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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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MIRROR FRAME IN CARVED WOOD.

IN THE STYLE OF THE ITALIAN RENAISSANCE OF THE SEVENTEENTH CENTURY.

BY FRED MILLER.

I WILL commence by stating that the accompanying design is a free adaptation of a very good and well-preserved specimen of a seventeenth-century mirror frame, that is well worth the attention of all skilled wood carvers, whether professional or amateur.

Work of this character, it should be said, is difficult, and should only be attempted by those who have passed the initiatory stage. The "carving" must be executed with precision and crispness, and, at the same time, there must be a freedom and springing quality about it, in order to give the sensation of the lines flowing from a common centre and being continuous throughout. Broken-backed curves and disconnected lines ruin the entire effect. If you examine good specimens (and almost all specimens are good) of seventeenth-century Italian carving, you will see what I mean by continuity. One can imagine the craftsman taking a soft, yielding material, and by dexterously guiding his tools, executing the long flowing curves that make up the design in a few sweeps of his gouge. *This* effect we know is obtained by time and labour, and yet when we look at the finished work we should feel that it was wrought in the first freshness of the day, when the nerves are vibrating and the energy is elastic. There should be no feeling of labour about wood carving. Merely the result of infinite pains and a cycle of days depresses one; and though good work requires both patience and time, you should get that nervousness into your carving which makes one feel that the work was wrought in a happy moment, when the interest is undiminished and the hand unwearied.

What has this, I can imagine some one saying, to do with wood carving—this transcendentalism? Everything, I reply: for it is the *spirit* in which you executed your work that gives it its feeling, gives it life. The letter only it is which kills. And so much modern wood carving is wholly deficient in *esprit*. It is commonplace and mechanical in execution if not in design, and depresses rather than exhilarates the beholder. It might have been turned out by a machine instead of executed by the hand of the cunning worker. Therefore, before putting in hand such a work as that figured, charge yourself with feeling, and let the artist triumph over the mechanic.

If the work is for gilding, good pine will do to execute the design in. But if the wood is to show the American walnut, oak or mahogany is better. The thickness of the wood depends upon the amount of "undercutting" you intend to put into your work. This class of design does not look well in too low relief. The effect is largely due to the different planes (or depths) in the work, and the back scrolls that support the front ones should be, say, 1½ in. thick, and allowing for the parts in highest relief the wood ought to be about 3 in. to 3½ in. thick. Two pieces 1½ in. thick when planed might be glued together, the lower piece for the back scrolls and the oval frame itself, and the upper piece for the work in highest relief.

Make a careful enlargement of the design as far as the main lines go (for it would serve no practical purpose to indicate much undercutting), and paste this down on the wood; be careful to strike the oval correctly. The wood should first of all be pierced, and if your design is accurately enlarged, it might be worth going to the expense (not a considerable one) of having this done by a steam fret cutter. By piercing the design you are helped in the execution of the work, as it gives you a clear idea of the general scheme. The outside or outline of the design should also be cut round; now "ground out" to the depth of

Mirror Frame in Carved Wood. Example of Italian Renaissance, Seventeenth Century.

the back scrolls. If you have glued two pieces together, this will be to the depth of the upper piece. This gives you a very fair idea of the "masses" of the design. But so far the difficulties have been purely mechanical. The real difficulties begin with the carving itself, and about this little that is helpful can be said in writing. This is so largely a matter of feeling. I have endeavoured to indicate by light and shade the general disposition of the principal curves, and your own intelligence and artistic perception must do the rest.

The scrolls resting on the oval frame should be, say, ⅛ in. deeper than the frame itself, that is the full depth of the wood through where two pieces are glued together. I said the lower piece should be for the frame and back scrolls. But where the wood is solid the oval frame itself might be 2 in. in depth, the back scrolls 1⅛ in., and the foremost ones the full depth, 3 in. This gives you three planes, and you can introduce subtler gradations as the work progresses, so that one plane looses itself or sinks into the one below it, for it should not be apparent how many planes there are. The completed work should have subtle qualities if it is to be worthy the notice of the readers of this paper.

A few visits to the South Kensington Museum during the progress of the mirror frame would materially help one, as there is a good collection of wood carving there, and one can always get help and inspiration from looking at good work.

HOME-MADE POLISHING WHEELS, ETC.

BY OPIFEX.

EMERY wheels of various sizes and degrees of cutting power are almost indispensable to a well-stocked workshop, and, as they are rather expensive articles to buy, it may prove a boon to many amateurs to know that it is quite possible to make very serviceable wheels oneself. Besides, there is the pleasure of making them, and the satisfaction which every genuine mechanic (I mean amateur genuine mechanic, not genuine amateur) feels at having supplied his own wants. Many amateurs who live near a good tool shop, and are possessed of plenty of means, have their workshops crammed with everything that the heart of workman can desire, but I doubt if they enjoy their work half so much as he who makes his own tools and appliances. It is much to be able to say of some piece of finished work, "I made it all," but much better to be in a position to say, "I not only made *that*, but the tools with which it was made are my own manufacture also." Now my idea of WORK is that it aims at providing its readers not only with instruction as to "what to make and how to make it," but that it strikes at the root of the matter of success in all mechanical work by showing us how to be thorough-going and therefore independent workers.

It is with the hope that I may help to carry out this latter object that I contribute my "mite" in the shape of some hints upon the making of polishing wheels and artificial whetstones.

I do not pretend that they are as good in every respect as those manufactured by the trade, but they have stood me in good stead in many a job, and I may say that I never knew what comfort, with respect to edged tools, was until I had supplied myself with these home-made articles.

I shall begin with directions for making a coarse-grained wheel for rough work, such as grinding chisels, etc., etc., and here it may be asked, "Why not use an ordinary grindstone?" But that is just my point, and my answer is that I find the artificial stone, driven in a small machine (something like that shown at page 119 of Melhuish's catalogue, only a little heavier, and which carries all my wheels), answers better than any ordinary stone, except, of course, for large tools.

Such a wheel as just mentioned should be about nine inches in diameter, an inch and a half wide, and may be composed of emery or sand.

If of the former, what is known as grinding emery should be used; and here it may be well to point out the different names by which emery powder is known:— 1. Corn emery; 2. Coarse grinding emery; 3. Grinding emery; 4. Fine grinding emery; 5. Superfine emery; 6. Coarse flour emery; 7. Flour emery; 8. Fine flour emery; 9. Superfine flour emery.

No. 3 will suit best for our present purpose, but as the grain of this powder is coarse, it will be necessary to add some fine powder in order to supply "body" to the mixture of which the wheel is to be composed; in other words to fill up the chinks which occur between the grains of the coarse powder. The other ingredients required are shellac, resin, and a small quantity of cycle cement. The proportions of these ingredients are as follows:— No. 3 emery powder, 3 lb.; emery flour, washed, 1 lb.; shellac, 4 oz.; resin, 1 oz.; cycle cement, 1 oz.

The flour emery should be washed by mixing well in water, allowing the coarser particles to subside, and pouring off the water. This is necessary because the fine dust would absorb more than its share of the shellac in the after process of melting. The shellac is pulverised as finely as possible in a metal mortar, or, failing this, it may be powdered by tying it up in a closely woven cloth, and beating it on a block with a heavy pestle or mallet. Whichever method is employed it must be reduced to powder which will pass through a fine wire sieve.

The resin and cycle cement are treated in the same way, and if a small quantity of emery powder is mixed with the latter while pounding it will expedite the operation, otherwise it is rather a difficult substance to reduce to powder; but I find it admirable for supplying *toughness*, and much more workable than vulcanised rubber.

When the shellac, etc., have been pulverised and passed through the sieve, all ingredients are well mixed together.

A suitable mould must now be prepared; this should, of course, be of the exact size of the proposed wheel, and I have always used the bottom portion of some tin vessel for the purpose; for the smaller-sized wheels an old lobster tin, etc., but for this large size it is not always easy to find a suitable vessel. I use part of a drum in which soft soap is sold, which is 8½ in. in diameter, but the reader will provide for himself; whatever is used it must be perfectly round, about 1½ in. deep, and as free from dents as possible.

Paint the mould all over the inside with an even coat of blacklead mixed with beer, etc., and when dry it is ready for use.

A considerable degree of heat has now to be applied to the mixture, and great care will be necessary lest the shellac, etc., be burned. A good vessel to use is a small cast-iron frying pan, *not* a thin sheet iron one on any account, or the result will inevitably be failure.

Place the pan upon a hot, clear fire, and stir the contents with an iron spoon, etc., scraping the mixture from the bottom of the pan as it melts, and removing from the fire if it shows any sign of burning. It should not be heated sufficiently to smoke, and the heating should only be continued until the mass has become thoroughly incorporated. Do not expect it to melt in the sense of becoming fluid, but when it has become thoroughly heated, turn out into the mould as quickly as possible, and ram well so that there may be no breaks or flaws. As this mixture keeps its heat for a considerable time, especially in case of a large quantity, it will be safe, in this instance, to cover the bottom and sides of the mould with a thick coat, and when this is well pushed in, fill up with composition from the pan, which should be kept hot during the operation.

When the mould is full, or when the required thickness is obtained, the upper surface should be smoothed over, and the edge made compact, so that when the wheel leaves the mould there may be no flaw or gap at the corners of the cutting face. This smoothing should be done with a broad, pliable knife, or "spatula."

The packing of the mould is one of the most important parts of our subject, as unless the composition is well pushed in there will be flaws on the under side and edges of the wheel, and also the operation has to be so quickly performed, in order that the surface may not have time to cool, so that the second application may merge in the first.

Any one who has watched workmen laying down "val de travers" or any asphalt roadway will have a good idea of the consistency of this emery composition, and also the method of working it, as the substances and their treatment are very much alike. When the mould has become cold, the wheel may be easily turned out, and the next step is to make a hole through the centre for the spindle.

Find the centre on each side with a pair of compasses, and bore with a red-hot piece of round iron, of a suitable size—that is, something smaller than the spindle. Be careful to make the hole at right angles to the sides of the wheel; and when made, but still hot, press the spindle through and screw up.

The wheel may now be run in the lathe at good speed, and trued up with a red-hot iron.

If the mould has been right, and the hole has been carefully bored, the wheel will be fairly true, but it will be necessary to have it perfectly so.

Use a rather thick iron which will retain heat for a considerable time—an old large-sized flat file is what I always use. While red-hot hold it to the sides of the wheel until the surface becomes slightly melted, when, by applying the edge of the tool, any unevenness may be easily removed.

Owing to the speed of the wheel, there is great danger of the hot particles flying into the face of the operator, and this should be guarded against by watching the effect of the hot iron through a piece of glass, which may be held in the left hand or by another person.

The face is then made true by the same means, and our first wheel is made.

Thus far, at the risk of being thought tedious, I have entered into all particulars, however simple, knowing from experience that there are few things requiring more

careful manipulation than the subject in hand. Remembering many failures resulting from ignorance of these details, I give them in the hope that any reader who makes the attempt may be spared much trouble and disappointment.

Another good wheel for rough work may be made of sand, two parts, powdered glass, one part; the other ingredients in the same proportion as in the wheel already described.

The sand should be what is known as "silver sand," and must be well washed, thoroughly dried, and allowed to become cold before mixing with the other ingredients.

The glass may be composed of any fragments of broken decanters, dishes, etc., usually to be found about a house. It must be pulverised in a metal mortar, and passed through a fine wire sieve.

In Spon's "Workshop Receipts" the direction is to melt the shellac and stir in the sand, etc., but I do not think this practicable, as the shellac is so small in bulk compared with the other ingredients, that it would be impossible to incorporate, say, two pounds of sand with two ounces of shellac, unless the two substances were thoroughly mixed while cold and in powder.

It must always be borne in mind that we should aim at using a minimum of shellac, resin, etc., otherwise, whilst the forming of the wheel will be comparatively easy, its efficiency will be lessened, as the excess of resinous matter causes the pores of the composition to clog; in fact, this is the great difficulty to be overcome with all wheels of the kind, and the only preventative, even in the case of the best, is to keep up a constant and copious supply of water during use; either running the under side of the wheel in water, like an ordinary grindstone, or by a constant drop from a small cistern of some kind above the wheel.

So far, I have given directions which are only the expanding of receipts obtained from such sources as Spon's books, etc. If there are any other published instructions on this subject, I have never been fortunate enough to come across them; but although this method works well in the case of such rough wheels as above described, I have not found it satisfactory for those of a finer make. My experience of shellac is that it is very difficult to reduce to a very fine powder; and that even when finely pulverised, it is rather unmanageable in combination with such substances as those which form the other ingredients in polishing wheels, etc. When mixed with these ingredients in a dry state, and then heated, it is apt to become absorbed by them, and the mixture therefore refuses to bind; if heated to excess in the least degree, the same result ensues; if insufficiently heated, the gritty and resinous substances fail to become thoroughly amalgamated, and the mixture is honeycombed and crumbles when cold; whilst if the shellac is at all in excess, the wheel, etc., as mentioned before, will clog in use, and is therefore worthless. Encountering these and other difficulties, I was led to adopt another method which proves most satisfactory, and is, as far as I know, unusual. The process is briefly as follows:—In the first place I dissolve the shellac in methylated spirit, forming it into a thick paste, and then, heating the dry emery, etc., I mix the whole, working it thoroughly until all the gritty particles are incorporated in the shellac.

To reduce shellac to a thick paste, put, say, three or four ounces into a small vessel, and pour about a wineglassful of methylated spirit upon it. Boil water in another vessel something larger than that which contains the shellac, and, when boiling, place the latter in it. The shellac will soon melt, and the boiling point of spirit being much lower than that of water, the gum will quickly be reduced to a thin liquid, which, upon cooling, will become a paste.

If, however, it remains liquid when cold—the consistency should be that of thick treacle—place it again in the boiling water until more spirit is evaporated, and by this means the proper consistency may be obtained.

The next step is to prepare the other ingredients. For each ounce of shellac, Spon recommends a piece of resin the size of a walnut. This I think a little in excess, and use twice this quantity to three ounces of shellac.

Powder the resin in a mortar, and then take the same quantity of cycle cement, and melt it in some small metal vessel. When melted, add the resin and a small quantity of the shellac paste. When well mixed, this should be added to the proportion of shellac required for the work in hand, the whole being again melted and thoroughly mixed.

Now heat the emery powder and other grit in some metal vessel. I always use home-made copper bowls for all these operations, and find them more satisfactory than iron pans, ladles, etc., as the heat takes effect so much more quickly, and may be more easily regulated, which is a very important consideration in all these processes. For the method of making these copper bowls, see my "Hints on Hollow Work in Sheet Metal" in No. 18, page 282.

When the emery, etc., is quite hot, apply heat once more to the shellac, and, having placed the powder upon a metal slab, which should also be moderately heated (a piece of sheet iron fixed above a spirit lamp will serve in the absence of a thicker slab, which would retain the heat), with a strong knife or small trowel work up the powder and shellac, when the latter, being partially diluted with spirit, will thus be equally distributed through the mass, and will coat each particle of the powder.

The mixture is next returned to a metal vessel, and subjected to a strong heat, great caution being necessary not to burn it. This will drive off the excess of spirit, and more thoroughly melt the shellac, and when this object is accomplished, turn out the mixture as quickly as possible into the prepared mould and proceed as before directed.

The following are some of the substances which I have found most useful for the finer wheels, etc.:—1. Fine emery, 2 parts; washed flour emery, 1 part. 2. Finest emery, 1 part; washed flour emery, 1 part. 3. Fine emery, 2 parts; very finely powdered glass, 1 part. 4. Washed flour emery, 2 parts; Oakey's Wellington knife polish, 1 part. 5. Fine powdered glass, 1 part; fine powdered pumice (washed), 1 part. In each case shellac, resin, and cycle cement in the proportions before directed.

All of these mixtures when moulded in flat cakes also make excellent artificial whetstones and slips, which will be found most useful for various purposes; and the ease with which they may be grooved, or made to assume any desired shape while hot, renders them peculiarly suited for sharpening carving tools, etc. etc.

I strongly recommend all workmen to adopt my plan of making polishing wheels at home. It is not work that presents any special points of attraction in itself, but it has the eminent merits of being useful and practical although not ornamental.

LOCK REPAIRING AND KEY FITTING.

BY THOMAS WILSON.

REPAIRS OF WORN KEYHOLE—COMMON BACK SPRING LOCK—DESK LOCKS—MORTISE LOCKS—PADLOCKS.

MOST of the locks that are made now are bushed at the keyhole with a small extra plate to avoid wear, but the lock shown in the last paper and a few others are made without a bush, so that occasionally the keyhole is worn away, and the key works loose in the lock. Fig. 3 shows covering plate of lock with worn keyhole. If it is only slightly worn, it can be remedied by making a number of centre punch marks with a centre punch, as shown in Fig. 2; but the keyhole of lock case cannot be done in this way without removing the bridge ward, which is rather a troublesome job. The best way to bush a lock is to cut out a small brass plate with keyhole, and solder or rivet it over worn keyhole, but as this is rather a difficult matter for an amateur, I will describe another plan, which, although it may not look so well, will answer the purpose. Every one is familiar with the iron washers used for putting under the heads and nuts of bolts. Buy two of these at an ironmonger's, of a size to fit over the pin of the key—about $\frac{5}{16}$ in. will be required for a key similar to that shown in the sketch of lock which appeared in the last article—and file one side of them bright; now scrape or file the keyholes of lock bright, and lay the washers on them with the bright parts downwards. Procure a pennyworth of spirits of salts (muriatic or hydrochloric acid), pour it in an old cup or gallipot and put some scraps of zinc in it—if you have not any old zinc get a pennyworth of zinc nails. When it has done boiling, put a little of the spirits on the washers and keyholes, place a small piece of solder on the top of them, and hold them in the flame of the gas or over a clear fire until the solder melts, then lay them on one side to cool. They will now appear as shown in Fig. 4, and after the part marked A is filed away they are completed. The collar of the key will probably require filing back to allow for the extra thickness of the bush. A soldering fluid called "Solderine" is sold by most ironmongers. This preparation is ready for use, and does not require "killing" with zinc before being used. A stick of blowpipe solder can be bought for a penny or two, and the washers at a penny a dozen.

Fig. 1 shows the interior of a common backspring lock. The cheapest way to repair these is to take them off, buy a new one and throw the old one away. A lock of this description can be bought for 4d. or 6d., so that it will be seen it does not pay to repair them.

The old lock should be taken as a pattern when purchasing a new one, so that the new lock may fit in the same place. It is sometimes difficult to get a new one of the same pattern as the old, and then it becomes a question whether it is better to repair the old one or to cut the woodwork for a new one. If it is decided to repair the old it will probably be found that the spring is broken. This can be easily remedied by cutting off a piece of a stout feather spring, and fitting it in the slot of the bolt at B. To get the bolt (A) out, bend back the rim gently at C, afterwards bending it into position when spring is fixed. If a new pin is required, a piece of wire must be used considerably larger than the pipe of key, and filed down so as to form a shoulder as shown at A, Fig. 5. The pin must then be

held in the vice at C, and the part marked B rivetted into the lock.

In small locks, such as desk locks, the bolt is sometimes broken. These cannot be repaired, as any extra thickness at the place where it is broken would prevent the bolt from working, but it is comparatively easy to make a new one. The broken pieces should be filed bright on one side, and laid on a piece of brass of the same thickness, and soldered on as described in bushing a lock. Now file away the brass plate around the old bolt, hold it in the gas to melt off the old pieces, and you will have your new bolt. (Fig. 6).

Before finishing with warded locks, it may be as well to say a word about mortise locks. If these are out of order, it will usually be found to be either the spring or the follower that is wrong. To repair or replace these the lock must be taken off, and, although this is a simple matter, it may be as well to describe how it is done.

Fig. 7 shows the edge of a door with mortise lock fixed. To take it out remove the knobs and spindle, then take out the screws of face plate A A, under this will be found two other screws. These must be taken out, then if the screw-driver is inserted in the keyhole, and the lock pushed forward, it will come out sufficiently to be grasped by the hand and pulled right out. If the follower is worn out, a new one must be fitted. Those for mortise locks (Fig. 8), and indeed for most rim locks, are not riveted in as described in my last paper, but work between the two plates of the lock. The old one should be taken as a pattern in buying a new one, but it will probably require a little alteration before it will fit. The spring is pretty certain to be a feather spring, and a new one can be bought for a penny, as mentioned in my last paper. The screws of face plate are very short, and liable to be lost; should this be the case the plate can be fixed by ordinary screws, long enough to reach the woodwork.

Keys to padlocks must be fitted by examining the wards, as far as possible through the keyhole, or by blacking the blank as previously described. Warded padlocks, however, can be instantly picked, by holding the lock on one side and raising the tumbler with a pick, when the bolt will drop back by its own weight.

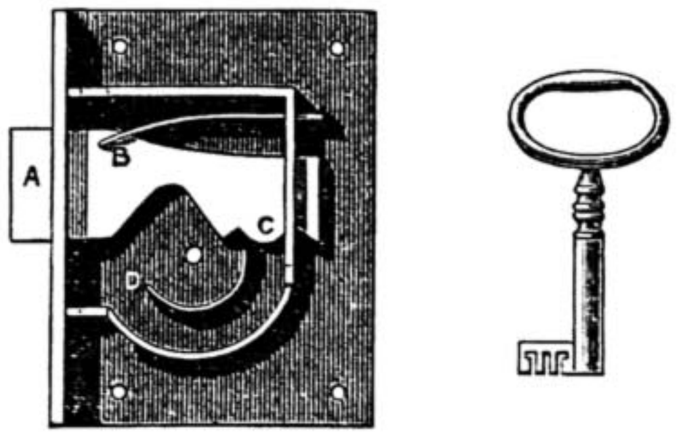


Fig. 1.—Interior of Common Back Spring Lock.

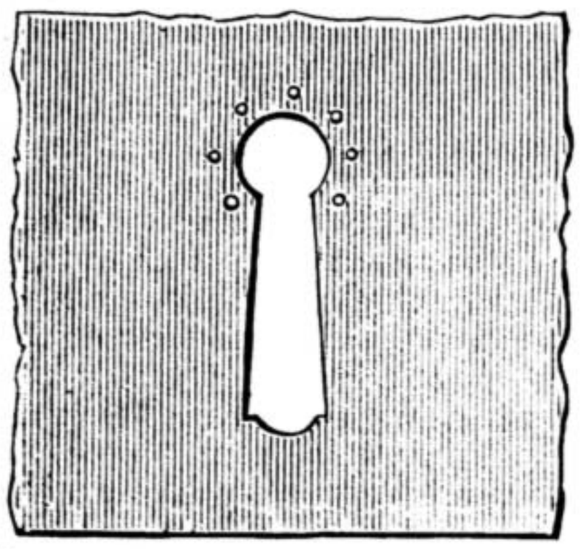


Fig. 2.—Mode of Repairing Worn Keyhole by Enlarging Hole.

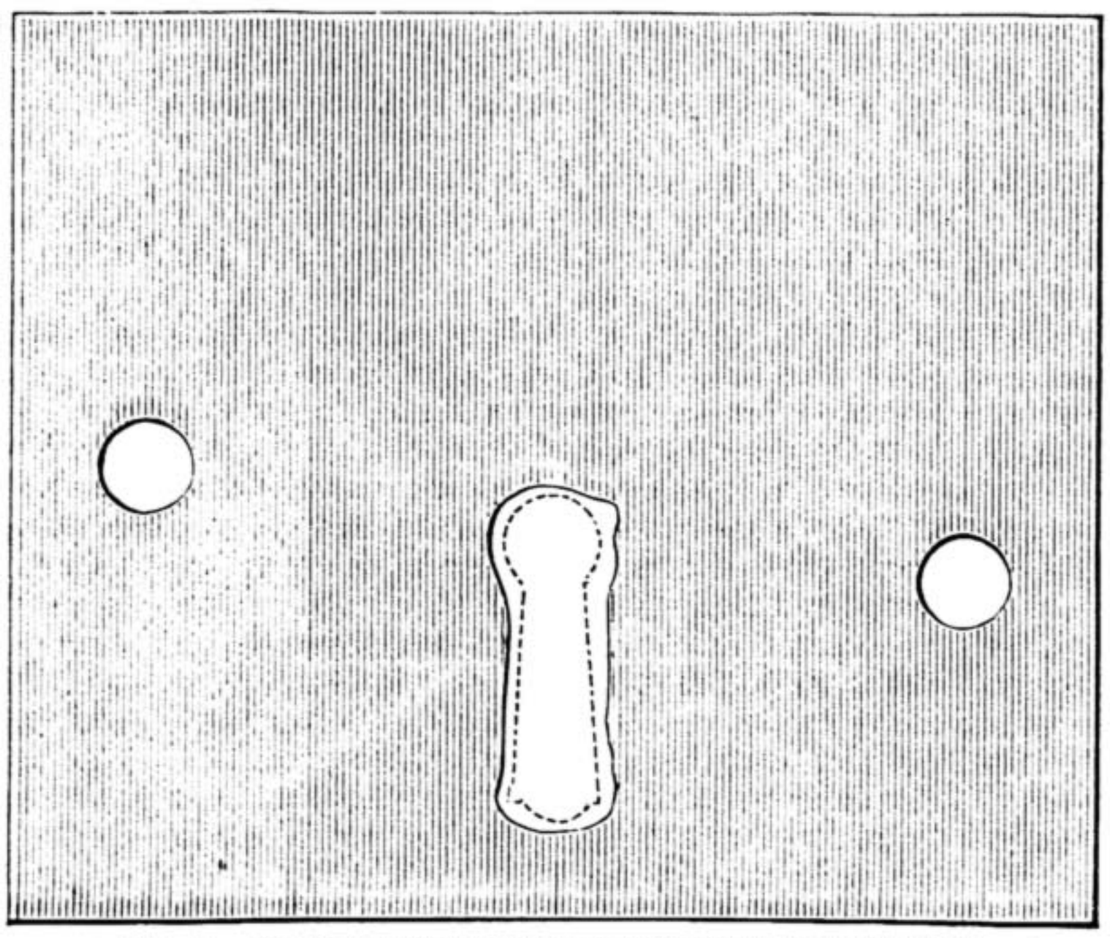


Fig. 3.—Covering Plate of Lock showing Worn Keyhole.

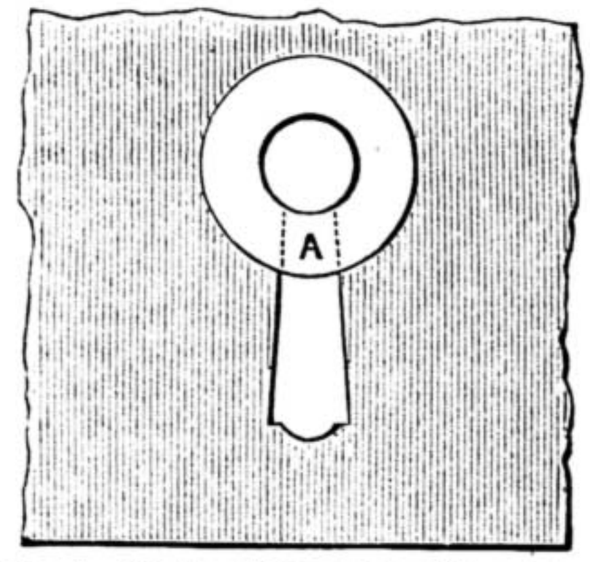


Fig. 4.—Mode of Repairing Worn Keyhole with Iron Washer.

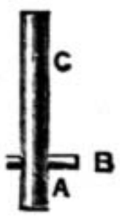


Fig. 5.—Mode of Repairing Pin.

Fig. 6.—Shape of Bolt of Drop Lock.

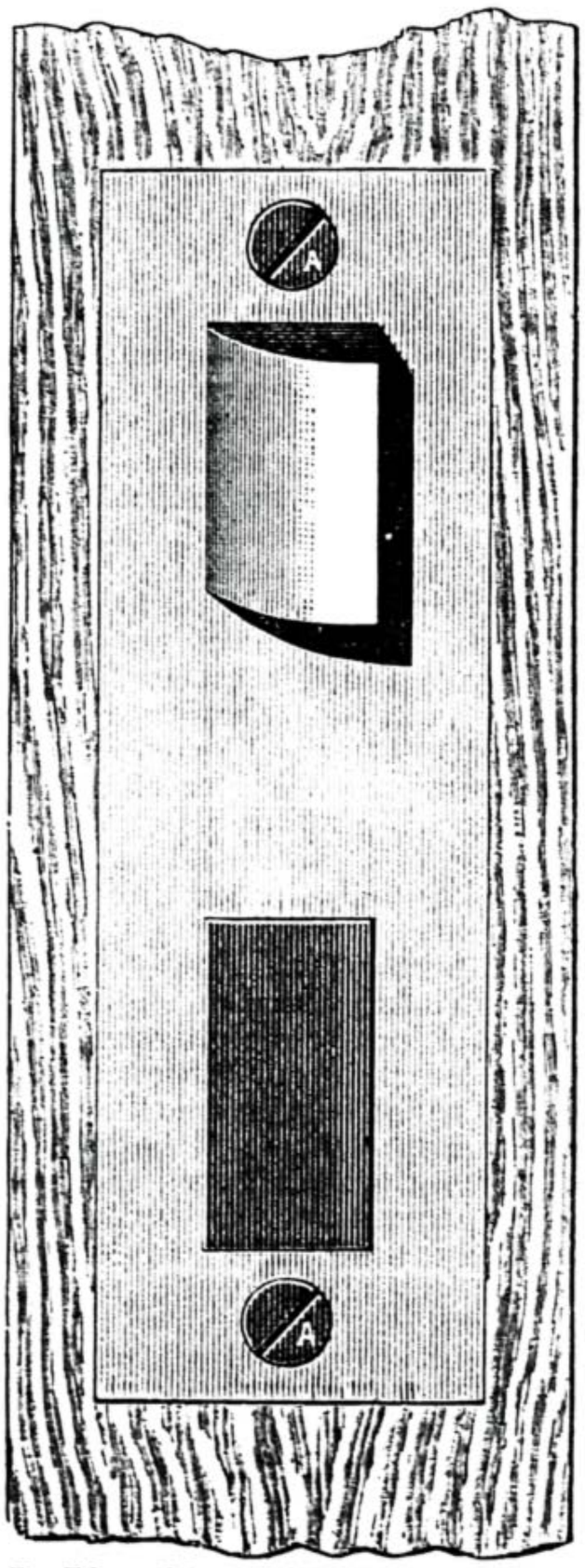


Fig. 7.—Edge of Door with Mortise Lock Fixed.

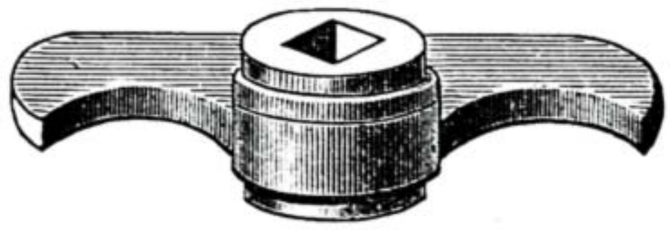


Fig. 8.—Follower in Mortise Lock, showing Form, etc.

Before taking leave of warded locks, I may mention that when a new key is required it is not always necessary to get a blank and cut the wards. All ironmongers keep a large stock of keys with the wards ready cut, and one can generally be found that will fit the lock with a little alteration. As these are the same price as blanks there is nothing gained by taking a blank if a key can be got instead.

In lever locks, which I shall take occasion to describe in the next paper, keys *must* be cut from blanks. It would be useless to enumerate all the patterns of warded locks in use, as it would fill several numbers of WORK, and would serve no useful purpose, as the directions for cutting the key to rim lock, as described in No. 21 of this Magazine, are really applicable to all warded locks. But should any difficulty arise, I shall be pleased to answer any correspondent who may stand in need of assistance through the medium of "Shop."

A FEW WORDS ABOUT SCRAPERS.

BY A CABINET MAKER.

IN a recent article in WORK, called "Friendly Hints to Amateur Wood Workers," by D. Denning, the writer alluded to the use of the scraper. At the time, I must confess, the necessity of calling attention to such a well-known tool did not occur to me, or rather it occurred to me as being superfluous. "Surely," thought I, "everyone must know about the scraper without being told," and I wondered why the writer did not tell us about something we did not know of. The utility of mentioning even the ordinary tools of one's own trade, soon however, became evident to me, for a customer, who is hardly an amateur in his own calling, dropped in and referred to WORK, speaking of the article above referred to from an amateur woodworker's point of view. I know he does a little bit in the cabinet-making line, and one thing leading to another, he said he would like to know something more about the scraper which he had seen mentioned. He had heard of it before, but did not think it much use. Was it really important to use it? How was it made? and a good many other questions

besides. Not that I minded being asked them, for the querist is a pleasant young fellow, who does not come bothering about, interrupting and hindering one at his work with all sorts of silly notions, leading one to suppose that he thinks he is conferring an honour or, at the least, condescending very much to ask opinions from a tradesman. Amateurs like that can't be much surprised if they get a rebuff, but if they will be content to ask without pretending to teach, they will not often find that an artisan is afraid to let them into what they call trade secrets. Herein, if I may express an opinion which is not immediately connected with scrapers, this Magazine will do a great deal of good. It concerns itself with both amateurs and professionals, who will by it be more drawn into contact with each other. The result can only be beneficial to both. All this, however, is rather a digression, which I have been drawn into through noticing the stand-offishness of some gentlemen amateurs, and the rather extraordinary way in which they sometimes meet the artisan. Personally, I never object to tell anyone what he wants to know if he will come and say straightforwardly what it is, or if it is any matter I don't feel myself at liberty to speak about I tell him so. When, however, he comes as though he were afraid to ask, and, as it were, tries to worm the desired information out of one, then I "dry up." If he thinks he will be so clever in extracting my supposed trade secrets from me, then I am vain enough to think he shall not. Now, no doubt, some adopt this course through diffidence or fear of intruding, and this feeling of reticence on their part cannot be blamed, as a tradesman's time means money to him. When, however, a good practically-minded amateur is willing to learn, I don't think there are many men who are such churls as to refuse to tell him what they can. There are a few, but there are not many, and in my own experience I have rarely come across one. There is one kind of amateur who won't get to know much; I mean the man who does not care to lie under a supposed obligation, but wishes to pay for lessons. A very praiseworthy wish on his part, but he sometimes spoils the effect when terms come to be spoken of. A case in point occurs to me, and will show very well what is meant. A wood-carver among my acquaintances, one who is always willing to tell anything he can while going on with his work, was asked to give some lessons at the pupil's residence. Said would-be learner was willing to pay—listen, brother craftsmen, and amateurs too, for future guidance—the fabulous sum of sixpence per hour. The offer was, of course, indignantly refused. Committees and such-like self-promoted bodies for the spread of fine art labour have been known to fall into similar mistakes. Now I hope no amateur will take these remarks amiss. I don't think they are couched in offensive language, and I think sensibly-minded men will give me credit for wishing to put them on the right tack for getting over any little difficulty they may encounter in their pastime.

With regard to the scraper, very likely there are others, besides the reader I have referred to, who would like to know something about it. Certainly it is much easier to tell and show anyone how to use it than to explain on paper; still the thing is so simple that no doubt I shall be able to make myself intelligible. It is difficult to know exactly what a man who is quite unacquainted with a tool wishes to be told about it. It all looks so simple to one who has been in the habit of using it, that he is apt to condense his information when asked to explain how it is used, and tell his inquirer to do so in "the usual way." Correct enough, no doubt, but hardly specific enough to enable one who has never seen the tool to use it effectually. Perhaps in this instance I cannot do better than incorporate the questions and answers on the occasion referred to.

To begin with, the scraper is a thin bit of steel of any convenient size, say about 5 in. long by 2½ in. wide. I don't know the exact gauge of the metal, but ⅛ in. would be too thick. Scrapers are to be bought for a few pence each, but they may very easily be made from a piece of a broken saw. The edges, after the piece has been separated with a cold chisel, must be filed down

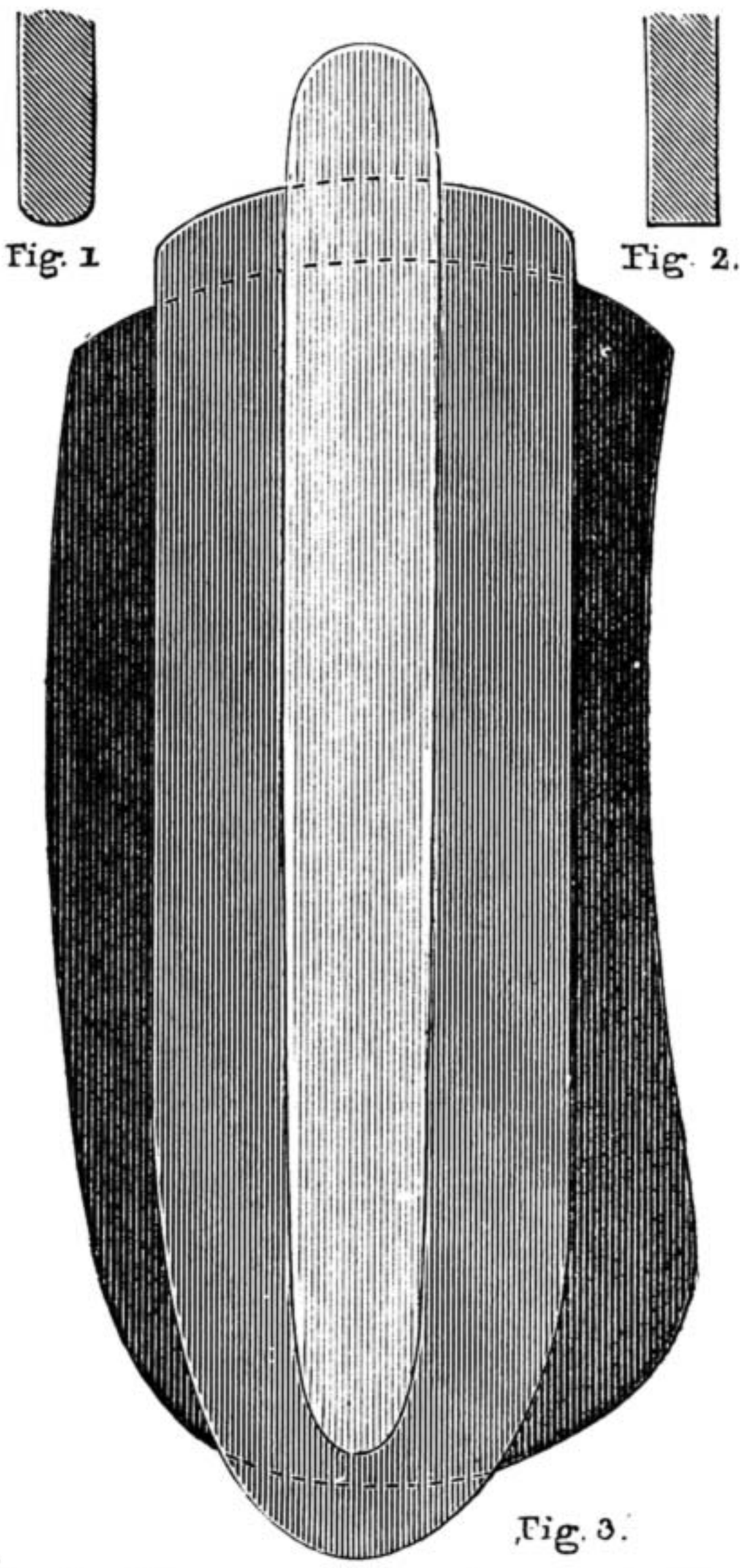


Fig. 1.—Edge wrongly formed. Fig. 2.—Edge rightly formed. Fig. 3.—Outlines of Shaped Scrapers.

straight and square. If it is to be a scraper for flat work, of course it is necessary that one side at least must be perfectly true. This can easily be made by running the file lengthways along the edge, which must afterwards be smoothed down by a rub or two on the oilstone, just enough to remove the file marks. It is necessary to be careful not to round the edges like Fig. 1, but to keep them perfectly square like Fig. 2. Both these illustrations, of course, are given in section on a very much enlarged scale to prevent mistake. The edge, it will be seen, is not a cutting one, but scraping in its action. Such an edge as shown in Fig. 2 will certainly scrape, but the operation would be so very tedious that the tool would be practically worthless. To sharpen it properly is not a difficult operation, but it is one that requires a certain amount of knack, which, however, is soon acquired with a little care and attention. It is not so much sharpening that is required as turning the edge over to form a kind of burr on each face of the steel. A properly-sharpened steel can, apart from its action on the wood, easily be told by holding the plate between a finger and thumb of one hand and moving it with the other, when a very perceptible burr should be felt. A suitable piece of steel does not require much sharpening; a few strokes with the sharpener is all that is necessary. The sharpener may be any hard bit of steel, but perhaps there is nothing to beat the "currier's steel." This is a thin steel rod set in a handle, and, I believe, can be obtained at most tool shops, but instead of it any hard, smooth piece of steel will do almost as well, the rounded back of a gouge for instance. To sharpen the scraper, support it firmly on the bench with the left hand, the edge to be treated being perpendicular. Then draw the sharpener with a smart firm stroke along the edge a few times. Don't rub it up and down irregularly, but take vigorous sweeps with even pressure from top to bottom. If the sharpening is too prolonged, it may have a contrary effect from that intended, as the burr may be scraped away. As I said, to do the sharpening properly requires some knack, though it looks so easy and really is. If the novice can't manage to acquire it after a few trials, he will do well to ask some one to show him how, or better still, let some competent man see how he does it. The chances are that he will detect some fault at once.

When the scraper is properly sharpened, the next thing is to learn how to use it effectively. Scraping is rather laborious work, but when a really finely-finished surface is desired, it is not well to avoid the drudgery. Both hands are used, the thumbs bearing a good deal or most part of the hard work. To show the action of the scraper and the way to hold it is easy enough, but to describe it without fear of being misunderstood is another matter. However, I don't think any one can go far wrong if he will attend to the following directions. I may as well say that it is chiefly on large flat surfaces that the scraper will be found most beneficial. From this it follows that one of the long edges is mostly in requisition. This being so, grasp the scraper in both hands, the thumbs being on the inner or nearer side, and pretty near the centre, and the other fingers so disposed that they have a good grip. Now incline the top edge of the scraper away from you, the lower edge being pressed on the wood. Then scrape, the motion being always a pushing one, with the steel held at an angle to the wood. The sharp edge will scrape off the surface and leave it smoother than any plane almost could do. Of course, discretion must be used not to apply the scraper too much in one part to the exclusion of others. It will be noticed that the pressure of the thumbs causes, or ought to cause, the scraper to bend forward a little in the centre, so that sharp corners are kept from digging accidentally into the wood. It is for this reason that steel ⅛ in. thick would not do. A certain amount of pliability is essential. As soon as the edges refuse to bite properly it is time to sharpen them again, and if in course of time they get rounded off, a rub with the file or on the oilstone will soon put them all right again.

Scrapers need not be always rectangular, as this shape is only required for flat level surfaces, but their edges may be curved to fit

any special surface. For instance, here are three outlines of scrapers in actual use, given in full size (Fig. 3). They are not often required; still they come in handy sometimes, and when a special curve is wanted it can easily be filed down. There is no fixed size for such fancy scrapers, as everything depends on the work they are intended for.

With these remarks the subject must be closed. I don't think any material point which the ingenuity of the worker can't get over has been omitted. If it has, no doubt inquiries will be duly answered in the "Shop" column, and as I see WORK has a very extended circulation in the town where I reside, I don't offer to tell all and sundry who might call on me for lessons on scraping. Hence I merely subscribe myself a "cabinet-maker." As an excuse for the crudeness of my style, I may further say I am "one in the white," *i.e.*, without "polish," but so long as the "stuff" is right, that is only a secondary matter. Good furniture is recognised more by the material than by the polish, which is, like this concluding sentence, only a "finish."

SOME ARGUMENTS IN FAVOUR OF VENEERING.

AN EXAMINATION OF SIR CHARLES EASTLAKE'S OBJECTIONS TO VENEER.

BY DAVID ADAMSON.

ONE objection that often operates against veneer in popular opinion is its alleged want of durability. I say in popular opinion, because those who are most capable of judging, that is the people whose business it is to be in constant contact with furniture, know perfectly well that veneering is not a source of weakness, even if it does not increase the strength, as it is sometimes considered to do.

The question of strength is, however, of secondary importance when compared with durability, and on this score there may possibly be some objections of rather more weight than some of the others which have been alluded to. It must not, however, be inferred from this that furniture when veneered is not quite as reliable for ordinary purposes as when solid. It is only less so when constantly exposed to a moist, warm atmosphere, such as that of some tropical regions during the wet or rainy season. In this country veneers may be used without fear of their not remaining in good condition, always presuming, of course, that the articles of which they form part receive fair usage, and that the veneer itself is properly laid on a suitable foundation; we do not require to make furniture as if it were to be constantly exposed to all the changes of weather. It must be made with due regard to its subsequent use and position, and if this be done, it is a very questionable argument to urge against veneer, or any other method of construction, that it is not adapted for furniture. It would be reasonable to say that veneer is not fit for the external parts of buildings, and it may fairly be supposed that architects when decrying veneer sometimes, overlook the fact that furniture is not exposed to hail, rain, and storm. It is well known that architects are seldom successful designers of furniture, and this may be, altogether apart from their not understanding its construction, to a great extent attributable to the apparent impossibility of freeing their minds from ideas of the larger structures they are commonly called on to devise. I am aware that these remarks may not be altogether palatable to members of the architectural profession, who commonly suppose themselves to be capable of designing, not only furniture, but anything else connected with the house; without, however, in any way wishing to cast reflections on their skill, it must be said that they are not the most competent people to express an opinion on domestic furniture. Some few of them may be acquainted with the subject, more or less, according to the time they have devoted to it, and their opportunities of studying it practically. They then are equal to the furniture designer who is a specialist, in fact they have qualified themselves to design furniture. Among such, the late Bruce Talbert may be instanced, and, to a smaller degree, Sir Charles Eastlake. To both of these, by their work in connection with furniture, much of the improvement which has taken place within recent years, may be ungrudgingly attributed. Eastlake, however, as is shown by more than one remark in his admirable book, "Hints on Household Taste," was only partially acquainted with furniture, or rather (should I say?) with the furniture industry, with its commercial or £. s. d. aspect; without a knowledge of which no man can be thoroughly competent to correctly judge of the capacity of cabinet-makers to design and manufacture sound artistic furniture.

As Eastlake is by many regarded as a thoroughly reliable authority, it may be well to see what he has to say about veneering:—

"Veneering has been so long in vogue, and is apparently so cheap and easy a means of obtaining a valuable result, that it is always difficult to persuade people of its inexpedience. Veneering has been condemned by some writers on the same grounds on which false jewellery should, of course, be condemned. But the two cases are scarcely analogous." Then after referring to the practice of silver-plating, which he states is "too universally recognised to be considered in the light of a deception," he continues, "I do not see exactly how veneering is to be rejected on 'moral' grounds." Further, the impracticability of using walnut wood, by which it may be presumed *burr* walnut is meant, in any other way than in veneers having been admitted, he states that when, "for instance, in piano cases the leaves are so disposed as to reverse their grain symmetrically, the arrangement is not only very beautiful in effect, but at once proclaims the means by which that effect is attained. There are, however, many practical objections to the mode of veneering in present use. To cover inferior wood completely in this fashion, thin and fragile joints must be used, which every cabinet-maker knows are incompatible with perfect construction. The veneer itself is far too slight in substance, and even when laid down with the utmost nicety is liable to blister, especially when used for washing-stands, or in any situation where it is exposed to accidental damp. It is never worth while to buy furniture veneered with mahogany, for a little additional cost may procure the same articles in solid wood." He next refers to a "substantial oak table," which he had made from his own design "at a price which was much less than I should have paid for one veneered with rosewood or walnut." "The most legitimate mode of employing veneer should be in panels of not less than a quarter of an inch in thickness, and, if used for horizontal surfaces, the inferior wood should be allowed to retain a a border of its own in the solid."

I have ventured on this fairly long quotation in order that both sides of the vexed question of veneering may be presented to the reader, and Eastlake's remarks are fairly typical of some of the more commonly urged objections, though it must be admitted he writes in a more unprejudiced manner than some of those who have discussed veneering. Some of his remarks having already been disposed of, others may be taken and examined. In the first place, he refers to it as a cheap and easy means of obtaining a desired result. Now this, I think, most cabinet-makers will dissent from, for they all know that veneering increases the cost of any article, and that it is not what may be considered easy. About the cost I shall have something more to say shortly, but this seems a suitable place to make a few remarks about the "easy" part of the work. I don't mean to say that it is really difficult to an expert artisan, or that the physical toil is great, but for all that, if by easy we are to understand that it can be managed properly without skill and experience, then it must be acknowledged the term is incorrect. To lay veneers thoroughly tests the skill of the worker, and is a constant tax on his general intelligence, so that one who can manage veneering is by no means a mere mechanic. He must have brains and be able to use them as well as his hands. Perhaps the qualifying word "apparently" should be looked on as an admission that this is the case.

The observation about walnut veneers proclaiming the means by which the effect is produced when laid in a particular way, bears out to some extent what has been previously said about veneers not being deceptive. Of course, when laid in the way Sir Charles admires, any one can see that veneers have been used, but in any case the practised observer is very rarely at a loss to tell when wood is veneered. The deception then is only in degree varying according to the perceptive powers of the beholder, and seldom depending only on the way in which the work has been done.

The statement that thin and fragile joints must be used whenever an inferior wood has to be covered with veneers will be news to most practical men, at least to those who have not read "Hints on Household Taste," and one almost wonders how its talented author can have been led into making such an extraordinary assertion. That bad joinery may be concealed by veneer is, no doubt, incontrovertible, but that fragile joints are by any means necessary or usually connected with veneered work is, fortunately, not correct. In practice the jointing used in any piece of furniture is the same whether the surface is veneered or plain. It may be good, bad, or indifferent, according to the worker's skill, but the veneering, *per se*, makes no difference whatever, so that this objection, which might carry weight, may be dismissed.

Were it not that silence about the statement that veneer is too slight in substance, might be construed into an admission that it is so, that expression of opinion would be passed over for what it is worth. Beyond custom there is no arbitrary limit to the thickness of veneer, and without knowing what thickness Sir Charles Eastlake had in mind when writing, it is rather difficult to say that it is too thin. It is sufficient for us to know that veneer as ordinarily cut is quite substantial enough for ordinary usages. Something more will be said later on about

thickness of veneers, meanwhile it will be sufficient to state that wood one quarter of an inch in thickness would hardly be regarded as a veneer in the ordinary sense of the word.

That veneered surfaces, to pass on to the next objection, are liable to "blister" is not to be denied, though the liability is not so great as an inexperienced person might suppose on reading the quotation in which it is mentioned. Indeed it is so very small, when veneers are properly laid with the utmost nicety, that it may almost be regarded as non-existent. Blisters generally indicate bad workmanship, and they are so well under control that where they are found it is generally safe to infer that they depend more on careless manipulation and supervision, or subsequent improper usage than on any inherent defect in the form of construction. Occasionally an apparently causeless blister will show, but very rarely. If any rise after the article has left the workshop, it may generally be taken for granted that damp has been the cause. Of course, no one could defend the use of veneered tops for washstands any more than he would advocate the employment of brown paper bags for toilet basins. Marble is so commonly adopted for washstand tops that it seems almost needless to suggest that these are sometimes made of wood. It will be observed that in the quotation from the "Hints" no mention is made of any special part of a washstand, but I infer the top is meant, as no other part is liable to come in contact with any exceptional amount of water. So far as accidental damp is concerned, it may be said that few articles of furniture will stand much of it whether they be veneered or not. If we are to discard veneers for this reason, we must go a little farther and refuse to admit any upholstered piece of furniture into our houses—nay, let us go the whole hog at once, and have nothing about us that will ever wear out or that can, by fair or foul means, accidentally or designedly, be injured. Then, and not till then, may we consistently say that we object to veneer because it might be injured by accidental exposure to damp. We have only got to act up to the idea of getting absolutely imperishable things to land ourselves on the heights of absurdity (wherever these may happen to be situated).

WROUGHT IRON AND STEEL GIRDER WORK.

BY FRANCIS CAMPIN, C.E.

Connections and Bearings—Expansion Joints and Bearings.

Apart from the joints in each distinct part of a structure, such as cross and main girders, there remain to be considered the connections of these parts with each other, and also their bearings upon each other, and upon other places of support. The bridge flooring itself may be carried by cross girders, by cross girders supporting longitudinal girders or bearers, or by main longitudinal girders only. I shall take for example the most complete form, that in which longitudinal and cross girders both occur in the flooring, the latter being carried by the main girders. The covering of the floor will be separately dealt with subsequently.

In those cases where one girder rests upon the top of another, there is no question of load upon the rivets or bolts used, their duty being then confined to keeping the supported elements in their proper positions, and preventing them from being displaced laterally, or lifted during the passage of a load. In other positions, the load carried by the girder, together with its own weight, will come upon the connecting rivets, and it is always safest so to arrange the attachments, that they shall be in shearing stress, as we are more absolutely certain of their strength in that direction, than when relying upon the resistance of the head which, unless the workmanship is unimpeachable, may be open to some amount of doubt. The cross bearers in light foot bridges are commonly riveted up to the undersides of the main girders, but upon these the load is small, and the margin of strength very ample. On a foot bridge 10 ft. wide, with cross bearers 4 ft. apart, the maximum load would not exceed three tons, and the bearer would be held up by not less than eight rivets, which, allowed to be as little as $\frac{5}{8}$ in. in diameter, would show a *working strength* of more than twelve tons. When, however, we have to deal with the heavy traffic of road and railway bridges, the case is very different.

In studying the connections now under consideration, it must be remembered that at present we are dealing with plate girders only, in which the web, being continuous, can receive the load of the cross girders at any point in the length of the main girders without putting any bending strain upon either top or bottom flange. I call attention to this because a different state of affairs will sometimes occur in lattice girder structures.

In Fig. 11 is shown a method of connecting longitudinal with cross girders, the tops of the girders being made flush to receive the floor covering. A, A are the ends of two longitudinal girders in elevation, being nearly the same depth as the cross girder, B, B, to which they are connected; they are shown deep enough for the bottom flange plate of the longitudinal to run under that of the cross girder, in order to give continuity of structure. It, however, very frequently occurs that the cross girders are much deeper than is necessary for the intermediate longitudinals, as shown at D, D, ends of longitudinals attached to the web of the cross girder, E, E. Additional rivets are here introduced into the junction by means of the brackets, G, G, the ends of which rest upon the angle iron of the bottom flange. In the first figure, the joint is chiefly made by the angle irons, C, C, and in the second by angle irons, F, F, and brackets, G, G; E, E are the flanges of the cross girder. Below is shown a horizontal section of such a joint. H, H are the ends of the longitudinals; I, I, I, I the connecting angle irons; and K, K the cross girder.

It is very desirable in such a combination as the above, to take the load as fully as possible directly from the supported girder to the web of that carrying it, as by so doing the tendency to twist the cross girder on the passage of a load is much reduced, and an undue stress on the horizontal angle irons obviated. Terminating the top flanges of the longitudinals at M assists in this, and secures a flush top to the girders. As shown, the angle irons which connect the flanges to the webs of the longitudinal girders, are turned round at the corners, so as to form a solid continuous frame throughout; but when the girders are of considerable depth, say, 2 ft., the angle irons may be cut-through, as shown at N, N, but the corners should be kept solid to protect the ends of the webs from diagonal shearing stresses. In setting out these girders, sufficient depth should always be allowed to admit of a comfortable joint being made, one that can be properly got at by the riveters so as to ensure good workmanship. This is a point that it strongly behoves the manufacturer to examine before commencing the work, for should the room available at these connections be insufficient, a bad and ricketty joint must result; and this being constantly made worse by vibration, the structure must in the end become shaky, and very likely, positively unsafe.

The next connections to be examined are those between the cross girders and the main girders. If it be necessary to place the former beneath the latter, they should be so suspended that shearing stress only is brought upon the rivets; this may be effected most conveniently when the main girder is of box section.

Box girders have two webs connected with the flanges by angle irons, as in single web girders. In order, however, to allow of the attachment of suspending pieces for the cross girders, the angle irons joining the webs to the bottom flange must be put inside the webs, as shown in Fig. 12, where A, A represent the lower parts of the web plates, and B the bottom flange, in vertical section. It is obvious that this form is only suitable for large girders where there is space between the webs to get at the rivets. The cross girder end, C, must also be of a form suitable for the attachment of the straps, D, D, by which it is carried, and of which four will be required, two on each side. The required form may be obtained by stopping off the central web of the cross girder at L, L, and there connecting it by angle irons with a strong diaphragm, and therefrom to the end, making it of box section, as shown at H, H. The side plates are joined to the flanges by angle irons, and stiffened by rigid internal frames, G, to afford a substantial hold for the lower ends, F, F, of the suspending straps; E, E is the bottom flange of the main girder, shown in vertical section on the dotted line, B, B. Referring again to the upper view, the straps, which are made of angle iron or steel, are fastened to the cross girder by the rivets, I, and to the webs of the main girder by the rivets, K. Both in these and the connections previously described, great strength is required on account of the concentrated nature of the loads to which they may be subjected; thus, in a railway bridge, the longitudinal girders and the cross girders receive the concentrated load on the driving wheels of the locomotive, and on ordinary road bridges that occurring in a heavy traction engine, or steam road roller.

When the main girder is single webbed, the cross girders cannot be thus suspended, and in any way that they may be attached to the bottom flanges of main girders, the load must, at length, hang upon rivet heads, if it is only on reaching those that fasten the bottom flange to the main angle irons. It is therefore necessary to fasten the cross girders to the main girder webs above the bottom flange, if we want a thoroughly reliable job; such a joint is shown at Fig. 13, where A, B is a vertical section of the lower part of a single web plate girder; C, the end of a cross girder fastened by rivets at D to the web of the main girder. The bottom flange plate of the cross girder is stopped at F, and the angle irons and web run on as shown, the former being fastened to the bottom flange by rivets, of which one is seen at G. N is one of the ordinary tee iron cranked stiffeners, and I an inside stiffener turned up at the bottom, and fastened to the cross girder by the rivets, E; thus the

effect of the stiffener, I, is continued to the bottom flange, B. It is to be remembered, that to get the best result there should be enough rivets at D to take the whole load on the cross girder in shearing stress, and no pressure should come upon the flange, B, nor drag upon the rivets at E; then this connection, when properly fitted, makes a very solid piece of work.

Another arrangement is shown where the end, K, of the cross girder is placed higher up the web, and clear of the bottom flange. It is fastened to the web, N, by the rivets, L, and its position further secured by means of the brackets, M, M, placed above and below. An objection to this is that the bottom flange loses its stiffener on one side. In both these forms of joint, if the cross girders do not fall on the stiffeners, the web of the main girder must be supported by a plate on the other side through which the rivets holding the cross girder will pass, as the webs are generally too thin to be subjected

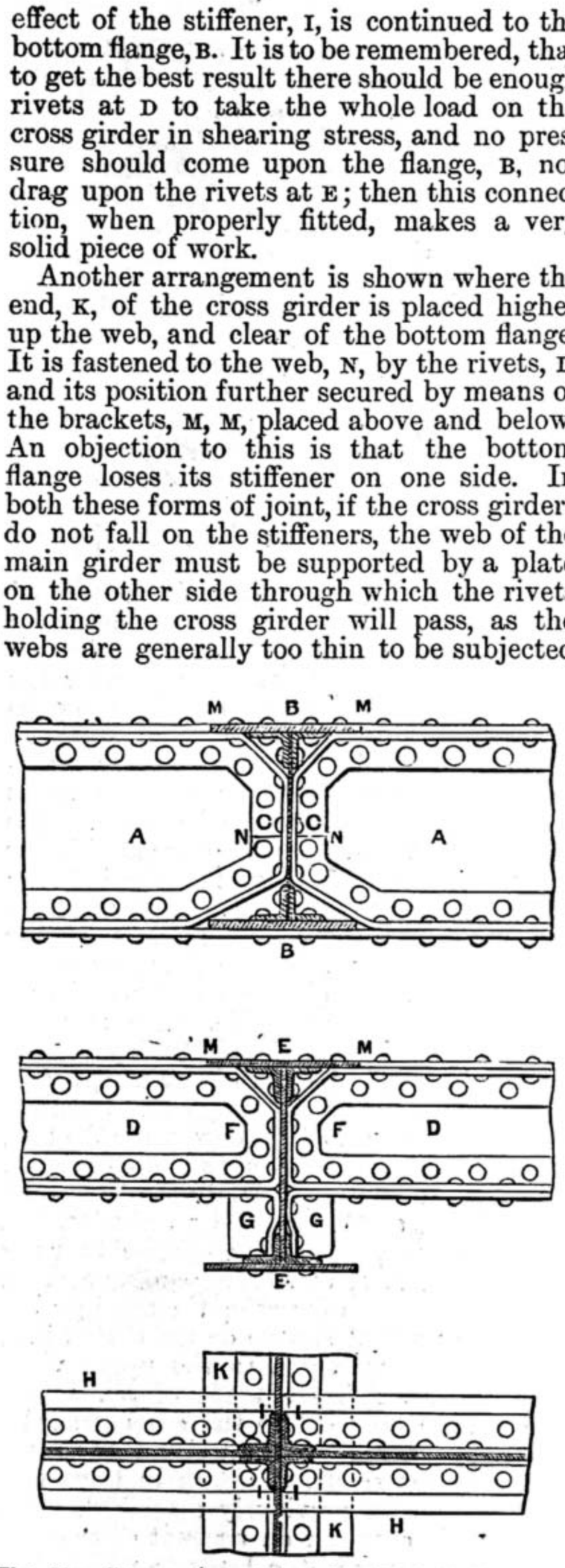


Fig. 11.—Connection of Longitudinal Girder with Cross Girder.

to the possible drag upon the rivets, due to the vibration set up by a heavy passing load, such as 15 tons, moving at a high velocity; and this will constantly occur on railway bridges, and on those carrying a double line of way there will sometimes be this on each end of the cross girder.

The expansion and contraction of the metal that occurs with change of temperature must, of course, be provided for when the work is of any magnitude; this variation of length amounts, in the English climate, to 1 in. in 150 ft. between summer and winter, and is provided for either by sliding or rolling bearings. If this expansion were not met, a great stress, equal to about 6 tons per sectional square inch of the metal endeavouring to expand, would be set up; and to me it seems curious that it has not been customary to provide for the lateral as well as the longitudinal dilatation of the material, for although the lateral movement will be less in distance than the longitudinal, it will be equal to it in intensity. The expansion bearings should evidently be arranged to move in a diagonal direction instead of in one parallel to the length of the main girders.

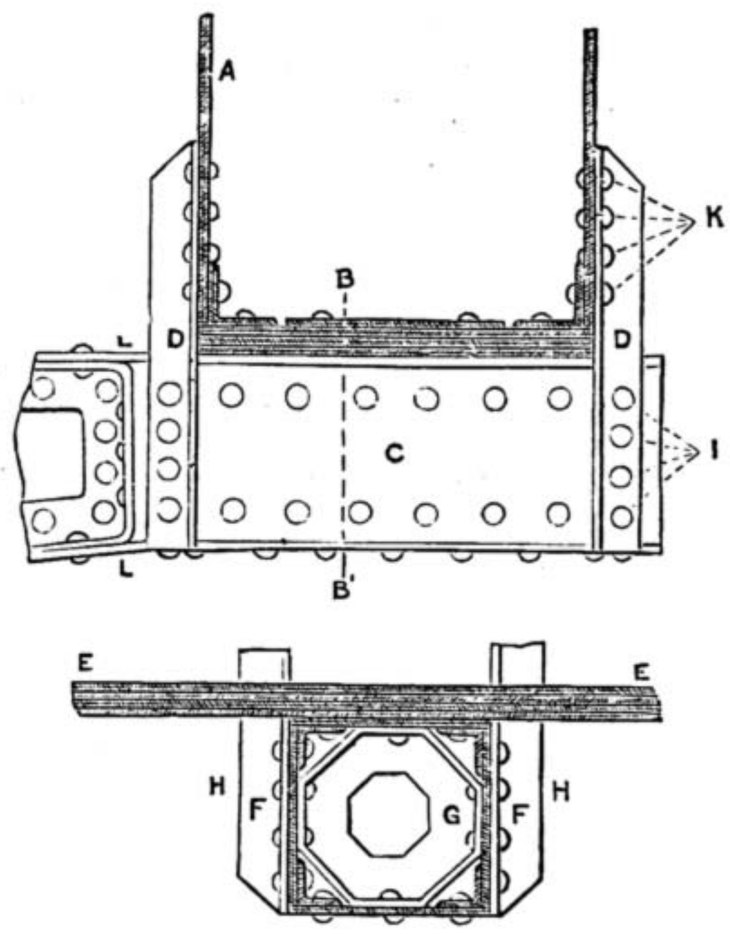


Fig. 12.—Connection of Cross Girder with Box Main Girder.

When the piers supporting the work are in themselves solid and stable enough to withstand the horizontal resistance of the friction of sliding plates, these may be used; but if there is any doubt upon this point, the girders must be put upon rollers. Where a number of consecutive spans follow on, if it is desired to connect them together, expansion joints must be introduced at intervals, and the same course pursued in regard to the flooring.

The expansion joints between the girders may be conveniently made by connecting them together by means of bolts passing through india-rubber washers of sufficient thickness to allow of the necessary expansion; such joints have been made with blade springs instead of the india-rubber washers, but such work is clumsy and would not be found in structures designed by men of experience.

There is another movement in the ends of the main girders that in large spans requires to be provided for, it is that caused by the deflection of the girders under a load which

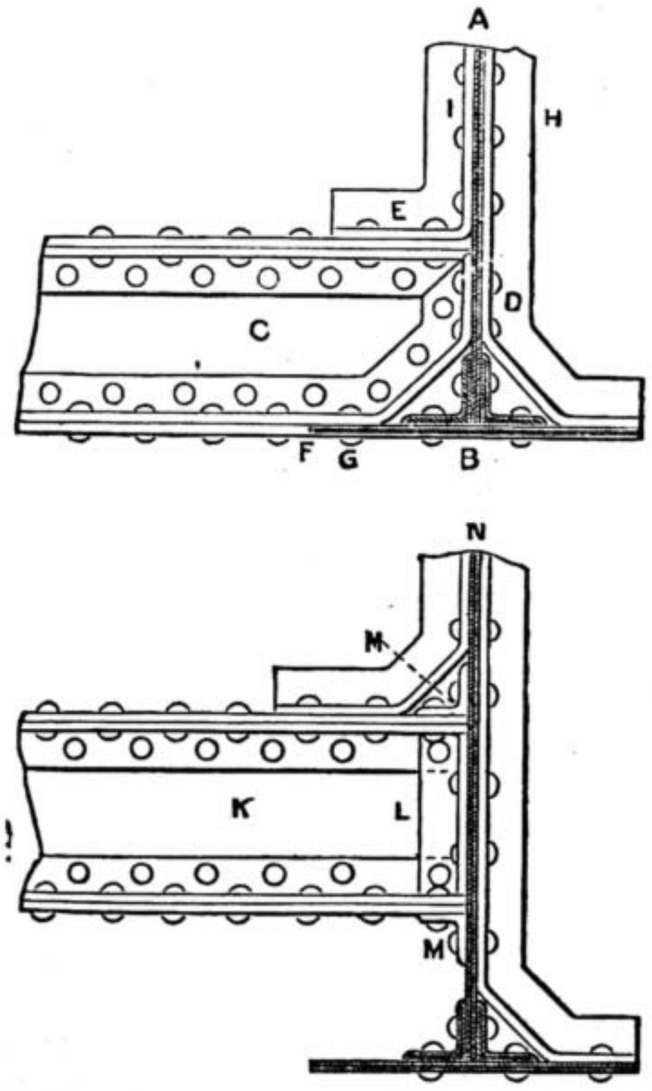


Fig. 13.—Connection of Cross Girder with Single and Main Girders.

will tip up the extreme ends. In short spans this movement is accommodated by bedding the girders on some slightly yielding material, such as felt; but in larger ones, a rocking bearing must be used, so that the load may be distributed equally over the surface of the bearing, otherwise the pressure will all fall on its inner edge. A side view of a rocking bearing upon rollers is shown in Fig. 14; A, A is the bottom end of the main girder, and to it is bolted a casting, B, B, preferably of steel. The upper surface of this casting is planed and fitted to the bottom of the main girder. This is done on an ordinary planing machine, the work being secured to a travelling plate which moves backwards and forwards under the cutting tool. On the under side of the casting is a hollow cylindrical surface, truly worked in a shaping machine, and this is fitted to rock upon a cylindrical saddle, C, forming the top of another casting, D, D. By this arrangement the angular movement of the girder end is accommodated, and the pressure is always uniformly distributed over the lower surface of D, D, which is planed to rest upon another planed surface, such as E, E, or upon rollers, F, F, interposed between them. These rollers are to be accurately turned all of exactly the same diameter,

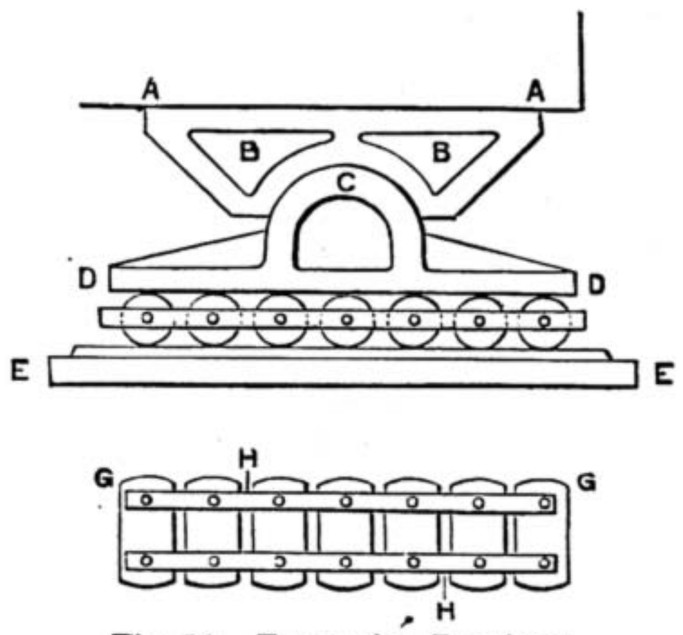


Fig. 14.—Expansion Bearings.

otherwise the bearing upon them would be taken only upon the larger ones. The axis of the saddle, C, must be at right angles to the length of the main girder, or it will jam in rocking, and if the rocker does not act, all the load will, when the bridge deflects, come upon the front roller. The lower or bed plate, E, E, is secured to the pier or abutment by holding-down bolts. If these bed-plates are carried on a transverse girder, they will accompany the girders in the lateral expansion of the bridge, but if firmly fixed to masonry, the girders must slide slightly upon them. At the ends of the rollers are pins which pass through holes in the side bars of a light frame, held together at the ends by distance bars; the rollers are thus placed in their proper relative positions, and prevented from running together while the girders are being adjusted upon them.

The larger the diameter of the rollers the better bearing will they afford, but the more space will they take, and thus increase the total length of the bearing to a perhaps inconvenient degree. To obviate this difficulty, parts of rollers are used, as shown at G, G, their relative positions are secured by the side rods, H, H, at each end, and the arcs are made of sufficient length to amply allow for the movements accruing from change of temperature. Metal, as I have said before, is liable to expansion in hot weather and contraction in cold weather; and this alone accounts for the use of roller bearings.

A Small Sideboard for the Dining-Room with Drawers and Cupboards.

A SMALL SIDEBOARD WITH DRAWERS AND CUPBOARDS.

ITS ARRANGEMENT AND GENERAL DESIGN.

BY ALEXANDER MARTIN.

In a dining-room, the article of furniture which exerts the most influence in the general appearance of the room is, undoubtedly, the sideboard; and it is not, therefore, surprising that cabinet-makers and house furnishers have devoted a very great amount of time and attention to its design and manufacture. For moderate-sized dining-rooms, a 6 ft. or a 6 ft. 6 in. sideboard is considered large enough now, although a few years ago the sizes were generally 7 ft. and 7 ft. 6 in. But if the length of the sideboard top has been curtailed, the height of the back has been increased; and this, along with the fashion of dividing the back into three, five, or more panels, has entirely changed the style of design. The under part must of necessity have the usual drawer and cupboard accommodation, but even this has been changed considerably in the arrangement and decoration.

In a smaller room, however, which can scarcely claim the dignified title of "dining-room," but must be content with the more humble designation of "parlour," there usually is a chiffonier which takes the place of the sideboard, and serves for such, both in its useful and in its ornamental capacities. Now it has been noticed in the

furniture trade, that sideboards of a size between the chiffonier and the ordinary sideboard are finding a ready sale; and in order that the many readers of WORK may be kept well to the front in all that is going on in this direction, this paper has been written.

The usual chiffonier measures along the top, 4 ft. or 4 ft. 6 in., while the ordinary sideboard is 6 ft. long; so that a small sideboard with a top 5 ft. long comes in between these sizes; and in a small dining-room or in a moderate-sized parlour, it is much more imposing than a chiffonier, with its usual two cupboard doors, and one drawer under the top. One of the latest styles of these 5 ft. sideboards is that shown in our illustration. It will be seen to consist of, in the lower part, two cupboards and three drawers, with an open space in the centre for a jar or other ornament; and in the upper part there is a shelf extending right across the back, with three bevelled mirrors above it. A novel feature is the roof over the centre plate; it lends importance and dignity to the whole article. If any readers object to the extra work entailed by this arrangement, let them read right on, and they will by-and-by find various suggestions given, and it will be strange if they be not satisfied with one or other of them.

The important matter of what wood our sideboard is to be made of must be decided before much can be done. Oak is the fashionable wood for a dining-room, American walnut coming next in the race for favour; Spanish mahogany will, however, always hold its own as a furniture wood; and it is frequently used for the dining-room by those who want something different from what they see elsewhere. This wood has the additional advantage of attaining a splendid rich tone of colour in the course of a few years. But as it is wholly a matter where taste is allowed full play, there is no need to say more about it here.

As the illustrations of the details of the sideboard will occupy the greater part of two pages of the Magazine, it has been judged better to reserve the whole of them for the next number, in which the different parts and their construction will be fully described.

At present any intending maker will do well to look up some sound well-seasoned wood, either oak or American walnut, or Spanish mahogany, as he may choose. It is desirable also to study carefully and thoughtfully the design of the sideboard given in figure, so that the workman may fix in his mind its general appearance and form, and the relative position of the parts of which it is composed. Time thus spent will be found not to have been thrown away when the work of construction is commenced in earnest.

MAGIC PHOTOGRAPHS: HOW TO MAKE THEM.

BY WALTER E. WOODBURY.

AT the present time there are being sold in Paris a large quantity of so-called magic photographs.

A piece of white paper mounted on pasteboard is all that they appear to consist of, yet by dipping one into water, the portrait of some popular actress or celebrity soon makes its appearance.

I feel sure that a great many readers of WORK, who dabble in photography, will be glad to know that the method of producing these pictures is a very simple one.

Take any negative suitable for the purpose. The quality of the negative is of little importance. Make a print from this negative on a piece of ordinary chloride of silver paper; it can be obtained from any dealer in photographic materials.

Without toning in the gold bath, place direct into the fixing bath composed of a ten per cent. solution of hyposulphite of soda.

This will cause the print to assume a dirty yellow appearance, and it is then necessary to wash carefully in several changes of water until the hyposulphite is entirely eliminated. This is the most important part of the process, as unless every trace of the hyposulphite is removed from the film no invisible image can be made.

A bath is next prepared containing a five per cent. aqueous solution of bichloride of mercury. In this the pictures are placed, and if watched the image will be seen to gradually fade away, until it finally disappears altogether.

When no trace of the image can be detected, the prints are again subjected to a good washing, and afterwards laid across a pole or hung up to dry.

Ordinary cheap photographic mounts, or even pieces of pasteboard, will do to mount these pictures on, but before mounting we have another part to prepare.

In a strong solution of hyposulphite or sulphite of soda dip a few pieces of stout blotting paper, so that it becomes thoroughly impregnated with the soda; then hang up to dry, and cut into small pieces the size of your photo that we have left ready for mounting.

In mounting, one of these pieces of the saturated blotting paper is laid between the mount and the photographic print. It is only necessary to paste round the edges. As these prints have to be dipped in water, however, it is preferable to use a waterproof mount, such as shellac dissolved in alcohol, or india-rubber dissolved in benzole. This will prevent the print from leaving the mount, as it would be apt to do if made to adhere by any substance soluble in water.

When mounted, your magic photographs are finished. To obtain the image, all that is necessary is to dip in water, which apparently acts as a developer, but the following is the actual chemical change that takes place.

The chloride of silver paper is composed of silver and chloride, which form chloride of silver, which, when exposed to the light, assumes a darkened colour due to the "reduction" of the silver. When this is placed in the bichloride of mercury solution, which is a corrosive sublimate, chloride of silver and calomel are formed. Both these substances are colourless, hence the disappearance to the eye of the image. But in the presence of hyposulphite or sulphite, another transformation takes place—the image again becomes dark, and owes its colour to the formation of sulphide of mercury, and probably sulphide of silver also.

Therefore, the real developer is the piece of saturated blotting paper placed between the print and the mount. In its dry state no change takes place, but when the water soaks through the print, attacking the blotting paper and dissolving the sulphite, which immediately acts upon the latent image, development is at once the result.

Prints made after this manner and not mounted can be developed with water, to which a few drops of ammonia have been added, or tobacco smoke even. This latter method of development was the one first used by the Parisians; the pictures were made to fit into the tube of a suitable cigar or cigarette holder, and in smoking the development took place. That this description of the method of making magic photographs may afford some amusement and instruction, if not profit, to some of my readers, is the earnest wish of the writer.

NON-SLIPPING WOOD PAVEMENT FOR ROADS.

BY J. CHARLES KING, AUTHOR OF "ROAD-MAKING AND HIGHWAY LAW," ETC.

IT seems strange that so excellent a paving for roadways as wood is made so as to be a curse as well as a blessing—for its quietness and cleanliness constitute it a blessing to the inhabitants of the houses of the streets in which it is laid, and also to the riders over it. Yet it entails a great amount of suffering to horses that have to travel on it, by its being made so smooth and its joints and surface so slimy, that it is a source of constant accidents to horses, drivers, and vehicles.

This non-gripping surface is moreover rendered more costly by too rapid wear, superinduced by the manner of laying it.

Let me describe the usual plan of procedure in London and other cities, for there is little difference in the way wood-paving is laid. The roadway is cleared of its old paving, and gangs of men are set to work to dig into the hard sub-surface of the road, from which the old paving had been removed. This is done to the depth of from six to twelve inches or more, and the stuff is sifted, the rougher and larger stones are barrowed about without much sense or method, and eventually pitched somewhere on the roadway, raked level, but left loose, remember; then some of the finer siftings are barrowed about and pitched on the top of the loose stones, and raked level and gauged down smooth with templets to the convexity of the intended road. Here at once is a bad foundation, the loose material being unequal in its depth of density—some parts being loose for six inches, others loose for twelve or more inches deep—so that the settlement will be unequal, and the wood-paving above it will in a short time present that billowy appearance of surface which marks the wear of wood-paving.

On this loose surface is laid a coat of lime concrete and gauged level. Now comes the wood blocks, which too often reveal more sap than should be. This is a cause of decay and quick wear under heavy traffic.

There are two systems of fitting the wood blocks together: one close, the other with space between the side fitting.

When laid, the tops of the wood blocks mostly have a coat of gas tar poured over them, which finds its way down between the joints, partially saturating the sides and ends of the blocks. Now comes a dressing of river drift or fine shingle and sand, sometimes mixed with lime and water. This is supposed to afford a bite for the shoes of horses. When done it looks as nice and level as a country taproom floor.

The contractor's unscientific job of mischief is done, and the ratepayers settle by local taxation a costly and deceptive job—too soon to be repeated and again paid for. It would have been less trouble and cost to

have done the work properly and the right way, and ensured a more durable wood-paving upon which the slipping of horses would be materially lessened in wet weather.

The senseless digging down and breaking up a hard sub-surface of road was the reverse of what should have been done.

It should have been gauged for convexity and mended where too hollow with concrete and granite, and rammed or rolled level and hard. No other sub-surface is needed. The wood blocks selected from wood free from sap, should be saturated with gas tar—as is usually done with the best work—and the blocks dried and weathered with this coat of tar. Then they should be laid with ⅝ of an inch space between the sides, and ⅜ of an inch between the ends forming the joints of the blocks. Into these spaces granite of *not less than a ¼-inch polygons* should be rammed tightly, after the manner of caulking a vessel—not with the contractor's unscientific broom—and the wood pavement is complete. No need to sand and lime the joints and surface to make slime, to make the pavement more slippery. These interspaced ridges of granite would be the grip for the horse shoes, and not being concreted together would, as they wore, break and form a grit for the surface to aid the horse's foothold, saving the cost of sanding it constantly, forming so much more slime when worn and churned up with the rain, or water from watercarts to lay the slime dust.

The paving should be watched, and more granite polygons rammed in to any open joints.

Breaking up roadways to cut off gas or water should be prevented. It is a common error to suppose that wood-paving is easier for horse draught of vehicles than granite pitching. It is so only at first; when it becomes unlevel it is much harder for draught than the rough granite pitching. This estimate of draught is with iron tires to the wheels.

OUR GUIDE TO GOOD THINGS.

79.—Watt's Electro-Metallurgy.

At the present time, when so much interest is shown in every description of work in which electricity is pressed into the service of man as an agent or motive power, the volume now under consideration will be welcomed as a serviceable addition to the many technical treatises on subjects in which electric action plays the principal part which have been already issued, or are still issuing from the fruitful press. "Electro-Metallurgy Practically Treated," to give it its full title, is by Mr. Alexander Watt, author of "Electro-Deposition," "The Art of Leather Manufacture," "The Art of Soap-making," etc. It says much for its popularity and utility when it is said that it has reached the ninth edition, having been subjected to considerable enlargement and revision, furnished with additional diagrams and illustrations, and brought down to date by the incorporation of the description of the most recent processes in metallurgy that have been introduced of late years. It forms No. 135 of Weale's Rudimentary Series, and is published at 3s. 6d. by Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. The book itself is divided into two parts, of which the first deals with Practical Purposes, and the second with Practical Notes. The first of these is subdivided into several sections, whose subject matter deals separately and in order with the following subjects, namely, the various batteries now in everyday use, the electro-deposition of copper, the electro-deposition of silver, the electro-deposition of gold, and the electro-deposition of brass and bronze, platinum, lead, nickel, tin, zinc, cobalt, and various alloys of metal. The second part comprises a variety of notes and recipes for various processes, and a clear and succinct description of the methods to be followed in effecting a very large number of things which the working electrician is called upon to do every day in connection with the work of electro-deposition. Among these are the whitening of silver articles, the whitening of brass dials, of timepieces, colouring gold articles, coating engraved plates with iron, and much else which it is not possible to dwell on in detail. At the end of the book will be found a copious list of articles required in electro-plating and gilding; a list of requirements for nickel plating on a moderate scale; a comparison of the relative values of Centigrade and Fahrenheit thermometer scales from freezing point to the point at which mercury boils; a table of weights and measures and tables of the electro-chemical relation of elements; the qualities of metals, showing at a view which are the most and least malleable, the most and least ductile, and the most and least tenacious; the conductivity of metals; the relative weights of different metals in cubic inches; the new legal standard wire gauge; the composition of common alloys; the weight, size, and surface of copper and brass tubes 10 feet long; and a table of high temperature, showing the different characteristics of each: thus the characteristic or description of 980° Fahrenheit is a red heat, that of 1,700 an orange red heat, and that of 3,000 a white heat. A good index of eight pages well completes the volume, and adds much to its value.

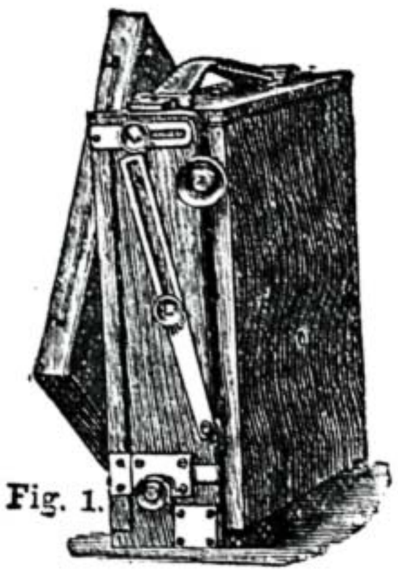


Fig. 1.

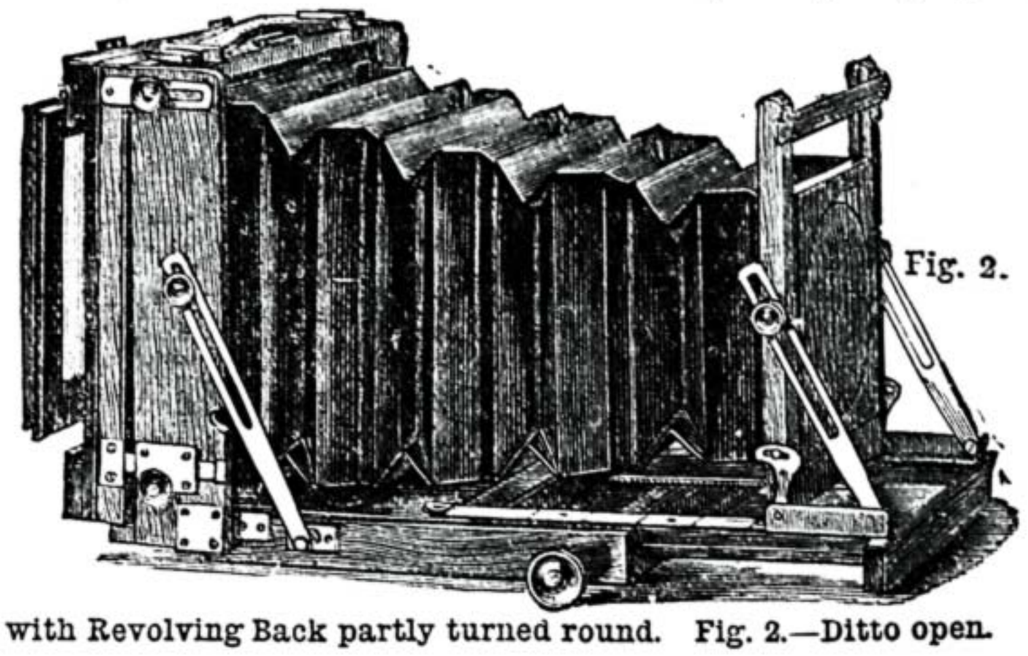


Fig. 2.

Fig. 1.—Drayton Camera closed, with Revolving Back partly turned round. Fig. 2.—Ditto open.

80.—Humphries & Co.'s Illustrated Catalogue of Photographic Apparatus.

This is an illustrated catalogue and price list of the photographic apparatus and appliances kept in stock, and supplied by Messrs. W. H. Humphries & Co., wholesale, retail, and export manufacturers, 268, Upper Islington Street, London, N. It is sent post free to any applicant on receipt of threepence. The cameras named and priced in Messrs. Humphries & Co.'s catalogue are all of their own design and manufacture. The principal specialty of Messrs. Humphries & Co. seems to be the "Drayton," a new long focus camera, which is shown closed and open in the accompanying illustrations.

The manufacturers claim that—

"The specialities of this camera are its compactness, portability, strength, and rigidity. It is free from loose parts, and can be set up in a few seconds, and comprises the following movements:—long and short focus; rising and falling front, with double swing; falling base board; double swing to back; rack and pinion side swing, and revolving adapter with check action, which cannot overturn, and is warranted not to stick; leather bellows.

"The improvements introduced into this camera are the easy working of all its parts; the special arrangement for revolving the adapter in metal rings instead of wood, which renders it free from climatic changes; and the stop action to the same when in position.

"The revolving adapter being always in position, the camera is ready for use at any moment, and obviates the old method of turning the camera on one side or taking off the reversing back, this being done by simply releasing the spring catch and turning the back round as required.

"There is also an improvement in the vertical swing to back in the means of pivoting, by which wear and tear is lessened, and perfect rigidity is maintained, and in the special arrangement for clamping the front side swing in position and the easy working and manipulation of the same, also in the clamping of the rising and falling front, which enables the operator to do so with one hand while focussing.

"The rack and pinion side swing to the back is an innovation for the sharping of distances.

"In introducing this camera, the chief aim has been to make it as complete as possible, both in construction and workmanship, for all classes of work. Classing together the extra conveniences and improvements in this camera, it will be found to be an instrument simple, compact, light, and capable of standing great wear and tear, perfectly rigid when erected."

The sizes in which the "Drayton" camera is made range from 4¼ in. by 3¼ in. to 15 in. by 12 in., and the prices from £5 for the smallest size or £5 12s. with extra double dark slide to £14 10s. for the largest size or £16 6s. with extra double dark slides. The cameras can be supplied with less than three dark slides if desired.

In addition to cameras and the different appliances that are needed by the photographer, Messrs. Humphries & Co., keep a large and varied stock of magic lanterns, suitable for all classes of exhibitions. The lenses are said to be remarkably good of their kind, and are fitted with rack and pinion, and with telescopic draw tube, which gives increased focal length. The condensers are composed of two plano-convex lenses of 4 inches in diameter in brass cells, and the lanterns are furnished with 3-wick or 4-wick refulgent lamps as may be desired. Smaller lanterns range in price from £1 10s. to £8, but the triunial lanterns range from £16 to £80.

81.—The Waterbury Watch.

One would imagine that the Waterbury Watch has been so widely and efficiently advertised that everybody must know all about it by this time. The Waterbury Watch (Sales) Company, Limited, 17, Holborn Viaduct, London, E.C., however, seem to think differently, for a specimen watch has been sent with a request for a notice in "Our Guide to Good Things," and perhaps this is so, for whereas as when the Company's leading specialty was first introduced for sale there was, if I remember rightly, only one kind, there are now four, distinguished as the L, E, F and J watches. Of these the E watches are supplied at 10s. 6d. each, the F at 15s., and the J at 17s. 6d. It is claimed for these watches that they are keyless, reliable, durable, and accurate. The long time occupied in winding up will be reckoned an objection, perhaps, by some, but it should be said that in the more expensive watches, *i.e.*, those sold at 17s. 6d., the wind is short and they are jewelled and dust proof. Every watch is guaranteed for two years, and the cost of repairs is but trifling. The Editor.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*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.—LETTERS FROM CORRESPONDENTS.

Screen Secretary.—G. F. W. (*South Kensington*) writes:—"I have been a subscriber to WORK from its commencement, and, I must say, am very much satisfied with every item of its contents. I am a joiner by trade, and some little while ago I was positively longing for some sort of a standard work on the lines of 'artistic furniture,' as described by David Adamson. I am always getting out designs for odd pieces of furniture and ornaments, such as cannot be bought in the ordinary way; but still I wasn't quite satisfied, I wanted to know other people's ideas, and when I saw the first edition of WORK I said to myself, 'That is the very thing I want.' I have succeeded in obtaining six subscribers towards it, and shall never lose an opportunity to get some more, because I think that it is something which will become useful to mechanics and amateurs alike, and as such must not be left to go wrong, and so slip through our fingers. Now in WORK No. 10 there is a screen secretary by David Adamson. It is a very useful thing. But there is one point which I should like to point out, and try to improve on it, which is this: In Fig. 5, the lid or flap is shown thus, Fig. 1. Now, sir, I

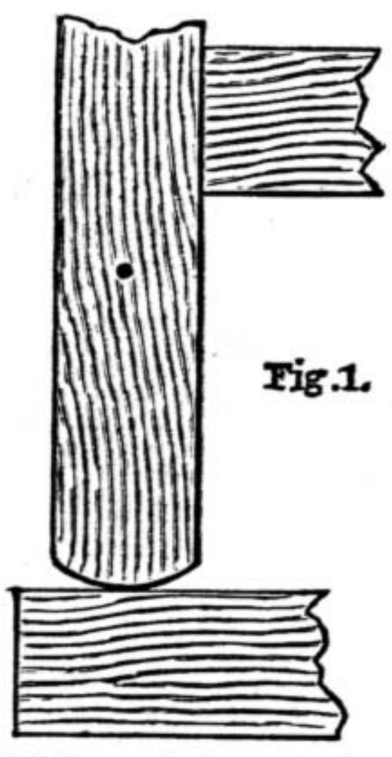


Fig. 1.

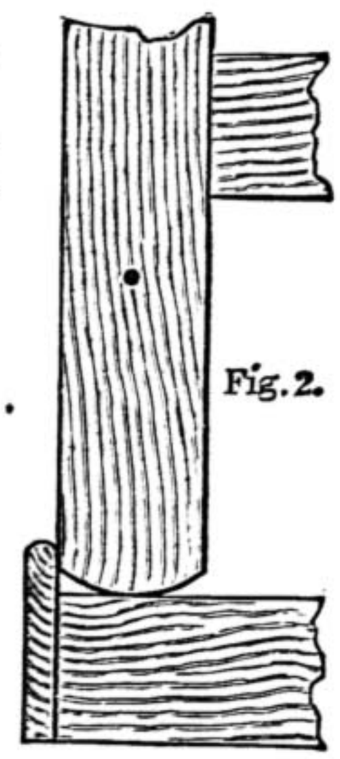


Fig. 2.

think it would be an improvement if it were shown like this, Fig. 2. You see that by planting that bead on that under shelf it completely hides the ugly joint which must otherwise be seen. The bead is at the same time flush with the front edge. because the lid stands back just that thickness."

Hollow Metal Plate Work.—PRACTICAL MAN (*London, S.W.*) writes in reference to OPIFEX (see page 282):—"His method of hollowing metal hemispheres, or saucers, etc., I do not agree with. In the first place, stamping half balls cannot be done in one blow. To stamp a half ball would require five or six blows from a drop press (not a fly press); it would not pay a master to do them under five blows. Of course each blow would be a different tool starting from one only a little hollow till it is got to the right shape. Spinning can be done in one operation. The next way is hollowing the way by which all practical men work tin, iron, zinc, copper, brass, nickel and silver. If given to me to get to a required hollow, I would do it by this method which is the easiest, cheapest and quickest, and best. (1) You want a block of oak or any hard wood exceedingly dry, and use it the grain up. Well our blocks are exactly the same as a butcher's block, only they are solid instead of having legs. (2) You want a bullet hammer—a cast iron one will answer well. We have three or four in the factory now in constant use; one with a face about 1½ over on the smallest side would be a convenient size. These can be procured at any tin plate warehouse. (3) The metal: I think tin plate will be the best to start on. If you go to a tin plate warehouse, and ask for a sheet of one cross 20 by 14 charcoal prime. Of course if you ask for this you will get the metal that will work, which will not cost more than 5d. Now for work: get your compasses and score a 5 in. circle, cut this out with a pair of snips; now draw a circle about 2½ in. just to give you a guide to the hammering. Now you will want a little hole or hollow made in the wood block about 3 in. over and ¾ in. in the centre or deepest part. Now with the stuff in the left hand, hammer in the right, proceed to hammer on the edge of your metal and on the edge of your hollow in the wood, and gradually go in towards the centre; and the greatest advice any mechanic can give is join your blows, the more you join them the smoother your work will become. This way your work will not require to be annealed. Excuse me for taking so much of your valuable space, wishing WORK every success. This is correct you can be sure, as I am a practical man."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Making Silver-plating Solution. — W. H. (*Pollokshaws*).—When a silver-plating solution is made up as you describe it—namely, by dissolving old silver in nitric acid, throwing down the silver as a chloride with salt, and dissolving the chloride paste in cyanide of potassium—you get chloride of potash in the solution, and this is bad, for it has a tendency to cause the silver to go on loosely, and thus strip under the burnisher. The solution will also give up yielding a good deposit sooner than one made up of cyanide of silver alone. If you must use old silver, adopt the following plan: — Dissolve as you do now, and convert into chloride, and well wash the chloride; then immerse in the wet mass a quantity of scrap zinc, and stir occasionally. After a time the whiteness of the chloride will disappear, and leave nothing but a dirty grey powder. This is finely-divided pure silver. Agitate the wet mass in water with the zinc until all traces of the silver chloride have disappeared; then well wash the grey paste in hot water to dissolve out all the chloride of zinc. Take out the zinc scraps, and add a little sulphuric acid to dissolve any little bits of zinc remaining; stir up a few times, wash until clean as you do now, then dissolve the whole in nitric acid. After this, evaporate off all the acid and convert the solution into pure nitrate of silver crystals. Dissolve these in distilled water, add cyanide of potassium solution until all the silver has been thrown down as silver cyanide; well wash this, and dissolve in cyanide of potassium solution to form the silver plating bath. I prefer buying the silver nitrate to making it myself. To prepare articles for silver plating, well clean them, dip in acid pickle to remove loose specks of dirt, then quick them in a solution of nitrate of mercury, and finally rinse them in clear water. This will be thoroughly dealt with in my "Notes for Electro-platers." If you meet with any special difficulty in preparing the articles, please write and let me know exactly what it is, when I will try to help you out of it.—G. E. B.

Silver Plating. — W. H. B. (*Leicester*). — You cannot use a better solution for silver plating than one made up of the double cyanide of silver and potassium in distilled water. Dissolve the nitrate of silver in distilled water, precipitate the silver as silver cyanide, well wash the precipitate, then dissolve in a solution of cyanide of potassium in distilled water to form the plating bath. If you wish for details of the process, together with weight (per gallon) of ingredients to be employed, please write again and let me know the class of work to be plated. For ordinary trinket work, one Bunsen cell will do fairly well; but a large Daniell or Smee is best for spoon and fork work, since the current is not so intense from these as from the Bunsen. (2) The length of time an article should be kept in the solution depends upon the quantity of silver required, and the volume of current passing through the solution. Now, one ampére of current passing through a silver-plating solution will deposit sixty-one grains of silver in an hour. This current will be obtainable from a large Daniell cell charged with sulphuric acid (one acid to twelve parts water) in the zinc compartment, providing the slinging wires are of No. 16 copper, the connections are clean, and the anode not too far from the work. You must, therefore, calculate the area over which this deposit has to spread, and you will then get a tolerable idea of its thickness. This must guide you in determining whether the coat is thick enough or not. (3) Clean the hoop well as for plating, then wipe dry with a clean soft linen rag. To the inside apply with a soft brush some good copal varnish tinted with red lead or with ultramarine. Allow this to get quite hard in a dry, warm room, or dry it in a lacquering stove before putting it in the plating solution. The "stopping" may be afterwards removed with rags moistened with warm spirits of wine. Many thanks for your kind appreciation of WORK, and for your suggestion, *re* banjo. Can't you just write and tell us how you made your banjo?—G. E. B.

Goat Cart.—F. E. B. (*Landport*).—A paper on how to make one is being prepared.

Bird Cage.—MINER (*Dykehead*).—An article on bird cage making is in preparation.

Cornpike.—J. P. (*St. Keyne*).—I do not know the implement termed a cornpike, but suppose it is a kind of fork. If so, it is not the practice to temper tools of this kind. They are made of cast steel, untempered.—J.

Loadstone.—W. L. (*Sheffield*).—Orme, of Barbican, London, can supply you with a piece of natural loadstone. You would only get a small fragment for 5s.—J.

Lantern (*Dartmouth*) asks:—"What advantage is gained by the use of cardboard carriers?" If the slides are properly mounted and marked with white spots or white line on the top front edge and carefully placed in boxes prior to exhibition, a carrier sufficiently long to hold three or four slides, 3¼ in. square, one in each lantern, so that when the last slide is placed in the carrier the first is pushed out, is all that is needed. A properly mounted slide has only a paper binding. Slipping and mechanical slides, of course, require exceptional arrangement.—E. D.

Size of Pulleys.—F. A. (*Islington*).—The diameters of the pulleys on the engine shaft and on the driving shaft of the machine, must be inversely as the speeds. Suppose, for instance, you have an engine running at 60 revolutions per minute, and you want to drive a machine at 200 revolutions, the ratio of the diameter of the pulley on the engine shaft to that of the pulley on the machine shaft must be as 200 to 60 — that is, the engine pulley diameter will be 3⅓ times that of the machine pulley. To state this as a general formula applicable to all kinds of machinery, let D=diameter of driving pulley and N its number of revolutions per minute; and d and n, the diameter and number of revolutions of the driven pulley, then,

$$d = D \times \frac{N}{n}.$$

In the above case let the engine pulley be 50 inches in diameter, then

$$d = D \times \frac{N}{n} = 50 \times \frac{60}{200} = 15 \text{ inches.}$$

This formula will also apply for calculating the diameter of toothed wheels and chain wheels.—F. C.

Yellow Piano Keys.—J. A. (*Salford*) has a piano, the keys of which have turned yellow, and wishes to know how to bleach them. I presume the keys are ivory, and not celluloid. If you will kindly see reply to H. W. (*Sheffield*), on page 317, you will find full details for restoring keys. To bleach try the following:—After taking the polish off with fine glasspaper, take a pennyworth of spirits of salts, and dilute with two-thirds cold water. Now rub over the ivory which is very yellow, and allow it to remain a few moments, and watch the result, not allowing it to remain too long, as it will burn it; when you see an improvement remove the surplus with a cloth damped with methylated spirits and fine paper and polish, in the manner described to H. W. Caution, do not spill the spirits of salts on your clothes.—T. E.

Electrophorus.—R. G. (*Preston*). — Charge the tray of your electrophorus with a mixture of eight parts resin, one part shellac, and one part beeswax or Venice turpentine. Mix well, melt together, and pour into the tray. The cake thus formed will not be so liable to crack as one of pure resin, and may be excited by rubbing with a piece of fur, flannel, or silk. The upper plate or cover may be made of sheet metal or of wood coated with tinfoil. If you make a new one of wood you should well dry the wood by baking in a slow oven before you make it up, but any sheet metal may be used for a cover, and this will not warp. The handle must be of glass or of wood well baked and then soaked in melted paraffin wax. Unless wood is thus treated it absorbs moisture, and becomes a conductor, whereas you want an *insulated* handle. A phial bottle may be used as a handle. Embed the neck in a boss of baked wood fastened to the upper plate. You may varnish the back of the plate, but must not varnish the face nor the tinfoil if you use this.—G. E. B.

Testing Platinum Contacts. — A READER OF WORK (*Chepstow*). — When nitric acid is applied to platinum it has no action whatever on the pure metal, but should the speck of platinum be slightly coated with solder (and this may happen accidentally), the acid would leave a black stain on the solder. Nitric acid will stain with a dark spot such alloys as pewter, solder, Britannia metal, and steel. It will also leave a dark stain on iron and on silver. By adding one part of chromic acid to six parts of diluted nitric acid, another testing liquid may be made which will leave a blood-red stain on silver, a brown stain on German silver, a black stain on Britannia metal, but have no effect at all on platinum.—G. E. B.

Telegraph Instruments. — H. D. (*Haverfordwest*) writes: — "I am delighted with WORK. It is really an excellent paper for amateurs, and has given me great pleasure to recommend it to all my friends at home and abroad. The articles by Mr. Bonney, especially, are not only practical, but are singularly clear and interesting. WORK may not be great in point of circulation or popularity, although that must surely follow when it is more widely known; but in its aims and objects, in its usefulness and comprehensiveness, in the ability and courtesy of editor and staff, the paper is without a rival. Accept, then, my heartiest wishes for its success. I have determined to try and make a telegraph instrument for my own use. Could you tell me where I could get a book upon the telegraph and telegraphy? I should like one that would describe the different kinds of instruments; and shall go in for the study of the subject. But, nevertheless, I shall eagerly wait for a description of the instrument from your able pen."—I thank you for your encouraging words in both of your letters, and your efforts for increasing the circulation of WORK. If all our readers worked as you do, our circulation would soon be great indeed. When I can find time to deal with the subject, and can make sure of having the line clear to run my train of thought, I hope to fully illustrate and describe a telegraph instrument such as you can make yourself. Meanwhile, perhaps, you may be assisted in your studies by reading Mr. E. B. Bright's book on "The Electric Telegraph," price 2s.6d. There are several books published on the subject, such as "Telegraphy," by W. H. Preece, price 3s. 6d.; "Electricity and the Electric Telegraph," by Geo. B. Prescott, 544 illustrations, price 18s. From any of these you will get a tolerably

general idea of the various telegraph instruments in use, but they do not give detailed illustrations of the various parts composing a telegraph instrument.—G. E. B.

Subscription to WORK.—W. A. D. (Government Land Surveyor, Vredefort, Orange Tree States, South Africa).—The particulars have been sent you by post to save time. Thanks for your letter.

Polishing Fretwork.—N. M. (*Norwich*). — The "easiest and best" way to polish fretwork is to clean and polish the wood before fretting, but as I gather from your inquiry that it is now too late for you to do this with the piece of work you are engaged on, it will be satisfactory for you to know that fretwork is generally polished after it is cut. The polishing is done in the ordinary manner, except that the grain is not filled, for the simple reason that the filling gets in the corners and is difficult to remove—in other words, the filling is more trouble than it is worth. It is not possible to get the best results of which French polish is capable without filling. This can easily be applied to the plain wood, and hence the reason why it is best and easiest to polish before fretting. You are, I presume, acquainted with the process of French polishing, so these remarks are given merely about polishing fretwork. If you polish the wood before cutting, you will understand the work must be touched up afterwards, and that it is necessary to scratch away polish at any joints to be glued together. If you have already done the cutting it may be useful for you to know that the pieces of fret should be polished separately before finally fixing them together. To minimise risk of breaking points let your rubber be small and firm. Don't attempt to polish inside the cuts, and carefully scrape away any polish which may accumulate as the work proceeds at their edges.—D. A.

Polishing. — A. B. (*Lower Edmonton*). — The three varieties of wood mentioned by you require different treatments so far as darkening them is concerned, the stains employed being different for each. These stains you can buy ready made, at a low price, at any oil shop where polishing materials are sold. If the stains as bought are too dark, dilute them with water. Walnut is seldom darkened by staining unless it is ebonised. From your mentioning this wood with the others I think you may have mistaken the slight darkening by oiling for staining, and if I am right in this supposition omit stain and simply use oil in its place. Prepare the wood by cleaning it up thoroughly with glasspaper. Rub in a little raw linseed oil, but do not saturate the wood with it. Allow the work to stand for a time, then fill the grain of the wood by rubbing in either some filling which you may buy, or one composed of whitening made into a paste either with turpentine or with a mixture of linseed oil and polish. Clean off superfluous filling and polish. The polish itself you had better purchase, but if you prefer making your own, dissolve some shellac in methylated spirits, say 6 oz. to 1 pint. Get a piece of soft rag and cotton wool to form a rubber, moisten this with the polish, apply just a touch of oil to the surface of the rubber, and go over the wood to be polished, with an even motion, covering every part equally. When the work has been bodied in with polish finish by spiriting off. This consists of using a rubber with methylated spirits instead of polish, just sufficient to remove the smears left by bodying in. Finishing with glaze is not nearly so difficult, but it is not as durable, and should never be resorted to for first class work. Glaze can be bought so cheaply that it will be hardly worth your while to make your own. If you determine to use it, omit the spiriting off, and go over with a rubber moistened with glaze. Such is a brief outline of the process which will be fully treated in a series of papers on polishing as soon as practicable. Meanwhile I hope the foregoing will be of assistance to you.—D. A.

Polishing Oak Overmantel. — J. K. (*Bethnal Green*).—To darken the job to the extent you name I think you will find that it will only be necessary to oil the wood and use brown polish, but, of course, a good deal depends on the colour of the oak as it is "in the white." Even if it may seem too light at first, remember that oak is a wood which soon darkens. Should a stain of some sort seem desirable use a very weak one of bichromate of potash and water. Put this on with a rag, but don't use too much of it. To avoid risk of spoiling your overmantel by making it too dark, finish up a small piece of wood of the same kind as that used in its construction. If this test piece is too dark, subsequently, you will see that you have used too much staining; while, on the contrary, if too light, more stain will be required. Do not on any account varnish your overmantel, but polish it in the usual way. For further remarks on polishing see above answer to A. B.—D. A.

Bending Rolls. — J. G. (*Wirksworth*). — You should place the centres of your bottom rollers about 9 inches apart, the rollers being 6 inches in diameter. To bend your heaviest iron cold will require a pressure of about two tons on the rolls; the top one being made adjustable.—F. C.

Papier-Mâché to Resist Water and Insects. —R. W. (*Manchester*).—The queries which R. W. repeats have been already answered. In his laudable desire for information, he forgets that with the heavy demands upon "Shop" space time must elapse between the receipt of a question and the publication of a reply to it.—S. W.

Fountain.—J. C. (*Hull*).—An article on the construction of self-acting fountains is in hand, and will be published as soon as possible. It would be impossible to give sufficient details in the columns of "Answers."—C. M. W.

Automatic Carriage Brake.—H. A. H. (*Diall Stenness*). — In my opinion your invention is ingenious and thoroughly practical, and its extreme simplicity precludes its getting out of order, and is a guarantee for durability. There should be no difficulty in getting the invention taken up, but you should obtain protection (it only costs £1) before showing it in the trade.—F. C.

Wheel for Lathe.—A. P. S. (*Heaton Chapel*).—A wheel of 20 in. diameter, and weighing 24 lbs. in weight would be too small and too light for a lathe of 6 in. centres; whether for wood or metal makes no difference. Such a wheel is only fit for a sewing machine or fret saw. For a lathe of 6 in. centres to be driven by a man, you require a wheel of at least 2 ft. diameter, and weighing about 70 lbs. For a boy's lathe. of 4 in. or 3½ in. centres, a wheel of about 22 in. diameter, and 45 to 50 lbs. in weight, would suit well. Two wheels like yours might do pretty well for a 3½ in. lathe.—F. A. M.

Cheval Screen Escritoire.—P. P. (*Blisworth*). —The drawings of the screen escritoire were to scale. Unfortunately I have mislaid the actual size, but if you take the ordinary height of a table for writing, as your ascertained measure, there will be little trouble in finding the rest, especially as the actual dimensions are not important to an inch or so.—J. G. W.

Cabinet in Fretwork.—A SUBSCRIBER FROM THE BEGINNING (*Slough*).—Your pen name is a favourite one I know, but is it not a "leetle" premature to adopt it yet? After No. 1,000 it will be a nice one to swagger; but seriously I am pleased you like WORK, and appreciate the real efforts of the contributors to aid its readers. The partitions of the cabinet should go right through—the depth to be about 4 in.—the width is, of course, the full size, as shown in the working drawing. If fret cut, the drawers may be white with the casing of the whole thing black. For inlaying full instructions were given.—J. G. W.

Cement, etc. — ONE IN THE DARK writes:—"Wanted to know how to make an inexpensive cement or compound, which will possess the following properties:—It must be capable of being used in a body as thick as a man's arm, to set hard in a few hours, with little shrinking, to bear a nail 2 in. long, being driven in when hard, and not to cause cracking or flawing, and to stand a moderate amount of heat without injury. The colour is no object."—To this the reply is:—[A mixture of plaster of Paris, with twice its bulk of plasterer's putty, and water, will set in a few hours; can be moulded, and will bear a moderate amount of heat. If too brittle for driving nail in, add more putty, or use Paris white and thin glue, instead of putty and water.—E.]

Violin Purfling Tools.—G. E. B. (*Hampstead*). —One kind of purfling cutter is sold by Withers & Co., 51, St Martin's Lane, London, for 4s. 6d.; another style is sold by J. Scheerer, Covered Market, Leeds, the price of which is 5s. 6d.—B.

Lithography. — APPRENTICE. — A tint such as you describe often results from using retransfer ink too strong; the remedy is to mix lithographic printing ink with it until the tinting disappears. You must be sure also, that your gum sponge and damping cloth are perfectly free from greasy matter, as want of care in that direction will cause you much annoyance, and contribute to failure.—J. H. M.

Photo-lithography.—PEN AND INK.—It is not competent to fully describe this process in the pages of "Shop," but as you say you are both photographer and lithographer you will, no doubt, be able, from the outline that I here give, to arrive at the necessary information which you lack, concerning the combination of those two arts, but I warn you to summon to your aid all the skill that you are master of. In the first place the lens in common use will not do for the purpose, as the picture it gives suffers a distortion at the edges that in some subjects is very disagreeable; you must, therefore, provide yourself with a lens that is free from this vagary. The detail of the copy to be reproduced must be clearly expressed by stippling or lines, and a glass negative is taken in the ordinary manner. A sensitive paper is used, the coating of which consists of equal parts of bichromate of potash and gelatine, thoroughly dissolved in 7½ times their combined weight of water. The coated paper is dried in the dark room. After a print taken on this paper has undergone exposure, the duration of which experience must decide, it is evenly and entirely coated with transfer ink by pulling through a litho press over a stone that has been previously covered with transfer ink. The print in this state is sponged with gum, and washed repeatedly in warm water, and this operation ought to effect the clearing away of superfluous ink, and develop a transfer that may be dealt with in the usual manner of litho printing.—J. H. M.

Japanese Cabinet. — CLERICUS. — It is the keenest pleasure to hear that any article one has written has been of the least use, and one that, although not absolutely without precedent, can never lose its original pleasure. I like the idea of red enamel for the cabinet, but should use for that no carved work, but gold Japanese paper, or gilded lincrusta for the panels. Liberty, of Regent Street, was selling recently, bundles of odd lengths of the former at 1s. and 1s. 6d. each; these are most useful. There is a gold over red pattern (not gold on a crimson ground, which is quite distinct), that would look extremely well, could you get it. C. Hindley & Sons, Oxford Street, W., also cut lengths of the Japanese-gold paper. For other purposes a new wood carving (Spurr's patent) that is to be shortly introduced in England, will probably satisfy you, as, save the cost, there is nothing to distinguish it from the finest hand-wrought work. If you could get at an oriental warehouse damaged lacquer tea-trays cheaply, they would come in splendidly for the panels of the cabinet.—J. W. G. W.

Enlarging. — W. P. (*Wisbech*). — A camera bellows is one of the things that cannot very well be described at length in "Shop," and would require a paper to itself. The *modus operandi* is somewhat as follows:—Make a box, the outside measurement of which is the same as the inside of the bellows. Procure enough black silesia to go round the box in two thicknesses, and lap, say, about a third over; paste a sheet of strong brown paper between the silesia, and form your bellows, fold by fold, round the box, pressing each fold as it is made, close up to the preceding one; leave on the box till quite dry. This may give you an idea how to go about the thing, or perhaps you can persuade the Editor to give you a paper with diagrams.—G. LE B.

Book Marbling.—T. W. W. (*Mold*).—The process of transferring the pattern from marble paper to the edge of a book is a comparatively easy one, although a considerable amount of dexterity will be required in the manipulation. Have ready at hand the following articles:—Some hydrochloric acid (spirits of salt), a broad camel's-hair brush, some strips of marble paper, a little broader than the edge to be operated upon, a few sheets of scrap white paper and a hammer. Place the book in the lying-press between pressing boards, and screw it up as tightly as possible. Take up some of the acid in the brush, and pass it quickly over the edge, lay on a strip of marble paper, over this place a sheet of paper, and tap gently but firmly with the hammer over the entire edge. Lift off the paper, and the pattern will be found to have been transferred to the book. It requires a good deal of practice, and not a little patience to make a good edge by this method. I hope bookbinder will succeed. The book will require to be flat and very smoothly cut. The marble paper must not be very highly glazed, in fact there is a special paper sold for this purpose. It can be had from Berry & Roberts. I will be pleased to know how you succeed with this.—G. C.

Milling Cutters. — KEYWAY.—You can obtain milling cutters for cutting keyways in shafting at any large tool maker's: send to J. Buck, 56, Holborn Viaduct, for price list. If you mount the cutter between centres of lathe you will have some trouble to fix and adjust the height of shaft. Another way would be to use a slot-drill in the drilling spindle, mounting the work between the centres; but this requires a driller and overhead motion. The size of cutter to use in a small lathe, is very vague—say, 2 in. diameter. The speed the cutter should run, if well oiled, would be about the speed you would use if it were of brass and you were turning it.—F. A. M.

Lettering in Gold.—T. E. T. (*Kingsland*). — I am pleased to see that you have been successful in binding your own books, and am also very pleased to give you the information you ask in regard to lettering in gold. Begin by washing the leather cover with paste water—*i.e.*, water with a little paste mixed in it. If the cover is of calf, rub it well over with paste to fill up the pores previous to washing. When this has become dry give the title and parts to be gilded two coats of glaire—white of eggs beaten until as thin as water—allowing the first to dry before applying the second. When perfectly dry, rub it over with an oily rag kept for the purpose. I don't mean a rag dripping with oil—there must be very little in it. Spread out the gold on the cushion, and cut it to the sizes required. To make the gold adhere until the lettering is finished, rub the parts where the gold is wanted with hog's lard or olive oil. For calf, use the lard; for all other leathers use the oil, and use both sparingly, as leather can be easily stained by these substances. Lift the gold from the cushion with cotton wool, and press it firmly on the book. The tools are heated in a gas stove, and must be warm enough to "bizz" when touched with the wet finger. The hot tool causes the gold to adhere, and whether it is an ornament or a letter it will be firmly impressed upon the book. To letter, you will require guiding lines to keep your letters even. This is done by drawing a fine thread over the gold. When the lettering is completed, the surplus gold is rubbed off with the oily rag mentioned above.—G. C.

Gold Vein in Marble Papers. — DESIROUS (*Dundee*).—This operation is a very difficult one. It requires no small degree of skill and dexterity. I did not think that an amateur or small tradesman would have attempted it, because of the cost and trouble connected therewith. The gold vein does not always adhere even on the London marble papers, for the simple reason that instead of gold powder metal bronze is used. When you ask for gold powder, see that you get it (as they say in advertisements), as herein lies the secret. Metal bronze is too heavy, and requires lithographer's varnish to make it stick. The substance used to make gold powder stick or adhere to the paper is prepared

with white of egg and spirits of wine in equal proportion and two parts of water, beating all well, and leaving it to clear. Mix a small portion of the gold powder with the liquid, and use a camel's hair pencil. I hope our friend will succeed. Of course, it is much cheaper to buy the paper already prepared, and far better, for the designs are much prettier than it is possible to make them in a small way.—G. C.

Ticket Writer's Ink.—H. T. J. (*Newport, Mon.*).—The colours should be bought in a dry state. Always use the best, such as lamp black, vermilion, royal green, and ultramarine. Mix your colours with a thick solution of gum arabic, and grind them well with a palette knife on a piece of glass or marble. To make colours lighter add flake white until of the required tints. There are other recipes.—H. S. B.

Watch and Clock Oil.—AMATEUR REPAIRER (*Kent*) cannot possibly do better than use Ezra Kelley's oils for watch or clock, at least, that is the conclusion I have come to after eighten years at the bench. For coarse, heavy watches I sometimes use Windle's chronometer oil. To cement stones use very best and new plaster of Paris, mixed with water. With clear settings a little coaguline is a good cement.—A. B. C.

Instrument for Enlarging Drawings.—INVENTION (*Liverpool*).—The "instrument" you refer to is doubtless that known as a pantagraph. If this is not the thing you saw, a pantagraph will serve the same purpose, as it is commonly used for enlarging drawings. I do not, of course, know in which shop you saw it; but if you are a "down town" man very likely it was at Matheson's tool place. You will also be able to get one at several shops in Whitechapel. As the Dinglet omnibus passes his door, perhaps you will find Jeffery, the artists' colourman, at the top of Renshaw Street, the most convenient for you; but you can hardly walk along the streets without noticing the pantagraph in many shop windows. The construction of a pantagraph will be explained in WORK in due course.—D. D.

Colouring Oak Overmantel.—J. K. (*Bethnal Green*).—A good deal will depend on the natural colour of the wood as to the amount of stain required to darken your overmantel to the tint required. You can best ascertain by experimenting on small pieces of waste, and you will probably find that by oiling before polishing and using ordinary, not white, French polish, you will not require any stain. If you should find this necessary you can buy a small quantity at many shops in your neighbourhood, or make some by dissolving a little bichromate of potash in water. To prevent the oak being stained too dark, be sure and add plenty of water; but if you try the result on waste, as suggested above, you are not likely to spoil the job. Of course, you know the stain must be put on before the polish.—D. A.

Carpenter's Bench.—J. F. R. (*Nottingham*).—Your want has been partly anticipated, as an article describing a small bench is now in hand and will shortly appear. I have said "partly anticipated," as the bench described is of rather an unusual kind, and while it will be useful to a very large number of readers it may not be just what you want. If so, I may say that the construction of an ordinary bench will be given ere long; and surely you do not need to be told that in order to render your bench easily removable you can put the parts together with screws. Criticism, as you suggest, is not objectionable when fairly given; and opinions are often valuable, though many of them may suggest alterations which are impracticable. Still, they all receive attention. With regard to advertisement pages and wrapper, it must suffice to refer you to remarks which have already appeared thereon in "Shop." Your good wishes are appreciated.—D. A.

Rough Frame.—G. S. B. (*Rotherhithe*).—The rough gilded frame, I confess, is beyond me. I hear it is done in the usual way, but fear that will be little assistance to you. It seems rather more than an amateur can attempt.—E. B. S.

Cheval Screen Hinges.—C. M. J. (*Limavady*).—The long elbow hinges I got at a country ironmonger's, whose name and address I forget, but Churchill or Melhuish would be sure to be able to supply them.—E. B. S.

Books on Estimating and Measuring.—L. G. (*Cambridge Road*).—The following are good books for measuring work connected with the building trades:—"Laxton's Builders' Price Book," 4s. (G. Wilson); "Laxton's Builders' Tables," 5s. (Spon); "Horton's Complete Measurer," 4s. (Lockwood).—J. H.

Heating Greenhouses with Oil.—SIGNALMAN (*Lancashire*).—My experience with heating apparatuses generally leads me to give the preference to a stove outside the house and hot water pipes within it. If the wick of the oil lamp rises—and sometimes it will rise—above its proper height, the result is the discharge of copious showers of soot, which will spoil everything, or almost everything, in the house. There are many oil heaters, but I give my preference to the "Tower" heater, of which you may ascertain all particulars by writing to Mr. John Waller, Arabin Road, Brockley, London, S.E. The hand-light to which you refer is an invention of my own, not of Mr. Le Brun. It is not yet patented, and, therefore, I cannot describe it at present. It is unfortunate that your soil is so sandy, but the remedy—namely, the admixture of plenty of good loam and humus, or leaf mould—would be worse than the ailment, on account of the expense. I should recommend you to try to do more with greenhouse work and growing in tubs and boxes. I have a fine display of geraniums in fancy boxes on walls, and grow cucumbers and marrows in tubs, training the former over the roof of the greenhouse, and the latter on trellis work and along the top of a wall. Results from work of this kind will compensate for the hungriness of the soil, in which, by the way, you ought to be able to get first-class carrots.

Garden Frame.—J. H. H. (*Sydenham*).—Sash lights are not suitable for garden frames. You should make your own frames, and this, I think, you may do from Mr. G. Le Brun's instructions for making lights for the roof of his "Tenant's Greenhouse." If you want more detailed information, write and say so, and you shall have it.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Billiard Slates.—CEMENT (*Cork*) writes:—"Would some kind reader give me a recipe for a cement for the filling up of chipped billiard slates? I have used resin and beeswax, and find in the ironing it is inclined to stick to the cloth."

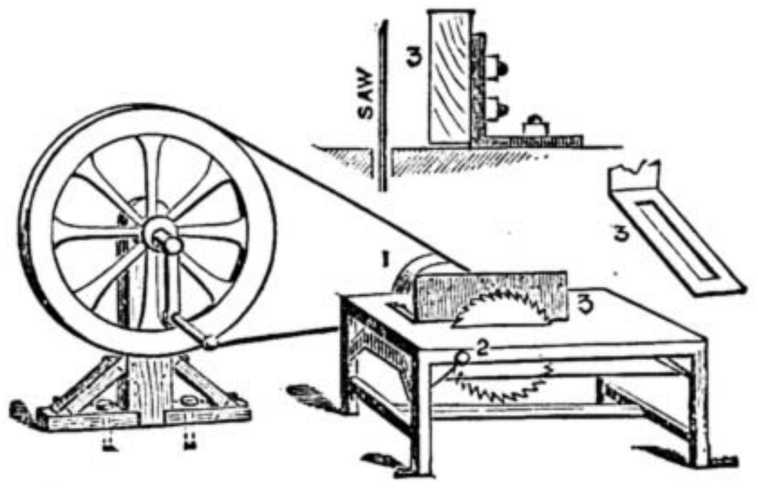
Lathe Work.—A READER OF WORK (*London, N.W.*) writes:—"Would any brother-reader of WORK that's well up in lathe work kindly tell me how to adjust compound rest on lathe, to give the right taper for male and female tapers, also the right place to drop nut into lathe screw in cutting odd threads per inch as 7, and broken threads as 4½ in. saddle taken back by hand at every cut for starting again, lathe screw ¼ pitch?"

Screwing Machine.—INQUIRER asks:—"Will some reader kindly tell me the names and addresses of the latest screwing machine manufacturers?"

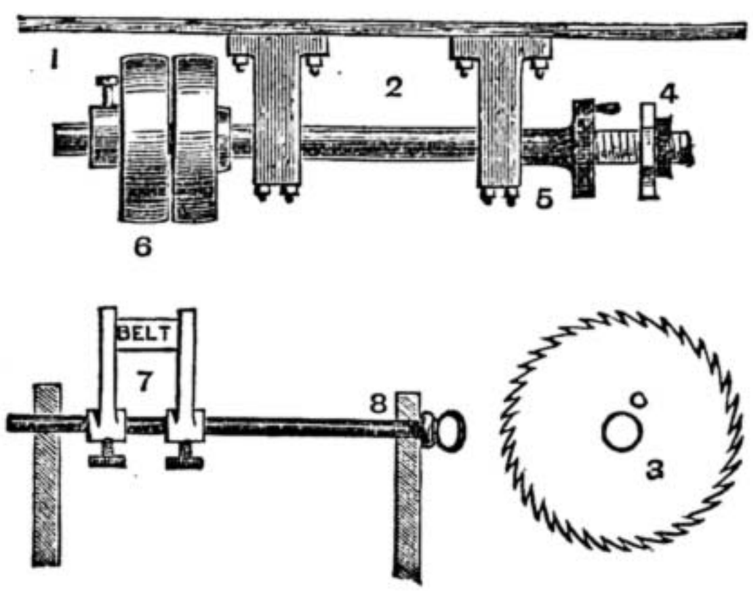
Blacking Hooks and Eyes.—H. R. (*London*) writes:—"Should be thankful to any of your numerous correspondents who could acquaint me with the process of blacking hooks and eyes, and the like."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Hand Saw Bench.—B. F. (*Liverpool*) writes in reply to G. H. L. (*Hull*) (see page 222):—"I send sketch of hand-saw bench as required. It does not want much explanation. He will find it hard work; the heavier the driving wheel is the lighter it will be to turn saw when it gets on a swing; the smaller



1, Fast and Loose Pulley. 2, Knob for Moving the Strap Back and Forward. 3, Fence to be Moved as required for the Cut.



1, Collar. 2, Spindle. 3, Saw. 4, Nut to Tighten Saw. 5, Place for Washer. 6, Pulley. 7, Belt. 8, Fork to Move the Belt.

the pulleys are the greater the speed on saw, but the larger they are the less power. I should say about 8 or 10 in. diameter, the driving wheel not less than 5 ft. There is another way, by having an extra driving shaft; but the above I fitted up and worked to cross cut firewood; it worked well, but required a strong man to turn it, and keep up the speed, cross cut planks, etc., also ripping 2½ in. boards."

Tobacco Pipe Making.—A PIPE MANUFACTURER writes in answer to SMOKE (see page 222):—"I wish to inform him that there is no book published on the above trade, that I am aware of; but if SMOKE wants to know anything concerning the same, I have an essay on pipe making which treats on all subjects, from the clay to the churchwarden or imitation meerschaum, etc, and which I will submit to the Editor if I may do so."—[I shall be glad to see the article on approval, to which you refer.—ED.]

Trade Notes and Memoranda.

OUR contemporary, *The Engineer*, recently gave illustrations of an automatic pill-picking machine, the joint invention of a practical chemist and of a practical mechanic. The machine can be set to reject any pills which are in the least degree above or below the standard size, or which are not perfectly round, while for commoner qualities of goods it can be arranged to reject only those pills which are conspicuously defective in either of these respects. The machine is already in extensive use.

AN immense engine for rolling steel rails is being erected at the works of Palmer's Shipbuilding Yard, Jarrow. It will be capable of exerting 10,000 h.p. The crank shaft is 21 in. in diameter, and the forging for the shaft weighed over 40 tons. The weight of the entire engine is over 300 tons.

M. BOLLINCKX is casting the valves of Rider engines with chilled faces. The chill penetrates to a depth of ⅛ in. to ¼ in. As the surfaces cannot be cut with a tool, they are ground with emery rollers. It is claimed that these surfaces are not only durable, but that they do not wear the surfaces upon which they work, and that the coefficient of friction is very small.

WHAT will be the longest tram-line in the world is being constructed in the Argentine Republic. It will connect Buenos Ayres with the outlying towns, and will be worked by horses. There will be five sleeping cars, 18 ft. long, each with six beds, which in the daytime are rolled back to form seats; and in addition thereto, four two-storeyed carriages, twenty platform carriages, six ice waggons, four cattle trucks, and two hundred goods vans.

WORK

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