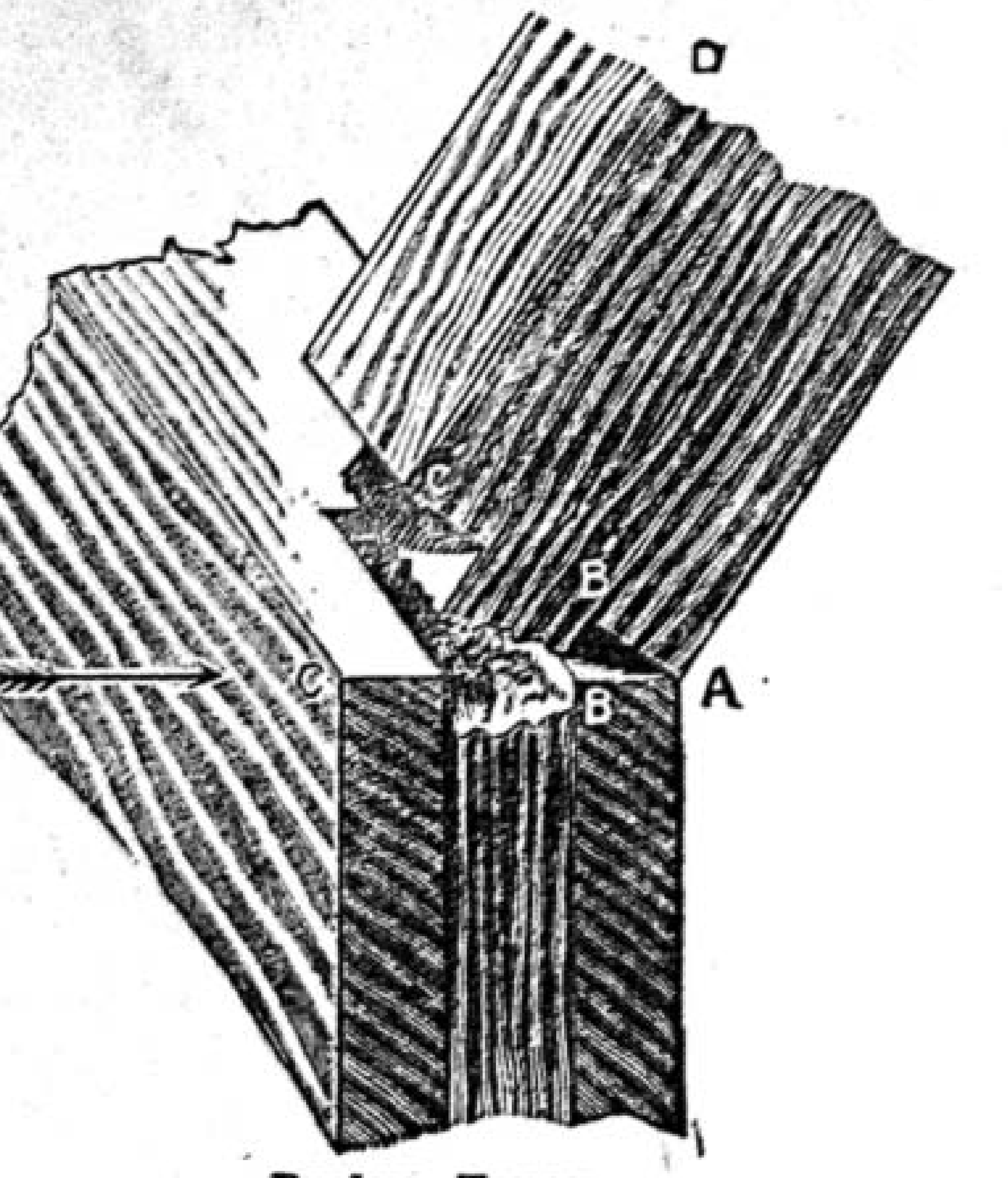
NOTICE TO CORRESPONDENTS.

•• 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. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTER FROM A CORRESPONDENT.

Constructive Strength in Woodwork.—F. C. (*Leytonstone*) writes:—"I should like to make a few remarks about the paper published in No. 63 on 'Constructive Strength in Woodwork.' (1) In the first place, what does the author of that paper call a practical workman? A man who makes dovetails with an acute angle, and runs his tenon saw too far into a tenon, I should call decidedly unpractical. An apprentice or novice may do so, but no foreman (who is worth his salt) would pass such work. (2) The theory about the bevelled glue joint looks very nice on paper; but there are other points to be considered. It is all very well with boards faced on both sides, and gauged to a thickness, but in practice we very seldom get these. If I get a lot of boards to join, I find some twisted, some crooked, and (with hard wood) some cross grained. Now, shooting boards of this description on an inclined shoot is out of the question. Then, again, boards are often faced on one side only; in such a case one of them would have to be shot with its back downwards, which is a bad practice. (3) Passing on to the V joint, one could hardly devise a more expensive form of joint. In the first place a man would require a set of planes, say five pairs, from ⅜ in. to 1 in. These, I should think, would cost about 10s. a pair—in all, £2 10s. (4) Then there is the time required to sharpen, and keep them in order, for if one of them is in the slightest degree out, the joint is worse than the square one—in fact, it would be quite as easy to groove and tongue the joint with a pair of match planes, and would make a better job of it. (5) My own opinion, and that of older and more experienced men than myself, is that a square glue joint is strong enough for all practical purposes, for, if it is properly made, the boards will break before the joint. To ensure success the boards must be shot accurately. The *best* glue should be used; this should be melted and thinned till it will run easily from the brush, and used hot. The workshop ought to be fairly warm, and the joint slightly warmed before gluing. The glue should be well rubbed into both boards with the brush. If the joint is a long one, say 3 ft., it requires someone at each end, and, directly the glue is put on, the boards are turned one on the other, and rubbed backwards and forwards till they cannot be moved without great force. This must be done quickly, for if once the glue becomes chilled before rubbing, you cannot make a good joint. (6) Just a word about the mortise and tenon joint. In the first place the writer says, 'These joints are of two kinds, secured in two ways.' I could mention six or more secured in as many different ways. Again quoting from his paper, 'the tenoning machine cuts mortises equally true,' etc. I say the tenoning machine does *not* cut mortises, it is the mortising machine. (7) Speaking of the joint recommended, Fig. 13, No. 63, he seems to have overlooked one great principle—that is, shoulders in compression should be at right angles to the thrust upon them. Take the spoke of a wheel for illustration; this is practically a strut, the cross strain on it being very slight, and when a wheel fails at the nave it is through that part splitting. (8) Now, what could be worse than a tenon which acts like a wedge? Even with an ordinary door made in that manner, in cramping up, the tenon would have a tendency to split the style. As far as my experience goes, a tenon does not break off short at the shoulder unless improperly made, or the wood is rotten. It generally breaks as shown in the rough sketch I enclose. In



Broken Tenon.

conclusion I will venture to remark that what our friend calls 'rule of thumb' is the result of years of patient study and hard earned experience, and when a theory is advanced of practical utility, you will find none more ready to adopt it than a thoroughly practical workman."

J. W. H. writes in reply to F. C. (*Leytonstone*):—"I 'should like to make a few remarks' on the criticism on my article, and would premise my remarks by saying that I approach my refutation of F. C.'s innuendos in the kindliest spirit, and deprecate the very captious tone he adopts. My object in writing the article was to do good, if possible, to awake a train of thought, in the minds of those who as a rule believe they 'are not paid to think' but to follow their instructions 'in the same old groove.' F. C. is not compelled to accept my article, he is at perfect liberty to decline to give it a second thought, but as he has chosen openly to attack it, thereby paying me the compliment at any rate of admitting that it is to some extent worthy of notice, I claim the right of reply, which I give *seriatim*, leaving the verdict in the hands of the scores of thousands of WORK readers. (1) In the first place, *whom* (I should say, not 'what') do I call a practical workman? This is a delicate ground, but a re-reading of my opening paragraph will, I think, sufficiently show that I refer to recognised journeymen joiners who, by the rules of their Union, are not allowed, however incompetent, to take less than a minimum fixed wage, and I can prove hundreds of cases, if need be, where such men *have* made dovetails at an acute angle, *have* made carelessly cut tenons so weakened by undercutting, and that in the charge of foremen, who would be the last to admit that they were not 'worth their salt.' (2) I reply to this that the objection of F. C. falls to the ground. Of course there is bad work and good work. I only maintain that if the boards are only faced on one side, if twisted boards (unfit for use as they are), or if cross-grained hard stuff, be employed, no form of joint will render the work *good* in any sense of the term. I say deliberately that for 'best' work the boards should *invariably* be 'gauged to thickness,' all twist taken out with a 'jack-plane,' and as there is usually one direction in cross-grained stuff that planes up, if the iron is sharp, better than another, this direction can be chosen if both sides are faced. I do not say that everybody is to be compelled to do 'best' work only, but I simply point out that if they wish to do so, in my opinion, this is the best way. Let F. C., instead of saying that my method is 'out of the question' under the circumstances he instances, show me a better way, which is what all WORK readers want to know, and which would be far more to the purpose. (3) Passing on to the V joint, I do not say that this is at all a cheap joint, but I know it is a good one and well worth any extra expense. F. C. flies to the conclusion that a set of planes, 'say five pairs,' would be necessary, ⅜ in. to 1 in. I may be accused of 'fencing' this objection when I remark that the 1-in. plane will do every size of V joint downward by thicknessing the fence, F, to the proper distance from the point of the V (see Fig. 9, No. 63, WORK), and similarly thicknessing out the fence, F, in Fig. 10, which might be done by screwing pieces temporarily on, or by means of thumbscrews having a brass plate movable and adjustable like a plough-fence, which would dispense with four pairs of F. C.'s imaginative planes, all truth being assured by keeping the point of the V in the centre of the stuff. (4) 'Then there is the time of sharpening and keeping them in order, etc.' Does not the Union provide by rule that every journeyman shall have an hour per week for sharpening allowed? I have heard so. F. C. says that 'if one of them is in the slightest degree out, the joint is worse than the square.' Let me ask whose fault would it be if the plane was out with its fellow? I provide a quadrant C, and thumbscrew S, and hinges H, H (see Fig. 10), to correct any inaccurate sharpening of the first plane, Fig. 9; I give two ordinary rebate plane blades G, G, one set slightly in advance of the other to cut the reverse Λ, with the means of adjustment, overlapping each other at the intersecting point. Of course any man can foil, if he likes, another's invention, but who is the loser I should like to know? Again, F. C. ought to know that matching planes should be used only for uniting end grain and side grain, and *never* as in matched boarding, for side grain to side grain. Did F. C. ever put up a single square of matched lining, in which the tongues were not split off in every other board? Therefore I deny that any match-plane joint would '*make a better job of it.*' (5) The province of WORK is to deal with facts not 'opinions.' I was taught to believe that a good square joint would hold against all time, and the board would very kindly agree to break anywhere else rather than at the joint. Experience, however, has rudely brushed away this dogma. I find that out of more than 5,000 boards which in the last thirty-five years I have had made 30 in. by 40 in. I never knew *one* to come apart anywhere else but the joint! I have had these boards made (30 in. only in length by 40 in. wide) in England, North and South, in London, for seven years, in France and Belgium, in New York, and have made them myself with a like result. I, therefore, logically conclude that, from some obscure cause or other, probably the effect of light or actinism, the cohesive power is insufficient to neutralise the physical force of the timber acted upon by natural causes. Therefore I suggest the V joint, which, from its own formation, precludes the action of light, gives nearly half as much again of cohesive adhesion in its area, and is therefore worth at least half as much again as the old square joint in labour, where *good, i.e., 'best,'* work is demanded. I perfectly agree with F. C. in his lucid description of the making of a good joint, and only omitted this myself from my article because I thought that 'everybody knew that!' (6) F. C. says, 'The writer says, "These (*i.e.*, mortise and tenon joints) are of two kinds, secured in two ways,"' and adds that he can 'mention six or more, secured in six or more different ways.' If F. C. can show me anything in the way of mortises and tenons beyond the *two* kinds my article points out, I shall be much surprised. I say, page 167, No. 63, 'tenons passing through,' and those where the tenons only 'go part through.' (7) I deny utterly the false principle enunciated by F. C. My reason is that in all strains there are several forces at work at the same time, and it is one of the primary laws of mechanics that 'the diagonal of the forces,' *i.e.*, the *mean resultant* is the direction of the breaking point, as F. C.'s own drawing shows (the reference letters are, it is only fair to add, my own). Follow this: A is the fulcrum of a leverage, in breaking a well-made tenon, mind! B parts with B^1, and C with C^1, because the force necessary to break the tenon is applied at D. If a force acts square at C in the direction of the arrow, the neck of the tenon would break off square, even in a well-made tenon. But if A be the fulcrum, A C and A C^1 being the leverage, a tearing process, *in the diagonal* (*i.e.*, the mean) of two forces acting in different directions, comes into play, and the result is that the tenon breaks *below* the neck. In the case of a wheel spoke F. C. says 'the cross strain is very slight.' Does F. C. know that the life of a London omnibus wheel is *under ten weeks* on an average? In America the writer has seen hickory buggy spokes housed ½ in. by ½ in., and mortised half their thickness into the nave in mortises tapered inwardly to allow of the tenons being spread by *iron* 'fox' wedges to ¼ in. bigger at their inside end! Here let me say that F. C. seems to be 'fogged' a bit. The wedges, whether 'fox' or otherwise, referred to in my article do *not* act in the splitting direction of wood, but against the end grain of the respective mortises. (8) A tenon never acts 'like a wedge' unless the wedges are moved; once home, the wedges are stationary and never move; the tenon is thereafter merely a dovetail. In my article I simply say that the weakest part of a tenon is at the neck or shoulder, and suggest extra strength at that point, especially *bad* tenons. I admit, however, that a tenoning machine does not always cut mortises, and that it would have been more explicit to have said mortising machines; but F. C. must have seen machines which cut both the tenons and the mortises also, which, thirty years ago, were termed, as I named them, 'tenoning machines.' In conclusion I shall be glad to see 'the result of years of (a so-called) experience and patient study,' as epitomised in 'rule of thumb,' exploded when theories of practical utility are advanced to English

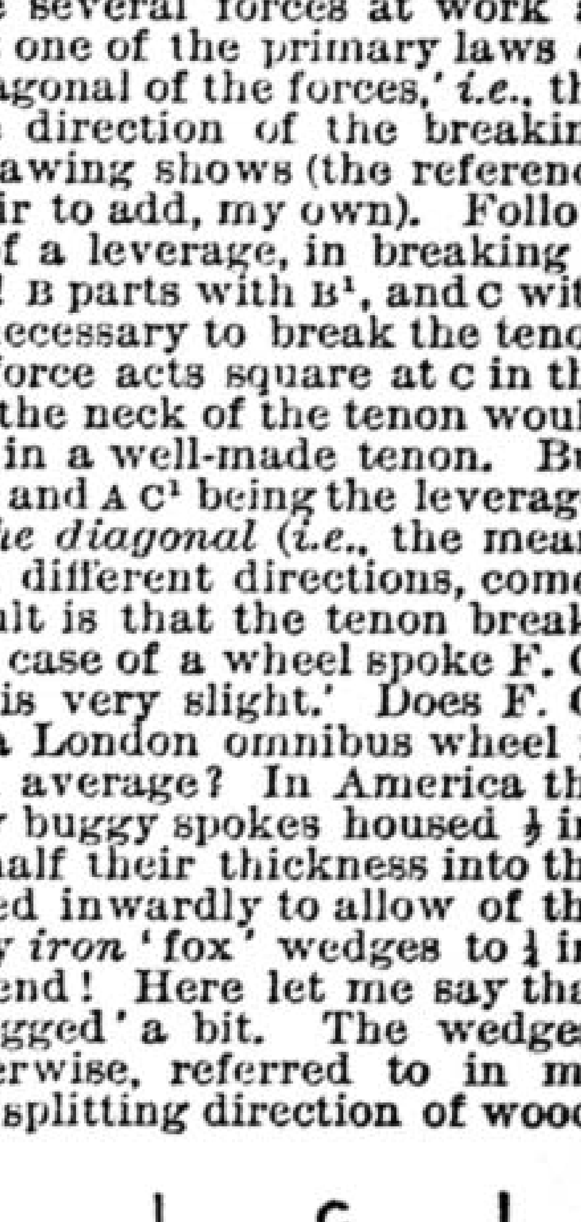


Diagram showing different thicknesses of Fence F (see Figs. 9 and 10, No. 63), C C centre line.

working men. I long to see that day dawn. I give a diagram showing in dotted lines how, by thicknessing out the fence, F, the one plane or its counterpart, any stuff can be V jointed up to inch, *i.e.*, ⅞ finished; but F. C. can see the planes and shooting-board at Moseley & Sons, 323, High Holborn, and will be better able then to judge. By-the-bye, I am glad to correct a palpable mistake in Fig. 1 (which, however, appears to have escaped my critic's notice). 'Angle of 30°' should, of course, read 'angle of 60°' (see No. 63). In conclusion F. C. has never tried a V joint, or he would have said so; I have. An ounce of example and experiment is worth a ton of precept and prejudice."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Oak Stain.—G. H. (*Congleton*).—If you had read the back numbers of WORK you would not have put this question. The simplest stain for the purpose of making new oak antique is composed of vandyke brown, ammonia, and water.—D. D.

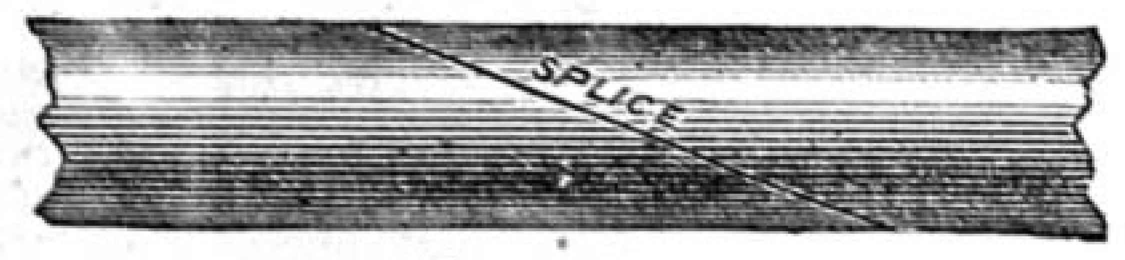
Bookbinding Work.—W. T. (*Blaydon-on-Tyne*).—I am very sorry that I cannot recommend a good book on bookbinding, as, strange as though it may appear, there is not such a book in existence, looking from a practical point of view. There are, however, a good many books on the subject, most of them too old to be of any use at the present day, and rather difficult to be obtained. I may mention one or two. "Bookbinding," by J. B. Nicholson, cloth, 9s. "The Art of Bookbinding," by Zaehnsdorf, 10s. 6d. Both these books are published by J. Zaehnsdorf, 14, York Street, Covent Garden, W.C. I cannot recommend them, for there is too much of the British Museum about them for the taste of a practical man. There is, by the way, another book which has been thrown in my teeth by a correspondent to WORK. It is entitled "Amateur Bookbinding," and is published by L. Upcott Gill, 170, Strand, at 2s. 6d. I suppose the correspondent referred to thought he was giving me a bit of information; well, I just take the opportunity of informing him that "I know all about these things," and still I say there is no reliable book on bookbinding suitable for the practical man of the present day. Wait for more articles in WORK.—G. C.

Book Plough.—H. J. J. (*Birmingham*).—Passing over the first part of your letter, I will at once answer the question which you desire the Editor to ask me, *i.e.*, what it cost me to make my machine. If you mean by this the plough described by me on page 716 of WORK, I have only one answer: I never made a plough, and, what is better, I would not think of trying; because, in the first instance, I do not think I could, and, in the second, I could buy one cheaper. I hope you do not think that we make all the things we describe. If we did, we would want a British Museum to store our curiosities in. I gave the description of the plough to a correspondent who asked for it; and the sizes, etc., were taken of those which are in every-day use in the binding shops. To prove that my instructions were sufficient to enable a person of ordinary intelligence to make a plough, before sending my description to WORK (in fact, when I was writing it), I showed it to a friend, who is a joiner by trade, and who had never been in a binding shop, and consequently had never seen a plough, and so thoroughly did he grasp the idea that he offered to make the drawings for me, an offer which I gladly accepted, as it gave me time to devote to something else. And, moreover, I asked a bookbinder what he thought of the description, and his answer was, "Anybody could make one from that." You had better read the portion again relating to the pin to keep the wooden screw in position, and study the figure carefully which gives details of the wooden screw. I need not write it over again, for I cannot make it plainer. No one can turn a thing round if it is fastened with an iron pin, but such is not the case; it is your understanding that is at fault. The knife fastens in the groove in the bottom of the bolt, and is tightened against the edge of the cheek by the thumbscrew on the top. The breadth and thickness of the knife depend upon the groove in the knife bolt; the length may be anything between 1 ft. and 1 in.; it is generally about 6 in. when new, but with continual grinding it soon becomes less. The plough, if well made, would cut not only WORK, but anything in the book line that ever was published. You seem to think a great lot of your money; 2s. 6d. is a small sum to make such a noise about. By the way, I have bought ploughs; the price of one complete is about 8s. 6d.; the knives sell at 24s. per dozen.—G. C. [Our correspondents are not to blame for the delay in answers appearing in "Shop." They return the questions answered at once, but the great pressure upon this part of the paper since the starting of WORK causes the delay. Enough "Shop" is in hand to fill many numbers of WORK. Your letter was couched altogether in a wrong strain.—ED.]

Bell Receiver.—A. F. (*Sheffield*).—The cost of materials for making such an instrument as described in WORK for September 28th would be approximately 2s. 6d.; viz., mahogany for body, 6d.; magnet, 5 in. by ¾ in., 10d.; wire, ¾ oz., No. 36, silk-covered, 3d.; two binding screws, 6d.; small wooden bobbin for coil, 2d.; ferrotype plate for diaphragm, 2d.; total, 2s. 5d. And this multiplied by four would give you the price of four instruments. If you intend making them yourself, and find any difficulty in getting magnets, wire, etc., if you write to Messrs. King, Mendham, & Co., Western Electrical Works, Bristol, you will get suited at above prices.—W. D.

Procuring a Patent.—X. W. (*Crowle*) wishes to know the best and cheapest method of obtaining a patent for a small article which he has invented. The *best* method, and that which will give least trouble to himself, if strict economy is not an essential, will be to place the matter in the hands of a respectable patent agent. The *cheapest* method will be to act as his own agent. If he follows this latter course, he is advised to write to the Comptroller, Patent Office, 25, Southampton Buildings, Chancery Lane, London, E.C., for the "Official Circular of Information," which will be sent him gratis and post free. After carefully perusing this, and our article, "Taking Out a Patent," Vol. I., page 545, he ought to find no difficulty in getting his patent without professional help.—C. C. C.

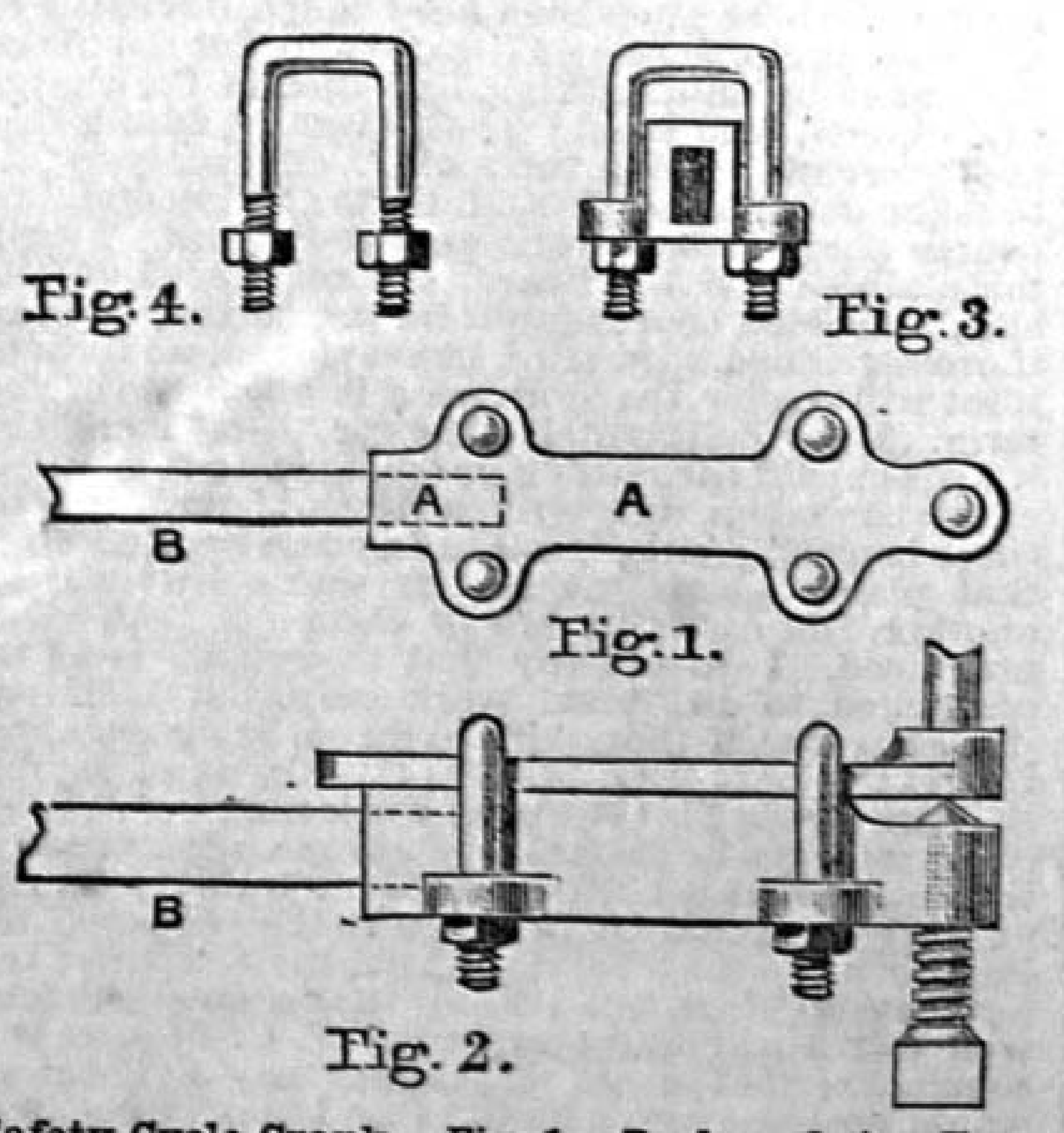
Bicycle Repairs.—W. H. C. (*Clifton*).—(1) By broken tyre I suppose W. H. C. means the rubber. The rubber should be loosened from the rim half round or more, and a clean cut splice made with a thin knife dipped in water. A splice 2 in. long will do, as in annexed diagram. Smear the splice on both cuts with "Octopus" rubber cement, and let them remain, without joining, for an hour or two, then join the two splayed ends evenly and carefully, and press together; it will hold at once, and you may proceed to melt the cement in the rim; pour on more if necessary, and place the rubber in, heating with a gas flame on the under side of the



Tyre Splice.

rim till the rubber rolls freely, and the cement oozes out at the edges. The "Octopus" cement is made of rubber dissolved in naphtha, and can be had of all cycle dealers. (2) W. H. C. is right in supposing the head has to be made on the spoke after it passes through the rim. In a former number of WORK I showed an instrument for doing this. If W. H. C. will look it up, he will see that it consists of two steel plates with pins passing through; they are each grooved to hold the spoke, and have to be gripped tightly in a vice with the spoke between; the head is then hammered up cold into a countersink in the ends of the two plates, half each; after this, screw up into in hub. (3) I have no good recipe for tyre cement, and never tried to procure one, as a very good cement can be had from any of the cycle dealers at 1s. per pound. It would not be worth the trouble for any one to make it for his own use.—A. S. P.

Safety Cycle Crank.—S. B. (*Exmouth*).—Bicycle cranks keyed on are a great trouble; the easiest way to get them to come off is to get on the machine and go several miles from home. This is the time



Safety Cycle Crank. Fig. 1.—Back or Outer Face of Bracket. Fig. 2.—Side View, showing Crank in position. Fig. 3.—End View, showing Socket for Lever. Fig. 4.—The Gland with Nuts.

they generally come off—when they are not wanted to. In the workshop it is sometimes next to impossible to get a keyed crank off without damaging or even breaking the axle. I have an instrument, however, that will start the most obstinate crank. It is made by a Mr. Loosley, of Brighton, and costs 8s. 6d. Here is a short description of it: In the accompanying diagrams, Fig. 1 is a malleable iron bracket having a sectional area at A A of 1¼ in. by 1 in.; it has four legs, bored to admit the ends of two glands made of ½ in. round bar steel; these glands are rectangular as shown in Fig. 4. The right-hand end of Fig. 1 has a hole screwed to admit a ⅝ in. square threaded screw, shown in Fig. 2 with the head downwards; this head is square to receive the wrench with which it is turned. The point of this screw is conical, and when in operation, the cone point enters the countersink that usually exists in the end of the shaft. Fig. 2 shows the instrument with the crank in place ready to be operated upon. The two glands, Fig. 4, are made wide enough to allow the slotted end of the crank to pass through. In the left-hand end of Figs. 1 and 2 a rectangular recess is made, shown by dotted lines, to receive a lever bar, B, about 20 in. long; this bar is 1¼ in. by ⅜ in. in section; this lever is used to counteract the pressure of the screw, which has a tendency to bend the outer end of the crank towards the wheel, and to bend the shaft as well. To use this instrument, you wind back the screw till only the point is visible, then place it on the crank, placing the point of the screw in the centre of the shaft. Then screw up the four nuts on the two glands till the crank is bound firmly in; now place the lever in the socket, then apply the wrench, and at the same time pull the lever with the left hand sufficient to keep the crank from bending; if this does not bring away the crank, it means to stay on.—A. S. P.

Indiarubber. — WATERPROOF. — Your failure arises from the use of gutta-percha instead of indiarubber solution. If you will try again, using a solution of indiarubber in naphtha, you will probably succeed in waterproofing your socks in a satisfactory manner. Gutta-percha is naturally hard and brittle; hence the splitting of which you complain.—QUI VIVE.

How to Fret a Banjo.—C. T.—Mark carefully the exact distance from the nut to the extreme diameter of hoop on a piece of wood or cardboard; then mark the exact place where the bridge will stand—about 3½ in. or 4 in. from edge of hoop, according to the size of banjo. Take a pair of compasses, or spring dividers, and divide the distance from nut to bridge into 18 equal parts. Work your compasses along, commencing exactly at the nut, and count the parts until you come to the bridge. If the point of the compasses at the 18th part comes exactly on the bridge mark, the distance between the points of the compasses will be the exact distance from the nut to the first fret. If you come short or over the bridge mark, alter the compasses either way required, and try again, until you get it right. Having marked off the first fret, close the compasses a trifle. Now commence at the first fret and divide the distance between that and the bridge into 18 equal parts; having done so correctly, you will again have the exact distance from the first to the second fret; mark off, close the compasses a little more, this time starting from the second fret to the bridge, dividing the distance into 18 equal parts, and so on, until you get all your frets marked, each time dividing the distance from the last fret marked to the bridge into 18 parts. Providing that you have divided with the compasses correctly, you will now have a fretting gauge practically correct, from which you could mark off any number of banjos of that particular size. This system of fretting banjos will do for any sized instrument. You could work the divisions out mathematically if you like, but you will find the method I give the simplest. If you want frets across the finger board, run a series of saw cuts across, glue in thin strips of sycamore or other light-coloured wood, and dress off level. Or you could have pearl dots along the side of handle, which look much neater than frets across the finger-board.—J. G. W.

Raising Water. — A WOULD-BE INVENTOR —There certainly are no means of artificially raising water above its level without the use of mechanical appliances of some sort or other.—F. C.

Rack and Pinion.—BLAIR ATHOLE.—You can get work of the kind you require from Messrs. Grimshaw and Baxter, 33 and 35, Goswell Road, London, E.C.—F. C.

Ventilators.—YOUNG TINSMITH.—To do this, lead your pipe into a box and stretch across the box a piece of green baize, fastened all round so that the entering air passes through, and the dust is thus filtered off. You can get the baize at any respectable draper's.—F. C.

Gas Burner Patent. — W. W. (*Lambeth*).—I do not wish to discourage you, but to judge from your sketch I do not think your burner would be a success. As far as I can see, you have made no provision for air, and there is no regulator. The market is already flooded with gas burners, good, bad, and indifferent. Full instructions for taking out a patent have already been given in WORK.—T. W.

Hot Water Supply.—VULCAN.—Messrs. E. and F. N. Spon, 125, Strand, London, publish a book entitled "Hot Water Supply," by F. Dye, price 3s. 6d., which I can thoroughly recommend as a practical and well-written treatise on this subject. I only know of one book on gas fitting; it is by John Black, and published by Crosby Lockwood & Co., price 3s. It would do very well for amateurs and apprentices, but would be of no use whatever to a practical man.—T. W.

Oak Stain.—GOLDRILL.—Without an opportunity of seeing a piece of the stained oak to which you refer, I cannot possibly say what stain has been used to give it a green colour. The only way for you to manage is to obtain a few specimens of green dyes or pigments and try them on waste wood. You should have no difficulty in getting materials in Newcastle, and very likely if you were to send a piece of the wood to any good colourman's he would be able to supply you with something suitable.—D. D.

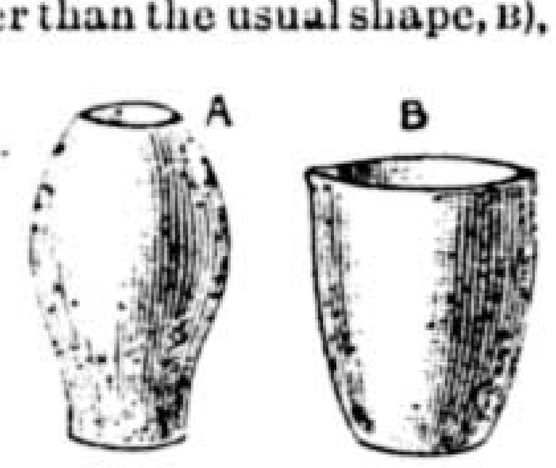
Veneering. — G. B. (*Oxon*). — Yes, of course; weights would do instead of handscrews when laying veneers with cauls. They are not so convenient in practical use as the screws, but as long as you get sufficient pressure to squeeze out superfluous glue, nothing more is absolutely necessary. I cannot tell you what weight per square foot would be sufficient, but you ought to have no difficulty in determining this roughly according to circumstances. You might almost as well ask what pressure, in pounds weight, is to be applied by the handscrews. Your question looks rather absurd when looked at in this way, does it not? No, the roughness left by the saw on the veneer is not so suitable as that made by the tooth plane. A good deal depends on the nature of the saw marks, but with the plane you will be quite safe. For small and occasional work, you might substitute a flat file for the plane. Thanks for good wishes.—D. D.

Microscope Mounting. — F. P. (*Brighouse*).—The small metal caps referred to in my last article in WORK, page 746, Vol. I., should be obtained without difficulty from any of the leading London or provincial opticians. I have always obtained all I have needed for my own use from Messrs. Thompson & Capper, 4, Lord Street, Liverpool.—A. T. S.

Book on Ship Joinery. — SHIP. — Apply to Messrs. Norie & Wilson, nautical booksellers, 156, Minories, London, who, perhaps, may advise you of some book containing this with other subjects.

Ascertaining whether an Article has been already Patented.—F. B. (*Swanscombe*), whilst he appreciates the light thrown by WORK on patent matters, is of opinion that the means by which an intending patentee may learn whether his invention has or has not been forestalled, have not been made sufficiently clear. In our answer to A. H. (*Portsmouth*) we pointed out that in most large towns a library of specifications is to be found where every facility is given to the inventor to satisfy himself on this point, free of cost. There is another way open to those out of reach of such a library, which will be known to all those inventors who have followed our often-given advice of obtaining from the Patent Office the "Official Circular of Information." This circular contains a list of abridgments of specifications; they are divided into 103 classes. Our inventor has, we will say, invented some new painting material; and from the list of abridgments he will select No. 50, which includes "paints, colours, and varnishes." It will cost him 1s. 10d. (by post 2s. 1½d.). From this he will judge whether he has the field to himself; and if not, he will see from the abridgments what specifications he ought to examine at length, and will send to the Patent Office for copies of them. The prices of specifications vary, but they are not costly, being published for public information, and not for profit.—C. C. C.

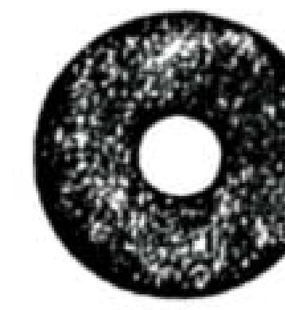
To Melt Gold Dust.—G. W. (*London, W.C.*).—Before commencing this reply, I shall indulge in a growl. Why do the people who write and expect us to give them a clear answer, I repeat, why do they not think about what they want to know, and give some indication of the quantity to be dealt with? Nearly every other question has some careless haziness of this sort, and, as it is one that could be obviated by a moment's thought, it is no wonder that I and others feel a bit savage. Everybody knows that to say a thing is as big as a piece of chalk, or as a lump of wood, conveys no idea at all of definite size, and these are very clear definitions to some I get hold of. For example, I am asked, "Can I melt gold dust in a large kitchener?" It is, of course, possible, if the chimneys are clean and clear, and the dampers open, to get sufficient heat for a few ounces, particularly if good coke and some charcoal are used; but if the quantity is great, how, by St. Dunstan, the patron saint of goldsmiths, can I reply in any but a general way, which will, most probably, not meet the particular case in point! However, here goes, and as there are two sorts of gold dust, namely, gold dust as found in a natural state, and secondly, that made by the file or other tools, scorpers, gravers, etc.—this latter being known in trade parlance as lemel—it follows that two descriptions must be given, as the inquirer does not take the trouble to say what he wants. First, for the pots employed; they are either the ordinary crucible or else the plumbago pot. The plumbago pots are far and away the best, but the others are generally used, for they are much cheaper, and, with care, can be used for almost all work. Both sorts should be annealed before use, for if they are to split it is better that they should be empty. When they split and let the gold down into the ashes, the pounding, grinding, sifting, and washing necessary to get it all back is no agreeable task, and will soon teach the advantage of a little previous care; and all that trouble leaves out of consideration the loss which is bound to take place after an accident of this sort. Morgan's, Battersea, is the firm that makes most of the pots used in London, and they can be bought at any jewellers' material shop, and there are plenty in or near Clerkenwell Green for G. W. to go to. Now for the fire. Do not have it too large or too hot when the pot is first inserted; it is much better to apply the heat gradually. Therefore, fill up your furnace with fresh coke, and let it burn slowly for a short time; then open your dampers and get all the heat you can. On no account omit to see that you have a good base of almost solid fuel for your pot to rest on, to avoid a capsize, which may occur if the fire be hollow. So much for pot and for furnace; now we will proceed to "run down" the gold dust. Put it in the pot with some pieces of borax and flx it in the fire. If it melts clear and bright, pour it as it is into a "skillet," previously warmed and slightly greased. If the molten metal spits, or makes a kind of eruption in the centre, or races round and round, then there is something impure in it, which we can probably remove by stirring up with a stick of charcoal, or by putting a layer of powdered charcoal on top. If that fails to clear the metal—for it should be as bright and clear as burnished silver—I should introduce a small piece of sal-ammoniac, or stir it with a piece held in the tongs. Failing a good result from that, a piece of corrosive sublimate (bichloride of mercury) should be put on the metal. During this time the molten state must be maintained, and the pot must be kept in the fire until the fumes are completely driven off. Put in some more borax, and pour the gold in when the borax has become completely liquefied; but do not get any of the fumes of either of these into your lungs. Should these have failed to give a bright and sound ingot, the method which follows will have to be used. It is the simplest I know of, but it is only one of the several ways used for the purpose of melting lemel, which we have previously defined as the gold dust produced while working the metal. In the first place the lemel has to be burnt, to get rid of all the organic impurities as far as possible. The way to do this is by placing a piece of brown paper in a clean ladle; then put the lemel on it and give it heat until it ceases to smoke, stirring it as it approaches red heat to prevent it melting and attaching itself to the ladle. Secondly, pound it in a mortar and remove all the steel and iron by means of a magnet. It is now ready for mixing with the flux; in this case we shall use pearlash, and an equal quantity of lemel and powdered pearlash should be taken and mixed together. Then place it in a melting pot (the skittle shape, A, is better than the usual shape, B), and do not fill it nearer than an inch or two from the top. If all will not go in at once—and it is not necessary that it should—the surplus can be added as room is made in the pot by the mixture sinking. As before written, heat it gradually and glance at it occasionally, for it may want to boil over; if it looks as if it will, it is only necessary to throw in a little powdered dry common salt, and that will quiet it down. We will now suppose that all has been put in and melted for some time, so we will take off a little of the flux with the poker, and if it is quite clear from metal, and is of a very dark green or dark brown colour—all through alike—the chances are that it will be ready for pouring into a warm greased skillet, or it can be left in the pot and the pot broken to extract the nugget. Lemel melted is rarely good to re-alloy for use, so the best way will be to have it assayed and fine gold obtained to value. Any refiner will manage that, or you could send a piece weighing twelve grains to Johnson, Matthey, & Co., Assay Office, Hatton Garden, and obtain a parting assay for 1s. 6d. That gives the exact quantities of fine gold and fine silver in a pound, troy; so it is easy to calculate the value of any size ingot. A plumbago pot is recommended, for sometimes the crucible gets eaten through by the boiling flux, and a spill may result. In both cases the ingot or nugget will have to be remelted—that is, if you are going to use it yourself; but my advice is, don't attempt to work lemel gold—you will be sorry if you do. Should you only want to melt such stuff once or twice, it would be better to get a refiner to do the whole affair, for he has furnaces specially built, and he would doubtless allow you to remain during the process, if the amount in question is worth the supervision. In conclusion, I feel as though the answer, long as it is, is unsatisfactory, for there are several other things that are in my mind, but no good end will be gained in writing them down in this reply, which, I trust, gives a clear account of how to melt gold dust.—H. S. G.



Crucibles.

Refracting Telescope — Huyghen's Achromatic Eye-piece — Magnifying Powers.—J. T. S. (*New Brompton*).—Your letter has interested me very much, because of its genuineness. Persevere with your experiment. If, as you say, your object lens is forty-eight inches in focus, and you use for eye-piece your half-inch plano convex lens, then the magnifying power must be $\frac{48}{\frac{1}{2}} = 96$; it cannot be anything else. If you use the ¼-inch for eye-piece, then the power is $\frac{48}{\frac{1}{4}} = 192$. But, in either case, you will not get a satisfactory result, for your object glass, being common, is non-achromatic, *i.e.*, uncorrected, and the using a single lense for eye-piece increases the error. I presume that you do not see your way clear to buy an achromatic object glass in place of your common one (an ordinary achromatic object lens, 2¼th inches in diameter and thirty-six inches in focus, costs, at a good London house, 18s.), and, therefore, the best thing that you can do is to make for yourself a proper eye-piece. To do this proceed as follows:—Procure two plano convex lenses, having their respective focal lengths in the proportion of one to three, thus—¼ inch and ¾ inch or ½ inch and 1½ inches. Place these at a distance apart equal to one-half their joint focal lengths ($\frac{\frac{1}{4}+\frac{3}{4}}{2} = \frac{1}{2}$ inch in the first case; $\frac{\frac{1}{2}+1\frac{1}{2}}{2} = 1$ inch in the second case. The plane sides should be toward the eye, to which, of course, the smaller lens should be the nearer. Between the two lenses and in the focus of the first should be placed a stop, as shown. The central hole, which defines the field of view, will need to be slightly smaller in diameter than the smaller of the two lenses used. The magnifying power of this combination will be about twice as great as the power which the larger of the lenses, used alone, would have. Thus you may calculate easily what lenses will give you a fixed power. For example. With lenses ¼ inch and ¾ inch placed half-inch apart, the power would be with your 48 inch focus object glass

$$: \frac{48}{\frac{3}{4}} \times 2 = \frac{48 \times 4}{3} \times 2 = 64 \times 2 = 128.$$


Stop.

This is quite high enough for you to attempt to use. The better plan, indeed, would be for you to get a plano convex 1½ inch, and with this and the half inch that you have, to make an eye-piece of power

$$\frac{48}{1\frac{1}{2}} \times 2 = \frac{48 \times 2}{3} \times 2 = 32 \times 2 = 64.$$

This power would show you the belts and moons of Jupiter, and even the rings of Saturn. Your idea that the power you have so far obtained is only ten is perhaps due to over-strained expectation. A telescope is always disappointing to a beginner. Get used to it, and learn all its faults, and then you will be able to see a great deal more. As for Venus, it is the most trying object of them all. Many a good telescope shows faults when it is turned on to Venus. She is so bright and so dazzling. When you would observe her, first stop your object glass down to about one inch, and then you will see her phases. Do not aim at high magnifying power. As a young student lay this to heart, that more pleasure and profit can be obtained with a telescope firmly mounted (how important is this!) and armed with a low power than with a loosely-mounted instrument armed with a higher power. Experienced astronomers, as a rule, use low powers, except for very special work. I should not advise you to attempt to make an achromatic object glass for yourself, and, if you were to attempt it, a lathe would have very little to do with it. Lenses are not made on lathes. But you might make a reflecting telescope; and when this 48 inch of yours is in working order and satisfies you, if you write to the Editor again, he will send your letter to me, and I will tell you more about it.—E. A. F.

A Complaint.—C. H. (*Bloomsbury*).—My contributor who writes upon the bench, plane, and kindred subjects declines to notice criticism couched in the tone of your letters.—ED.

Black Lead.—P. B. (*Ashford*). — Black lead, emery, and all kinds of polishing materials can be procured at the under-mentioned addresses: Messrs. Acton & Borman, 72, Shoe Lane, London, and H. S. Hannah, the British Emery Mills, Bermondsey Wall, London, S.E.—R. A.

Gold Transfers.—J. J. (*Bristol*).—You can obtain gold transfers for japanning from the following: H. M. Stevenson, 6, Edmund Street, Birmingham, and W. Gay, 115, Holloway Head, Birmingham.—R. A.

Springs.—W. H. D. (*Plymouth*).—I cannot tell you the price. You should write and enclose sketch to Messrs. Gillett & Co., clock-makers, Croydon, Surrey.—F. C.

Superficial Measurement.—E. C. (*Stepney*).—The old-fashioned duodecimal method is probably the quickest way when you become accustomed to it; it is worked as follows:—The total superficial area will be equal to twice the sum of the height and breadth multiplied by the length, plus twice the breadth multiplied by the height. For example, let the dimensions of a case be—length, 5 ft. 7 in.; breadth, 3 ft. 4 in.; and height, 2 ft. 6 in.

Height ..	2 ft.	6 in.		
Breadth ..	3 „	4 „		
	5 „	10 „		
		2 „		
	11 „	8 „		
Length ..	5 „	7 „		
	58 „	4 „		
	6 „	9 „	8	
	65 „	1 „	8	for sides, top, and bottom.
Breadth ..	3 ft.	4 in.		
		2 „		
	6 „	8 „		
Height ..	2 „	6 „		
	13 „	4 „		
	3 „	4 „	0	
	16 „	8 „	0	for ends.
	65 „	1 „	8	
Total ..	81 „	9 „	8	

The result is 81 $\frac{9}{12}$ square feet, that is, 81¾ square feet. The third figure, which represents $\frac{8}{144}$ of a square foot, may be neglected, or the sum may be called 81 $\frac{4}{5}$ according to practice. As the duodecimal system is scarcely known out of some few trades, it may be well to describe the mode of working it. In multiplying 11 ft. 8 in. by 5 ft. 7 in. we have 5 × 8 = 40; dividing by 12 we put down 4 and carry 3; then 5 × 11 = 55 and 3 = 58; then 7 × 8 = 56, 8 and carry 4; 7 × 11 = 77 and 4 = 81, 9 and carry 6. The remainder, 8, is put one remove further to the right, because its units are one-twelfth the value of those in the second column. The first figures of the product (65) are square feet, the second (1) represent strips one foot long by one inch wide, and the third (8) square inches.—F. C.

Sword Warping.—SWORD.—From the statement furnished it is clear the blade is badly made, and straightening it will not change it into a well-made blade. There cannot be a more delusive notion than the fault is in the hardening. The evil is inherent, and the act of hardening reveals it. A well forged blade would not warp if the plan of hardening be adopted as described in the article on "Swords," No. 19, WORK. They may be made too hard or too soft, but they will not warp for either of those reasons, if properly forged. The fault may be remedied by again heating and hardening and tempering the blade, but if the blade warp, it is of no use to expect to make it true and finish it; as a sword it will be ever a faulty weapon. It should be thrown with the "bushel-iron" as waste, and most careful supervision kept over the man who turned out the faulty blades. Note well the men who turn out the blades that do not warp. Pay them extra for the better workmanship they display. Or, better still, if you are an employer, set to, and examine into the various workings of a blade up to the time of hardening. It will be a confirmation of success. To attempt to set a warped blade true will be a mental fraud on your common sense, and a practical fraud on those who pay for the sword and rely upon it. We hear much of technical education, competitive examinations, and exhibition prizes for highly finished swords. Why not distinguish the most successful blade forger and blade temperer? Of course the men should not be scourged to their tasks by piece-work prices, but paid well, though the time taken over the jobs might be twice as long as allotted for piece-work earnings. It would not be much more on the total cost of a finished sword.—J. C. K.

Freezing Liquids. — INQUIRER (*Yeovil*). — A liquid can be cooled down or frozen by surrounding the vessel containing it with any of the following mixtures:—

Freezing Mixtures.	*Number of parts of each Constituent.*	*The Temperature (Fahr.) obtained.*
Ammonium nitrate ...	1	7°
Sodium carbonate ...	1	
Water ...	1	
Sodium sulphate ...	6	10°
Ammonium chloride ...	4	
Potassium nitrate ...	2	
Dilute nitrous acid ...	4	
Sodium sulphate ...	8	0°
Hydrochloric acid ...	5	
Sodium sulphate ...	3	3°
Dilute nitrous acid ...	2	
Sodium sulphate ...	6	14°
Ammonium nitrate ...	5	
Dilute nitrous acid ...	4	
Sodium phosphate ...	9	12°
Dilute nitrous acid ...	4	
Sodium phosphate ...	9	21°
Ammonium nitrate ...	6	
Dilute nitrous acid ...	4	

The nitrous acid can be made by warming strong nitric acid with white arsenic or starch, and conducting the fumes evolved into water. In ice-making the fresh water is placed in large wooden tanks divided longitudinally by metallic slabs, placed vertically, forming internal passages through which cold brine from refrigerating machines is pumped. As the cold brine circulates through between the plates forming the slabs, the ice is formed on their outside, and gets thicker and thicker until the two sides approach to about three or four inches from each other when the ice is taken out. But as this requires refrigerating machinery, I should think that a freezing mixture as described would suit your purpose better; unless, of course, you wish to cool liquid wholesale.—F. B. C.

Scarf Pin. — A. S. H. (*London, S.E.*). — The making of this will be included in the jewellery papers now appearing in WORK.

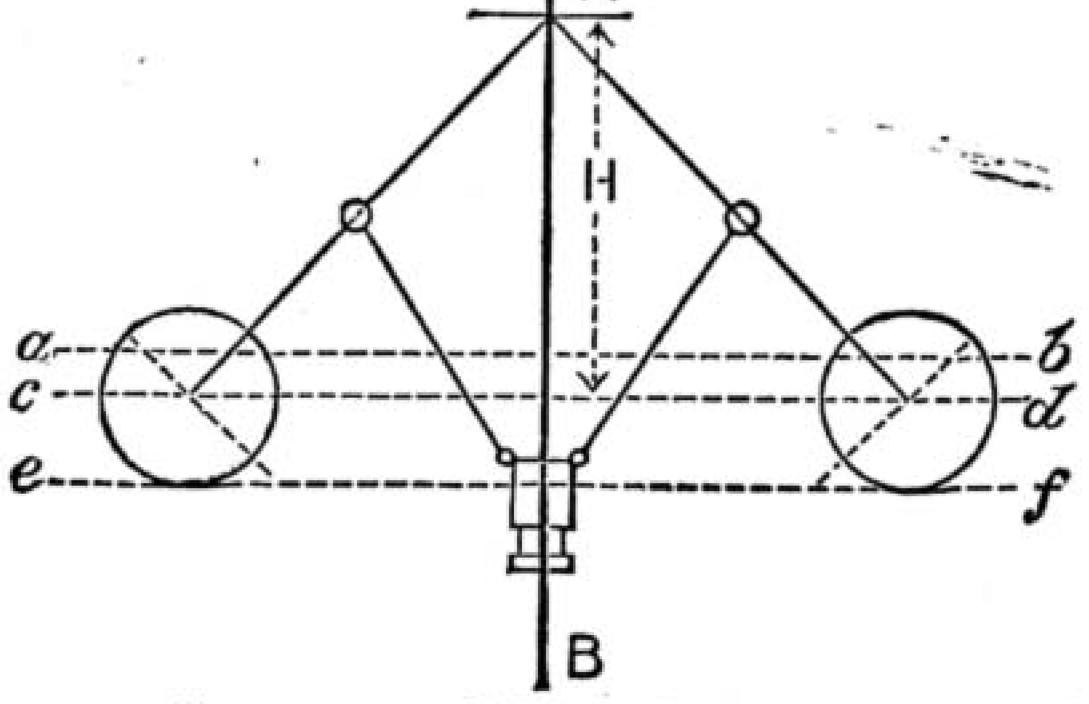
Ceiling Whitening.—W. H. B.—The paper on "Distemper or Tempered Painting"—published in WORK, No. 50, a few days after your query was sent—gives every information upon the above subject, and doubtless you have ere now availed yourself of its contents.—F. P.

Book on Metal Working.—GOLDRILL.—I am not aware of any book on art wrought iron work, though several articles have appeared in periodicals, on bent iron work, but I do not think they were of much value.—G.

Pine Wood. — E. H. (*Clerkenwell*).—If E. H. will write to me through the Editor I can supply him with first quality Quebec pine $\frac{1}{16}$ in. by 11 in., but he should be able to get it at most of the timber yards in his neighbourhood. Have you tried Snewin's, Hatton Garden, E.C.?—A. J. H.

Curing Rabbit Skins.—W. K. (*Leeds*).—There are various methods of curing small skins. One receipt is: Take $\frac{3}{4}$ saltpetre and $\frac{1}{4}$ alum, both in powder, and well sprinkle the flesh side with the mixture; fold the skin together flesh side inwards, and roll it up as tightly as possible, winding twine round the roll to keep it tight. Hang in a dry place for some days; then unroll and scrape clean with a blunt knife. Another way is to stretch and tack the skin, fur downwards, on a board, and spread the dressing over it. A good dressing would be, burnt alum, $\frac{1}{4}$; camphor, in powder, $\frac{1}{4}$; nutgalls, coarsely powdered, $\frac{3}{4}$; ground oak bark would do instead of the nutgalls. Burnt alum alone, however, makes a very good dressing, as it is drying, preservative, and obnoxious to insects. I have, indeed, cured many skins, in the absence of other dressings, with wood ashes, merely. If skins are hard and stiff when cured, they can be softened by well working some mellowing ingredient into the pores, such as soft soap, grease, etc. The beautiful softness of kid gloves (for which the skins are cured with alum alone) is gained by thoroughly impregnating the skin with yolk of egg, and then drawing it backwards and forwards over a blunt knife fixed upright till the rigidity of the fibres is overcome.—M. M.

Governor for Half Horse-power Engine.—W. W. (*Glasgow*).—To tell you how to make a governor for your engine in the "Shop" columns is impossible. 'Tis an intricate subject requiring an article to itself; I have dealt with it shortly in an article, in the Editor's hands, on "How to make a Quarter Horse-power Engine;" but cannot tell when you will see it appear. You must have seen cuts of the old form of Watt governor, with its long arms and slow motion, in all text-books on the



Governor and Parts for Engine.

steam engine, accompanied by the butterfly equilibrium valve; I suppose you do not wish to be told how that is made, but only to know about what size would suit your engine. Supposing, then, you have your throttle valve carefully packed so that it does not take much power to move it, you may do with balls of 2 in. diameter, arms 5 in. long, and at 100 revolutions per minute they will fly out to an angle of 45 degrees with the centre of revolution. Should the speed increase to 105 revolutions the plane in which the balls revolve will rise $\frac{1}{4}$ in.; should the speed drop to 95 revolutions the balls will fall till they revolve in a plane $\frac{1}{4}$ in. lower than the mean position. The figure will make this quite plain; the point A is the point of suspension, the lines *a b*, *c d*, *e f*, the three planes of revolution; with the arms 5 in. long, for 105 revolutions, H will be $3\frac{1}{4}$ in.; at 100 revolutions, H will be $3\frac{1}{2}$ in.; at 95 revolutions, H will be 4 in. Now you can set out your governor for yourself and arrange that the movement of the balls from the top plane to the bottom one shall open the valve from "shut" to "wide." The difficulty with these governors is, that their power is so small that the slightest stiffness of the valve will be too much for them to overcome; that is why I recommend you to have yours so large; many such governors do not control the valve, but are simply ornamental. If you make yours as described, you need never have a variation of speed of more than from 105 to 95 revolutions. I am supposing the governor will run at the same rate as the engine. If you wish the engine to run at any other speed, you can easily arrange it by sizing the pulleys that drive the governor; for instance, if you wish the engine to make 200 revolutions, you would have to make the pulley on engine half the size of that on governor, etc.—F. A. M.

Gold Blocking.—C. D. (*London*). — Although personally familiar with the uses of gold leaf in most matters appertaining to embellishment, I must confess your inquiry is not sufficiently explicit to enable me to answer with any degree of confidence. I would here ask all who can, to send a small sample of any article they ask information on, when such is of a convenient nature to send by post. Gold leaf can be affixed to a surface in a variety of ways. By contact with a hard, but slightly sticky, film or surface, such as oil gold size; by being placed upon a gelatinous coated surface, such as in glass gilding, etc., when the water evaporates and leaves the gold cemented to the substance; and by pressure only, such as the gilding process of bookbinding, and that, once greatly used, but now almost out of date, of gilding wall papers with genuine gold leaf. If the work you refer to is of a printed and ornamental nature, I should think the block is pressed on to a *size* of either isinglass solution, albumen or japanners' gold size, and then the leaf laid over it; the nature of the material would allow the little time required to lay the leaf ere the satin would absorb the size; when dry the superfluous gold could be dusted off.—F. P.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A STAINER (*Glasgow*); G. P. (*Elgin*); P. F. W. (*Dover*); INDEX; F. C. (*Leytonstone, E.*); W. V. C. (*Dublin*); JAY DEE; C. B. G. (*Sheffield*); A. E. D. (*Westcombe Park*); HYDROSTATIC; J. P.; MANUAL; C. B. (*Sheffield*); A. L. C. H. G. (*Liverpool*); G. R. R. (*West Calder*); A. L. (*Welling*); W. H. B. (*Leicester*); X. Y. Z.; J. B. J. F. B. (*New Cross*); AN INQUIRER; G. M. (*Cheadle*); J. H. (*Pemberton*); E. H. T. (*Birmingham*); M. D. C. (*Liverpool*); J. B. (*Rawtenstall*); T. D. (*Oldham*); HARRY; A. R. (*Doncaster*); J. H. (*Glasgow*); R. J. C. (*Deptford*); TEHRANI (*Persia*); MACHINE GUN; A. R. (*Hexthorpe*); F. T. (*London, N.*); W. R. (*Oswestry*); G. C. (*Huddersfield*); A FRENCH POLISHER; W. D. (*Belfast*); A. J. (*Faversham*); E. D. C. (*Leytonstone*); E. J. P. (*Chesterfield*); N. McK (*Oswestry*); O. R.; R. N.; J. W. (*Newcastle-on-Tyne*); O. S. (*Durham*); P. B. (*Weymouth*); A CONSTANT READER; J. S. (*Winchester*); R. N. (*London, S.W.*); B. L. (*York*); P. A. (*Birmingham*); W. R. (*Manchester*); G. K. (*London, N.*).

Trade Note.

IN accordance with instructions, the R. W. Hunt & Co. Inspection Bureau recently inspected 10,000 car wheels made by A. Witnery & Sons for the Savannah, Florida, and Western Railroad. For size, each wheel was measured around the tread by a brass tape divided into spaces of $\frac{1}{8}$ in. each. The record shows that 4,325 wheels were exactly the same circumference; 4,365 were but $\frac{1}{8}$ in. less; 881 were but $\frac{1}{8}$ in. over, while 429 were varied over $\frac{1}{8}$ in. either way. That is, the extreme variation in 8,690 of these wheels was $\frac{1}{16}$ in. in diameter, and in 881 it was only $\frac{1}{16}$. For roundness the wheels were tested by a true ring resting on the cone of the wheel, and none was found with a variation of more that $\frac{1}{32}$ in. at any point. For strength, 105 of the wheels were broken under the drop test, by a weight of 140 lbs. falling 12 ft. The specifications required that they should stand five blows. Two wheels broke at nine blows, while 50 required from 50 to 118 each. To start the first crack the average number of blows was 13·26; to break the wheel in two, the average number of blows was 49·56. The average depth of the chill at the root of the flange in the 105 wheels broken was $\frac{7}{16}$ in., and the depth did not vary in any case more than $\frac{1}{8}$ in. round the wheels. None of the wheels inspected were rejected because of chill cracks, blow holes, or other imperfections, and none needed to be ground or in any other way made smooth or true.

WORK

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.

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.

On the First of Every Month, **4d.**

Cassell's Time Tables

AND

Through-Route Glance-Guide.

A SUBSCRIBER *writes:*—"I always buy 'CASSELL'S TIME TABLES,' and although I travel almost every day have never yet found any mistake in it, and I consider it more useful and at the same time more simple than any other book of the kind."

"**'Cassell's Time Tables'** may be safely recommended to all intent upon a railway journey, as the clearly-tabulated routes and the useful maps of the suburban and provincial railway systems which they contain will enable the passenger to select the train required without the slightest difficulty or uncertainty."—*Morning Post.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

BEAUTIFULLY COOL and SWEET SMOKING.

SMOKE

PLAYER'S NAVY CUT.

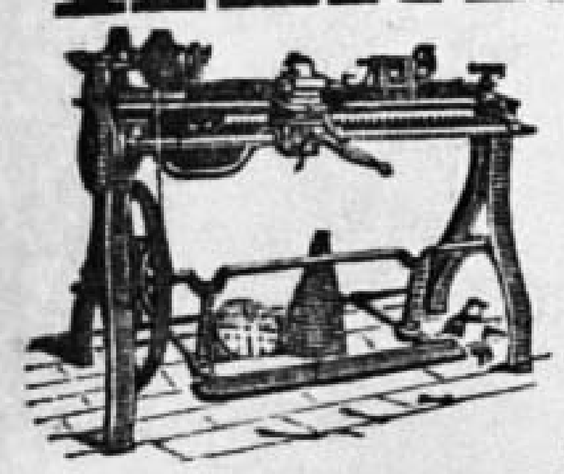
Ask at all Tobacco Sellers, Stores, &c., and take no other.

Sold only in 1 oz. Packets, and 2 oz. and 4 oz. TINS,

which keep the Tobacco always in fine smoking condition. **Player's Navy Cut Cigarettes** can now be obtained of all leading Tobacconists, Stores, &c., in packets, containing 12.

The Genuine bears the Trade Mark, "NOTTINGHAM CASTLE," *on every Packet and Tin.*

HENRY MILNES,



MANUFACTURER OF

HIGH-CLASS LATHES

FOR

SCREW-CUTTING & ORNAMENTAL TURNING

TREADLE MILLING MACHINES, HAND PLANING MACHINES, &c.

Ingleby Works, Brown Royd, Bradford.

ACCURACY AND LIGHT RUNNING GUARANTEED. **ESTABLISHED 1858.**

ESTABLISHED 1851.

BIRKBECK BANK.

Southampton Buildings, Chancery Lane, London.

THREE per CENT. INTEREST allowed on DEPOSITS, repayable on demand.

TWO per CENT. INTEREST on CURRENT ACCOUNTS calculated on the minimum monthly balances, when not drawn below £100.

STOCKS, SHARES, and ANNUITIES Purchased and Sold.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH or A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY, as above.

The BIRKBECK ALMANACK, with full particulars, post free on application. FRANCIS RAVENSCROFT, Manager.

Stephens Stains FOR WOOD.

Specimens and Prospectus giving full details as to use free by post.

H. C. STEPHENS, 191, Aldersgate St., London, E.C.

New and Enlarged Edition. *Cloth,* ***3s. 6d.***

COLOUR. A Scientific and Technical Manual treating of the Optical Principles, Artistic Laws, and Technical Details governing the use of Colours in Various Arts. By A. H. CHURCH, Professor of Chemistry in the Royal Academy of Arts, London. With *Six Coloured Plates.*

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

DELICIOUS

TEMPERANCE DRINKS.

Mason's Non-Intoxicating Beer, Mason's Wine Essences produce in a few minutes a delicious Temperance Wine or Cordial, Ginger, Orange, Raspberry, Black Currant, Lime Fruit, etc.

One Tablespoonful of **Mason's Extract of Herbs** makes one gallon of splendid Beer, refreshing and non-intoxicating.

A Sample Bottle of either Essence or Extract sent on receipt of 9 stamps, or a bottle of each for 15 stamps.

AGENTS WANTED.

NEWBALL & MASON, Nottingham.

INVALIDS

May be speedily restored to health by wearing one of

HARNESS'

ELECTROPATHIC BELTS.

Though they are guaranteed to generate continuous Electric currents, strong enough to cure almost all disorders of the **Nerves, Stomach, Liver, Kidneys,** &c., they do not cause the least discomfort to the wearer; but, on the contrary, they give support to the various organs of the body, and

INVIGORATE

the entire frame. They also effectually prevent **Rheumatism,** and kindred ailments. *Thousands of Testimonials* from all classes of society may be seen at the **Electropathic and Zander Institute** of the **Medical Battery Co., Limited,**

52, OXFORD ST. LONDON, W.

(Corner of Rathbone Place.)

Pamphlet, consultation, and advice, **Free on application.**

MANUALS OF

TECHNOLOGY.

Edited by Prof. AYRTON, F.R.S., and RICHARD WORMELL, D.Sc., M.A.

THE DYEING OF TEXTILE FABRICS. By J. J. HUMMEL, F.C.S. *With Numerous Diagrams. Seventh Thousand.* 5s.

STEEL AND IRON. By WILLIAM HENRY GREENWOOD, F.C.S., M.I.M.E., &c. *With 97 Diagrams. Fourth Edition.* 5s.

SPINNING WOOLLEN AND WORSTED. By W. S. BRIGHT McLAREN, M.P. *With 69 Diagrams. Second Edition.* 4s. 6d.

CUTTING TOOLS. By Prof. H. R. SMITH. With 14 Folding Plates and 51 Woodcuts. *Third Edition.* 3s. 6d.

PRACTICAL MECHANICS. By J. PERRY, M.E. With numerous Illustrations. *Third Edition.* 3s. 6d.

DESIGN IN TEXTILE FABRICS. By T. R. ASHENHURST. *With 10 Coloured Plates and 106 Diagrams. Third Edition.* 4s. 6d.

WATCH AND CLOCK MAKING. By D. GLASGOW. 4s. 6d.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

CASSELL'S

TECHNICAL MANUALS.

Illustrated throughout with Drawings and Working Diagrams, bound in cloth.

Applied Mechanics. By Sir R. S. BALL, LL.D., F.R.S. Cloth, 2s.

Bricklayers, Drawing for. 3s.

Building Construction. 2s.

Cabinet Makers, Drawing for. 3s.

Carpenters and Joiners, Drawing for. 3s. 6d.

Gothic Stonework. 3s.

Handrailing and Staircasing. 3s. 6d.

Linear Drawing and Practical Geometry. 2s.

Linear Drawing and Projection. The Two Vols. in One, 3s. 6d.

Machinists and Engineers, Drawing for. 4s. 6d.

Metal Plate Workers, Drawing for. 3s.

Model Drawing. 3s.

Orthographical and Isometrical Projection. 2s.

Practical Perspective. 3s.

Stonemasons, Drawing for. Cloth, 3s.

Systematic Drawing and Shading. 2s.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London.*

PRINTED AND PUBLISHED BY CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.