WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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Fig. 1.

NOTE.—Fig. 4, if used as another colour over Fig. 1, would leave a white fillet between their respective outlines all round.

Fig. 4.

Fig. 3.

Fig. 5.

Fig. 2.

Fig. 6.

Figs. 6 and 7 exemplify the same idea treated as Brackets.

Fig. 7.

Figs. 1, 2, and 3.—Parts of Corner and Border in Renaissance.
Figs. 4 and 5. Reverses: *i.e.*, White instead of Black as in former Figures.

Corners and Borders given in Illustration of "Examples in Designing for Work and How to Go about It;" being Hints on Art Work for Workmen.

DESIGNING FOR WORK: HOW TO GO ABOUT IT.

BY JOHN W. HARLAND.

THERE is really nothing so difficult as designing, in the true sense of the word. It is not that suitable ideas will not come into the mind just when you want them so much as *how* to express the ideas you have in such a form as that the workman or the amateur can carry them out readily without any superabundant labour that this difficulty most frequently presents itself. In other words, any ingenious mind can think of some form, or arrangement of form, that will please the eye; but something more than this is required—that the design shall also be what we call practical or practicable—*i.e.*, that it shall be capable of being applied to the purpose intended, and that there shall be no violation of the law of the fitness of things. For instance, a stiff, although elegant, combination of geometrical curves and figures would be out of place in the flat, such as a panel; yet, owing to the folds in which all drapery falls, would be very suitable if carried out in curtains, table covers, or tapestry hangings, where the severity of outline would be tempered and blended, and could never be seen entirely at one view. Further, to design for any given purpose, the designer can never succeed to the full if technically ignorant of the after-process by means of which his design is to be carried out. An artist who attempted to design a chair or buffet, let us say, without understanding how the construction ought to be made to combine strength with lightness, would certainly fall into some mistake which would betray his want of knowledge, and entail a large amount of very unnecessary work upon whomsoever had to carry out the execution of it. We think there is a vast amount of good inventive design thrown away for want of some theoretical knowledge of the after-processes, and one of the functions of WORK is to supply in its columns an insight into the principles of construction, as well as to teach the actual worker how best to do his work, that the designer may curb his imagination and modify his creation by studying the means and methods afterwards used to perfect and embody his designs. And the actual worker ought to know something at least of the principles on which all designing is based. The sooner we can explode the theory that "the cobbler should stick to his last," "the gunner to his linstock," etc., the better. A workman will be better for any knowledge, however extensive or varied, however theoretical or practical, concerning his tools, the materials in which he works, their properties and relations, and of the forms he is required by his copy or design to give to such materials. To illustrate this, suppose a circular form occurred in the construction of any piece of work, and the workman did not know how to reproduce with compasses a true circle, he would never get it absolutely perfect by any other means, and he would absorb endless time in approximating to it. Of course, this instance is purposely chosen to show how ridiculous it would be, but there are other curves than the circle that *some* designers and many workmen could not reproduce in a mathematically true manner, for want of theoretical knowledge. WORK in time will no doubt give the requisite knowledge, both theoretical and practical, and what I want to urge is that any one in reading WORK may benefit himself much more than at first sight appears by carefully studying articles that do not seemingly apply to his craft or business at all, and that he fancies do not concern him in the least.

The cleverest imagination, if untrained, is intractable and wild, just as the strength of a giant who knows not how to apply it is valueless and purposeless. Flights of fancy leave no impression on the air, unless undertaken systematically and with a clearly defined aim or object to confer the quality of usefulness upon them, in addition to mere beauty. It is all very well to sneer at utilitarianism, but it is the great factor that may make imaginative work productive and profitable. What is the use of the carrier pigeon soaring into the upper air and flying a thousand miles without the missive, carrying news to others, beneath its wing? Its flight is no less wonderful, the bird no less beautiful, the curves it performs in mid air none the less graceful, but it is, after all, its practical utility that is the chief cause of its being appreciated, and these other attributes which might have passed almost unnoticed are brought to notice and admired. From this let us deduce our first law of design.

(1) *Utility enhances the value of beauty.*—If this law be always remembered, imagination will be, to some extent, fettered at first by not having a free vent for expressing itself, but this curbing will, in the end, act as an incentive to it to widen the channel; and since it has no other escape, it will be much more easily utilised and turned to good account, instead of wasting itself on idle fancies and useless dreaming. We leave to the moralist to point out how such a gift as the imagination, left untrained and idle, runs riot and induces sin; we content ourselves by saying that, for the purposes of WORK, it is *waste* not to cultivate and train it to a useful career. One of the most curious and intricate, as well as subtle, powers of imagination is the building upon realities and facts by association of ideas a claim to sympathy and appreciation in others and by others. All beauty has a power over the human soul, and if the form and colour are beautiful in any design, a certain charm makes itself felt in the beholder; but if this sentiment is enhanced and deepened by association in his mind with other beautiful things, by recollections of tender passages in history or his own life, how much more is the beauty of the design made to penetrate and move him! This is one form of utility, for the object, or one of the objects, of the designer is achieved: his work has expressed a sentiment, a feeling; it has touched some chord. Such a design lives—nay, outlives—its designer: it is not the result of chance or accident, but of thought. Our second law of design is almost an axiom, since it is contained in the meaning of the word.

(2) *To design, one must think.*—One must think of every surrounding circumstance, every concurrent idea—think of days gone by, of all possible memories of form and colour—and think how these thoughts can be utilised and made subservient to the purpose in view, selecting such as are harmonious, reserving others that are not so for a future season, that no incongruity may mar the work. The more thought is expended, the purer, nobler, and higher, the more powerfully sympathetic, will the result be.

All human and mundane things are limited—time, space, power, and so on; our mode of expression more, perhaps, than all. Our power of expressing the brightest glory of light is reduced to mere white, the deepest darkness can only be rendered by black; between these range pigments that do not express one-thousandth part of the colours visible in Nature. To keep, as it were, to scale, colours must be used co-relatively—we must be content with our limited capacity for reproducing them *in petto*, in degree, in miniature, as to force as well as to size. Again, motion is inexpressible, as it involves an idea of three or more positions of a body following one another at three or more different consecutive times. We are limited in art to reproduce one position only at a time; we can only select such a position as will give an idea, firstly, that it has been arrived at only and solely by motion from a previous position; and secondly, that it is transitional only to some other future position. In short, we must express the condition or attribute of *unrest*. We can only arrive at such expressions as these by the aid of thought: first by analysing Nature, which is the consummate art of God; and secondly, by our imperfect art endeavouring to express its sentiment, rigorously and conscientiously abstaining from the temptation to attempt more than a confessed inferiority on the one hand, and on the other to a mere servile imitation. These remarks apply more particularly to the highest forms of human art, but are necessary here as generalities having a bearing on the thought necessary in the almost trivial design of every-day work. For it is most true that a careless, thoughtless spirit is evil and non-productive, and Nature carries out into the most insignificant detail the most wonderful and loving beauty of thought far mightier and grander and more exhaustive than is possible to the human mind. The more the imagination is enchained to dwell on such trains of thought as we have, faintly only, indicated, the more negative it will become, and the more surely will it veer nearer and nearly towards the direction of its guiding Pole-star, even in the most simple and apparently insignificant work of the day's business.

To illustrate this and show more clearly the intended bearing of the foregoing remarks, let us suppose a border is required to separate a dado around a room from the papering above. The idea of a border of this kind is self-evident; our every-day mention of it would be expressed thus: "A border running round, etc." This abstract ideal must be the governing motive; the form we select should be chosen entirely for its attribute of running. Now, as we cannot draw or paint anything in more than one position, and can only select an emblem of running, let us turn to the book of Nature. Plants give us delicate and beautiful colours, and as they grow and move imperceptibly to us, give us the best facility for emblematic motion. Further, many plants propagate by what are called "runners," like the garden strawberry, which throws out long tendrils or shoots, which run along the ground and strike root here and there, eventually to form other plants.

Here, then, is one motive, available for a design for a running border. Further search would reveal thousands of plants that would fulfil the conditions. Suppose again that, instead of a border round a room—*i.e.*, a horizontal one—we require a border round a panel, we should look for a creeping plant as a motive; but with this fact staring us in the face, that creeping plants cannot creep in the air without support of some sort, which would compel us to think again for the ideal support required. Back again to the inexhaustible book of

Nature, inquiring, in a spirit of reverence, for truth. What supports the ivy? Oftentimes the oak. Oak branches twist themselves into various forms, and shoot out at all manner of angles, and bend into endless curves; the ivy follows for the sake of its strong support. Here is a motive: one out of thousands that Nature holds out to us. "But we don't want a mere copy of Nature," it may be said; anybody can do that sort of design. I reply that I also do not mean to adhere to Nature servilely and strictly, but I believe this, that there is no truer, purer, or more logical basis of design than Nature, and if one only thinks out a natural synonym or emblem, as it were, pre-existing in Nature, that the functions of any design, however conventional, even geometric, its treatment may be, must of necessity bear the impress of their origin. I would add that if you quote from Nature, let your quotation be correct, and thus acknowledge its source, no matter how your fancy may lead you to carry it out in the way of treatment. There is nothing new, or even original, in this. The art of the Egyptians and the Greeks was thus based; well-known instances are the lotus of the one and the acanthus of the Corinthian capitals. These remarks bring me to "style," as it is termed, which only means carrying out in design a motive in the sort of way commonly done by others, either at any particular epoch, or in different countries, or in harmony with architectural ornamentation. The designer, when selecting a style of treatment, should therefore have read something of the history of, and be somewhat familiar with what is known of, the epoch, or people, or architectural ornament which that particular style expresses or represents. As the style very frequently is not a matter of choice with him, but depends upon the style of other portions of the decoration, it follows that he should study until he is fairly conversant with all styles. He should be able to analyse ideals, refer them to their own place, classify them as to style, period, or country, and to reproduce by special treatment other motives in the same style as they would have been treated at the time or epoch by those who produced the models of style he is called upon to follow. I point this out to the readers of WORK in order to enforce the truth that nothing of any value can result without labour and knowledge, which is its highest result, and without the constant exercise of thought, which is the nearest approach possible to the mind of man to the "Divinity that shapes our ends, rough-hew them how we may."

As it would be almost an impossibility for any one mind to amass such a wide knowledge of facts, and, at the same time, to undergo such drudgery as would train eye and hand to the mechanical dexterity known as the "technique" of his profession, as well as a knowledge of the after-processes of all trades in carrying out his design, so that it should be practical, as before pointed out, it is well to select one only of the almost infinite classes of design, and become thorough master of that, rather than study superficially the whole range—design, say, for textile fabrics, for furniture, for carving, for modelling, for casting in metal, for repoussé work, leather work, for engraving, etc.: for any one of these, not attempting all or even many of them. *Ars longa, vita brevis est.* Art is long, life is short—too short, alas! to succeed even in one thing sometimes: to succeed in everything far too short, and to attempt it would prevent success in anything.

Perhaps I have been led somewhat deeper into the ethics of my subject than was my first intention, but I hope, on some other occasion, to write more on the practical portion of it. The illustrations are examples of design and treatment which apparently have but little reference to the present article, but I give them in the hope they may prove useful as ideas for others to think out, as bases for other designs, or for adaptation to other purposes—in fact, as suggestions. For instance, for fretwork border round a panel one has only to leave the necessary stops to keep the white or solid parts together, and then saw out the black parts, or even, *vice versâ*, to utilise these designs at once. Again, for stencilling in colour upon a flatting ground in house decoration, Figs. 1 to 5 would answer very well; or, again, as the basis for a carved frame, with very little modification in treatment, they could readily be adapted.

CLEANING AND LACQUERING OPTICAL BRASSWORK.

BY CHAS. A. PARKER.

PREPARATION OF NEW AND OLD WORK—HOOKS AND HOLDERS FOR HANDLING AFTER DIPPING OR POLISHING—CHAMFERING WORK—BUFFS—LACQUER BRUSH.

IT must be understood that a lacquer is applied to the surface of brasswork for the purpose of improving its appearance and preserving a polish that has already been obtained, and is not intended to impart a brilliant lustre to old and tarnished brass, as some may imagine; the lacquer simply being a form of varnish which prevents the freshly polished surface of the metal from becoming tarnished by exposure to the atmosphere, hence the necessity of always lacquering work which should retain a good appearance. In point of fact, the operation of lacquering newly polished work detracts slightly from its appearance, but as it would soon rust and turn black if exposed to the air, it becomes necessary to protect the surface by a coat of lacquer, which, if good, will retain its colour and resist the action of the atmosphere for a number of years. The process of lacquering is rather difficult to execute properly, especially on large surfaces, when the beginner will find the lacquer continually getting a smeary look; but after a little practice, it will be possible to lay on an even coat of lacquer free from streaks, the great difficulty being to know the exact degree of heat best suited to the particular lacquer in use, and the effect to be produced, this kind of knowledge being such as can only be obtained by personal experience.

Preparation of the Work.—In all cases where the work consists of a number of parts fitted together, including camera fittings which are attached to the woodwork, it will be necessary to unscrew or separate their component portions and arrange them in such a manner that each screw, etc., shall be returned to its respective place; in fact, in order to prevent mistakes, it will be found advisable to number each piece of brasswork on the under side. The polish on brasswork may be produced by several different methods, as may be imagined from the great number of workers in this metal, each of whom pursues his own particular course in order to obtain the same result—a highly polished surface; different processes being gone through in each workshop according to the custom of the trade.

For finishing off coarse or common class new work, such as rough castings, which it is wished to protect from tarnishing or oxidising by a coat of lacquer, it will be necessary in the first place to prepare the brass to receive the coating by washing it thoroughly in very hot water with plenty of washing soda, using a stiff brush in order to entirely free it from all traces of grease, and after giving it a good rinse in cold water, the articles are dipped in a pickle, composed of equal parts of nitric acid and water, until covered with a white coating of the appearance of curdled milk, when they are quickly removed and rinsed in a large vessel of clean water, being afterwards dried in hot boxwood sawdust. The sawdust should be kept in a tin biscuit box, which can be placed over the kitchen oven to warm, and when the brass is dropped in among the sawdust, the box should be well shaken, in order that the article may be quickly dried. On being removed the metal will be found to have acquired a splendid lustrous appearance, and may be lacquered forthwith; or, if desired, the more prominent portions of the work can be smoothed by means of a flat file, which is held as nearly horizontal as possible, going over the surface first with a second cut, and then with a dead smooth, if not in possession of a smooth file to come in between the last named; the work being finally brought up to an even grain by means of Oakey's emery paper, in the following degrees of fineness: Nos. F, F F, and O.

In order to preserve the colour of the brass up to the moment of lacquering it will be advisable to dip it in a little commercial nitric acid to which a small quantity of cream of tartar has been added, the article being immediately afterwards rinsed in clean water to remove all traces of the acid, and then dried in hot sawdust, the dust being afterwards brushed off with a dry soft brush, and the article lacquered as quickly as possible.

In the case of old work which has been previously lacquered, such as a microscope or photographic lens, it will be necessary to first unscrew the lens cells and separate the inner tubes from the outer jackets, being particular to note the position of the various parts; and when thus separated, boil off the old lacquer in a lye made by mixing ½ lb. of potash with a gallon of water, the work being allowed to remain in this lye for about twenty minutes, when it should be taken out and immediately plunged into clean cold water, which will have the effect of removing the whole of the old lacquer; it is then taken out and brushed with a clean brush, and if considerably tarnished, it should be dipped in a pickle as before described, which will eat away all the outer coating of corrosion and leave the surface of clean brass. When quite bright and clean it is removed from the pickle and thoroughly rinsed in clean water. If running water is to hand, so much the better; if not, it will be found necessary to have several vessels of clean water handy, so that the work may have a good rinse in all of them, and on being removed from the last water, it is transferred to the sawdust box, from which it is taken in hand to be polished according to the instructions herein contained, and the degree of finish required.

It is advisable to conduct the operation of dipping out in the open air, or in a well ventilated apartment, as the fumes given off by the nitric acid are very baneful to health; but where ordinary care is exercised, there need be no fear of danger. Those who

object to the fumes of the nitric acid may use the following pickle, which has no unpleasant smell: Make a saturated solution of bichromate of potash with boiling water, and (when cold) add 1 oz. of sulphuric acid slowly to every ½ pint of solution. Never add the water to the acid or pour the latter into the hot solution, as it might be attended by serious consequences.

If an article has to be handled after dipping or polishing, it should be held in rag in the hand, or suspended on a piece of wire bent in the form of a hook, or it may be held between a pair of tweezers, a strip of wood slit longitudinally being a capital substitute for the latter. A brass or copper wire of about No. 10 B.W.G. may be bent into the form of a hook similar to Fig. 1, and used for the purpose of hanging the articles on while dipping, flat brass plates being placed on a wire holder similar to Fig. 2. As stated above, it is necessary to avoid handling the work during the operation of dipping, etc., as the slightest trace of grease from the fingers will spoil the after process of lacquering.

In preparing new microscope fittings for lacquering—or in fact, any work for which a superior finish is required—it will be necessary to first scrape up the curved edges of the various parts, holding them in the hand, or clamping them in the jaws of a vice between two pieces of sheet lead or leather. The tool employed for this purpose will be a scraper, which is simply an ordinary triangular file, the sides of which have been ground up smooth and sharp on a grindstone, the edges being set on an oilstone until they are sufficiently sharp to take off clean bright shavings. All the flat surfaces and straight edges of the work must be smoothed by means of a dead smooth file, which will obliterate all traces of the previous file-marks. When this has been done, take a piece of emery paper (not cloth) and use this to get rid of the file marks, wrapping it round an old smooth flat file or a thin strip of wood, having previously cut the paper to a size about an inch less in length and about three times the width of the file or wood, in order that it may be wrapped round it and held in position by the forefinger of the right hand whilst in use, being particular to rub in one direction only, and continue the process until all traces of the file marks have disappeared, when a finer emery paper may be substituted, until the finest (or flour) emery is finally used to obliterate the marks made by the previous paper. If a drop of oil is now smeared over the surface of the brass the grain may be brought up to a smooth and even semi-polish. It will be necessary to carefully clear away all traces of emery dust before commencing to use a finer paper, otherwise ugly scratches will continually appear on the surface of the work, only to be eradicated by going back a step and commencing *de novo*. After the finest paper the finish will be very good, but it can be further improved by rubbing with a piece of water-of-Ayr stone, which must be moistened with water from time to time.

Never substitute emery cloth for the paper, as the latter lasts much longer and works smoother than the former, very frequently working down to a glossy surface before giving way, and, moreover, the flatness and sharp edges of the work are better preserved by the paper than by the cloth. If the article is now held in a clean rag in the hand, and is then brushed with a soft brush (or a stick covered with one or two thicknesses of woollen cloth) and a little whiting, being afterwards wiped dry on a clean linen rag, it will then be ready for lacquering; or, if desired, the final polish may be imparted by means of a buff stick and a little crocus powder, or any of the numerous polishing pastes and powders. Of the latter, the writer has personally used "Davis's Metal Polish," ½d. per packet, and the "Universal Metal Polishing Pomade," 1d. per tin. The latter, which is a German preparation, has gained four prize medals, including a gold medal at Kensington in 1884, and it is certainly the most useful article for instantly imparting a brilliant polish to metal work that the writer has ever had the pleasure of using. Mr. H. Seeger, 21, Mincing Lane, London, E.C., is the sole agent for Great Britain, but it can be obtained from oilmen and some cyclist emporiums.

The following will be found the best method of using the preparation: Anoint a

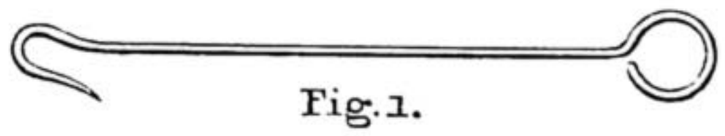


Fig. 1.

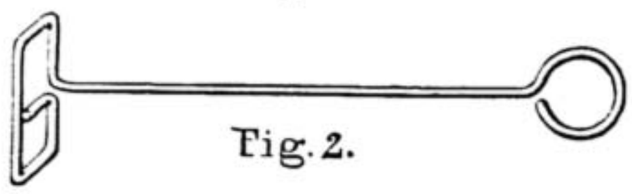


Fig. 2.

Fig 3.

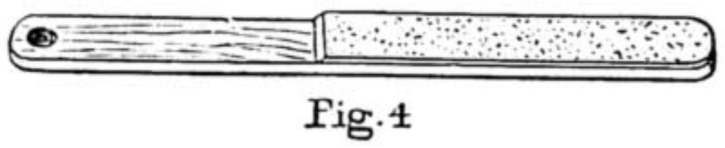


Fig. 4

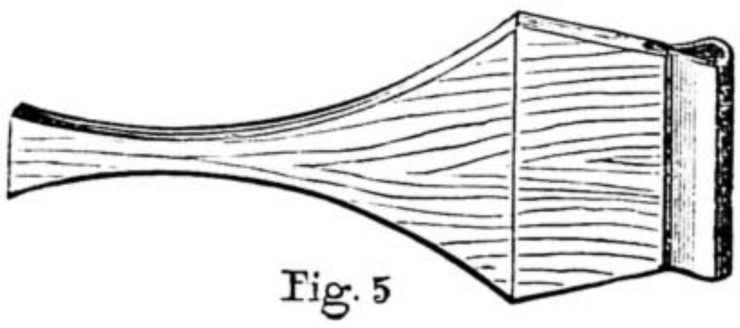


Fig. 5

Fig. 1.—Wire Hook for Handling Articles after Dipping or Polishing. Fig. 2.—Wire Holder for Dipping. Fig. 3.—Mode of Chamfering End of Stone. Fig. 4.—Mode of Making Buff. Fig. 5.—Best form of Brush for Lacquering Broad Surfaces.

polishing buff with a little—not much—and then rub briskly, and with considerable pressure, upon the surface to be polished, remembering that it is always usual to take the strokes off lengthwise of the work, which should be the same way as the grain left by the emery papering. This will speedily bring up the surface to a lustrous polish, providing that the article has previously been papered up smooth, and care has been taken to eradicate all the file marks. When the superfluous pomade has been cleared off by means of a piece of soft rag, the surface will present a polish very slightly inferior to a burnish in point of brilliancy. The screw holes will require cleaning out with a piece of pointed wood cut to the requisite size. This is a necessary precaution, otherwise the grease will melt out of the holes when the article is heated and overrun the surface, thus spoiling the lacquering. Small nuts and screws may be polished by means of a chamois leather which has been dipped in the pomade, and is held between the thumb and first finger of the right hand, being quickly rotated over the part to be polished, the superfluous pomade being cleaned off by another portion of the leather as soon as the polish appears. Screws will seldom require emery-papering first, unless they are very old and tarnished, as they are generally left tolerably bright from the lathe; but should they need it, the paper may be used in the same manner as the leather.

Although the process just described, in which the file-marks are eradicated by means of emery paper, is very rapid, it is apt, in inexperienced hands, to have a knack of taking off the sharp edges of the work, giving it a slovenly appearance; it is, therefore, usual with the best work to secure a superior style of finish by means of stone-polishing, using grey-stone, blue-stone, and water-of-Ayr stone. This process, although more tedious than the one previously described, imparts that neat and square appearance to the work which, in the eye of a connoisseur, is a sure indication of good workmanship. In order to secure this superior class of finish, instead of using the emery paper to remove the file-marks the three qualities of stone mentioned above are employed for the same purpose in the order given. The grey-stone, which is used first, must be wetted with water, and then worked rapidly across the surface of the metal, also in circles, until all traces of the file have disappeared, care being taken to prevent it from slipping over the sides or ends of the work so as to damage the sharp edges. This stone is afterwards followed by the blue-stone, which is used in the same manner until it has removed all traces of the coarser stone, the article being finally finished by going over the surface carefully with the water-of-Ayr stone, which is taken straight across the work from side to side, in order to lay the grain, the article being afterwards dried by wiping it on a clean rag; after which the final polish is imparted by means of the pomade before described, or, if desired, tripoli and oil may be used instead. A great many workmen file their stones to the form of a chamfer, as shown in Fig. 3, and rub the chamfered portion on the surface of the brass; a greater pressure is thus brought to bear upon the work, and the task of obliterating the file marks thereby hastened. It will be necessary to wipe the work each time that the stone is changed, and the polisher should be careful not to get any grit on the surface during the latter stages of polishing. When it is wished to finish off the brass in the highest state of perfection cleanliness is the first consideration, and unless all the materials employed are kept distinct from each other and quite free from dust, it will be useless to attempt to get good results. The work should be lacquered as soon as possible after being polished, as it will soon lose its brilliancy. To prevent the rapid tarnishing as much as possible, it is usual to wrap the articles in a clean linen cloth until ready for lacquering. The stones above mentioned can be obtained from any dealer in watchmakers' materials; for instance, Mr. Cohen, 132, Kirkgate, Leeds. They are sold in slips from 6 in. in length and about an inch square. Round or flat buffs will cost about 2d. each, or they may be readily made by gluing a thin strip of leather on to a narrow piece of wood, as shown in Fig. 4.

Referring to the appliance shown in Fig. 5, representing the best form of brush that can be used for lacquering broad surfaces, I shall reserve its description until I am able to deal with the methods of lacquering, which space compels me to reserve for another paper.

THE ÆOLIAN HARP: HOW TO MAKE IT.

BY C. P. WEBB.

THIS interesting instrument is somewhat incorrectly named; its more proper appellation would be Æolus's harp, as it derives its title from Æolus, who, in the heathen mythology, held the place of "God of the Winds;" but modern usage and euphony have corrupted it into the name it now bears. In a practical journal like WORK it may be incongruous to dilate upon its scientific principles; suffice it to say that it consists merely of a wooden box or shell, across the top of which are stretched some strings, which are acted upon when placed in a current of wind, producing a succession of harmonious sounds. The weirdlike, yet melodious, sounds proceeding from it have inspired the thoughts of many poets, but none more so than Thomson, who, in his "Castle of Indolence," thus feelingly alludes to it:—

"From which with airy fingers light
Beyond each mortal touch the most refined,
The god of winds draws sounds of sweet delight.

* * * *

Ah me! What hands can touch the string so fine?
Who up the lofty diapason roll
Such sweet, such sad, such solemn airs divine,
Then let them down into the soul?"

The name of its inventor, and also the date of its invention, are apparently shrouded in mystery. We have an allusion to it in the works of Kircher, a celebrated philosopher, born in 1602; but it does not appear to have been introduced into England until the year 1750, when it was described as a new invention.

The principle of its construction is so simple that it is quite within the capabilities of the veriest tyro in the art of woodwork; although, naturally, the greater the care bestowed upon the workmanship the more satisfactory will be the result.

We will first consider the construction of the body of the instrument. For this we shall require a piece of sound deal, ½ in. thick, 8 ft. long, and 4½ in. wide; this must be nicely planed, and have the edges truly squared. Cut this up into two pieces of 3 ft. 6 in. long, and two of 6 in. long; carefully dovetail the ends of all these pieces, that they may fit together and form the sides and ends of a box measuring 3 ft. 6 in. by 6 in. For the top and bottom take a very sound clean piece of ¼ in. or ⅜ in. deal, planed up and glass-papered, 7 ft. long by 6 in. wide; cut this into two equal pieces of 3 ft. 6 in. long each; in one of them, which is to form the top or soundboard of the instrument, at a foot from each end, and in the centre longitudinally, cut a hole about 2 in. in diameter (E, Fig. 2), with a fretsaw or sharp penknife. We next require two blocks to strengthen this board for the reception of the pins and screws which the strings are attached to. For these, take two pieces of beech or other hard wood 1 in. thick, 5 in. by 4 in. Finish these nice and smooth, and attach them to the soundboard, on what will be the under side, at ½ in. from each end and side, as shown at B in the sketches; they may be fastened on by glue and screws from underneath. This board may now be laid on to the framework; the blocks, if properly fitted, will just drop in, and in order to withstand the strain to which they will be subjected may be further strengthened by two small screws on either side passing through the sides of the box into them (see Fig. 3). The top itself is fastened on the sides and ends by means of glue and small screws round the edges. The other piece of thin board is now to be fastened to the bottom of the box in a similar manner, and the body of the instrument is complete.

We shall now require seven iron pegs, the same as are used for holding the strings in a piano, and a like number of violin pegs. Bore seven holes in each end of the soundboard into the blocks in the position shown

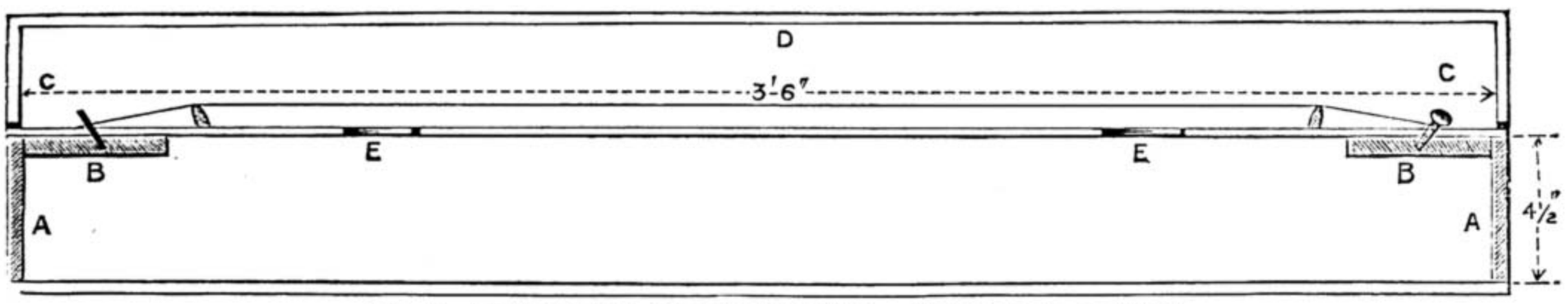


Fig. 1.—Æolian Harp: vertical section. (Scale, 1½ in. to 1 ft.)

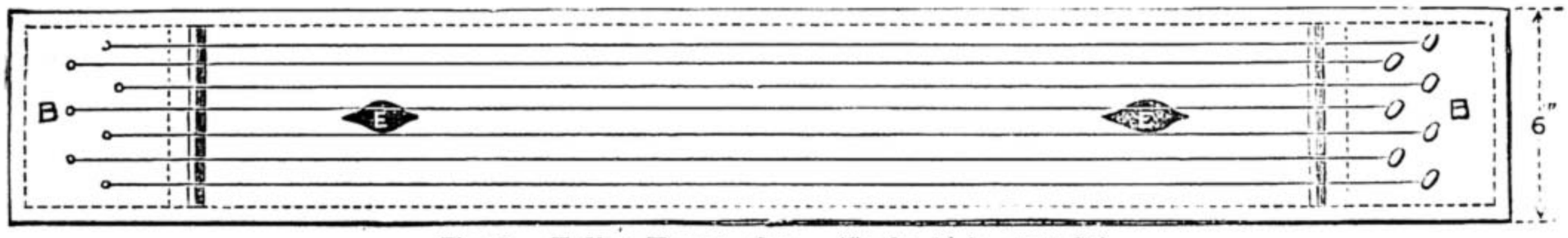


Fig. 2.—Æolian Harp: plan. (Scale, 1½ in. to 1 ft.)

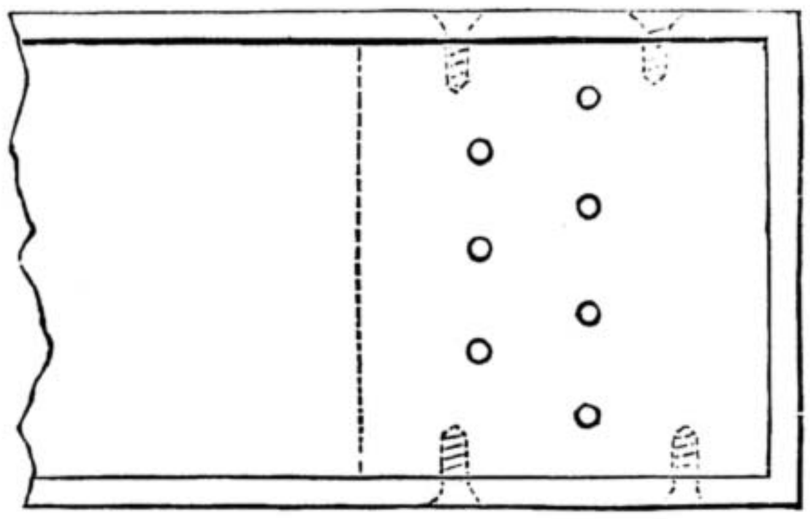


Fig. 3.—Mode of fixing Side to Block. (Not to scale.)

at B B, Fig. 2; these should be bored in a diagonal direction: as indicated at C C, Fig. 1, see that the pegs fit tightly in the holes, the iron ones at one end, the wooden ones at the other. Now cut two pieces of beech 5½ in. long by ½ in. by ⅜ in., and shave off two edges of each to form triangular pieces on a ½ in. base: these must be glued firmly across the face of the soundboard at about 5 in. from either end, and a slight notch made in the top edge opposite to each peg. These will form bridges across which the strings are to be strained.

Now procure some catgut (violin strings), pass one end through the holes in the iron pegs, carry it over the notches in the bridges, along the face of the soundboard, and attach the other end to the wooden pegs, which turn tightly in their holes until the strings are thoroughly strained. The strings must now be tuned in unison—that is, they must *all* be of *exactly* the same sound. This is done by turning the pegs until the desired effect is obtained.

As the effect is much enhanced by directing the current of wind over the strings, we must now take two pieces of ½ in. deal, 6 in. by 3 in., and a piece of board similar in size to that used for the bottom of the instrument; glue one of the small pieces across the edge at each end of the board; this will stand over the face of the instrument as shown in the unshaded portion in Fig. 1. Now place the whole on the window-ledge and close the window down on to the top of it at D, Fig. 1, and with a moderate breeze blowing we shall be rewarded by hearing the plaintive tones peculiar to the Æolian harp.

THE WATCH BALANCE-SPRING.

BY A. P. B.

THE balance- or hair-spring of a watch is a fine spring attached to the balance, to control the movement of that part when set in motion by the power of the mainspring, communicated through the train of wheels and escapement. The time-keeping qualities of a watch, therefore, depend to a great extent on the balance-spring and its proper adjustment. So that a watch of otherwise good construction and design would be of comparatively little value as a time-keeper if supplied with a badly-adjusted balance-spring; while a watch of inferior description might be rendered less inaccurate by giving closer attention to this particular part than is usual with watches of the cheaper class.

The strength of the balance-spring is mainly dependent on the weight and size of the balance itself, and must be of such strength as will give the requisite number of vibrations to the balance in a given time. The number of vibrations per minute in any watch may be readily found by multiplying the number of teeth in the escape wheel by as many times as the number of leaves in the escape pinion is contained in the number of teeth in the fourth wheel; this will give the number of double vibrations the balance should make per minute.

Too strong a spring causes the balance to travel too quickly, and the watch gains; but with one that is too weak, it will not move sufficiently fast, and the watch will lose.

The most advantageous length for a balance-spring is not so readily determined, as in certain forms of escapement somewhat long springs are required, while in others the best results are obtained by shorter springs. It is, however, usually found best in practice to give about ten turns of spring to a horizontal, and twelve or fourteen turns to a lever, escapement.

To fix a new balance-spring: take the balance, remove the small brass collet from the staff, and unpin the old spring; then, having selected a spring of the requisite number of turns, place the outer or last coil between the curb-pins of the regulator, and see that the balance pivot-hole will come

exactly opposite the centre of the spring when the balance shall be in place; then lay the spring on a flat surface, and notice if there is sufficient room in the eye of the spring for the collet. If, as is usually the case, there is not, then a portion must be removed, so that the space in the eye of the spring is of somewhat larger diameter than that of the collet. To ascertain if the spring selected is of the proper strength, take the balance and pass the staff through the eye of the spring, then place a minute portion of beeswax on the point of the pivot to keep the spring from coming off. Now pick up the spring by taking hold of the outer coil at a distance of about $\frac{3}{16}$ths of an inch from the end—the balance will be raised with it, being supported by the small piece of beeswax; give the balance a slight turn, and it will continue to move to and fro for some half-minute or more. Count the number of vibrations it makes in half a minute (it is easier to count each alternate vibration), and if this exceed the proper number that it should make in the time, then the spring is too strong; if, on the contrary, the vibrations are too few, then the spring is too weak for the balance, and in either case other springs must be tried until one is obtained which will give the correct number of vibrations in the time as near as can be calculated by the eye.

The spring has now to be pinned to the collet. To do this, first examine the small lateral hole in the collet, to see that it is quite free and clear; now take the spring at the eye, and bend the end to a distance of about $\frac{1}{16}$th of an inch to a right angle; pass this bent portion into the hole in the side of the collet, and pin it carefully in. The spring should now be quite true and flat with the collet, which should be exactly in the centre, and the spring leave the collet with a nice curve, care being taken to see that it does not touch at any other part, and that the small pin does not project from the hole and touch against the spring; otherwise its action will be impaired.

The spring has now to be attached to the balance-staff by the collet, the outer coil placed beween the regulator pins, and the end pinned into the stud, the collet being so adjusted that the watch will be in beat (in horizontal watches the dot on the balance-rim should be opposite the stud). The spring should be pinned into the stud in such a way that the outer coil will occupy the middle of the space between the two curb-pins of the regulator, so that when the balance is moved to and fro, it will strike both pins evenly. The regulator should be placed at the slow position, and the spring examined to see that it acts correctly; if so, the regulator should be gradually moved round, and the spring altered where necessary, till it is found to strike both pins evenly in any position at which the index may be put. The second coil of the spring should be observed, to see that it does not strike against curb-pin or stud. The watch may then be regulated in the usual way.

THE ART OF GRAINING.

PRACTICAL PAPERS ON PAINTED IMITATIONS OF WOODS.

BY A LONDON DECORATOR.

INTRODUCTORY AND ILLUSTRATIVE — PREPARING WORK — "GROUNDS" AND "GRAINING COLOURS."

THE utility and art morality of painted imitations, although not a subject of the first importance to the student of graining and marbling, is, nevertheless, sufficiently a question of practical interest to the community at large to warrant its introduction in these pages. Notwithstanding this distinctive branch of house embellishment has been successfully practised and honoured, to the direct knowledge of the trade, for fully one hundred years past in our own country, no subject of a like nature has caused such disputation and outspoken criticism amongst eminent decorative authorities of recent years as the practice and study of such imitations.

Half a century ago, and even still later, the art of graining was in the zenith of its popularity. The successful imitator was looked up to by the operative house painter, and, in fact, by the patrons of his craft as an art-worker—of the lesser order, maybe—but of a branch of decorative painting of a very remunerative nature, and such as even Royalty was pleased to patronise. As evidence of this, there is the still existing marbled imitations which, under the personal direction of the late Prince Consort, were executed upon the walls of the Grand Entrance, or "Marble Hall," the "Grand Staircase," leading from thence to the Throne Room, the State Ball-room, and other minor positions at Buckingham Palace, about forty years ago, and at which period the present front of the palace was built. Another notable example of painted imitations comes to my mind—the grand staircase of the aristocratic Carlton Club, Pall Mall: a splendid example of painted marbling, which Messrs. Gillow blotted out with "ivory white" paint and Dutch-metal gilding only some three years ago. What a radical change has transpired between then and now! To-day we have WORK offering to the would-be grainer for a few pence the foundation of that craft which a generation ago could only be obtained by heavy premiums or apprenticeship, and the execution of which was jealously guarded from the inquisitive gaze.

John Ruskin's much-quoted dictum, that "there is no meaner occupation for the human mind than the imitation of the stains and striæ of wood and marble," has, unfortunately, been a potent force in lowering graining and marbling from the exalted position it had obtained at the period mentioned. Until these uncompromising words went forth to the "community of refinement and art-culture" who hold him as the exponent and high priest of all that is true and beautiful in art, no very weighty opinion denouncing such imitations is recorded. From the earliest known times of its introduction and use, the value of this branch of house painting, which can combine so admirably utility with embellishment, had, indeed, been fully acknowledged and established; and had this sweeping condemnation been penned by a writer of less eminent ability and fearless individuality as an art critic than Mr. Ruskin, there is little doubt but that its proper sphere of decorative popularity would not have been in the least affected thereby. Coming as it did, however, from one whose judgment on most art matters is one to "conjure" with, the results were soon made evident, inasmuch that it became *fashionable* to decry that which was previously applauded, and the skilled and clever imitators of the metropolis especially found their occupation almost gone. "Old things have passed away!" became the cry of the unthinking following of this master mind. Even, as in some instances, where the architect or decorator was not averse to its introduction in a building, it rarely happened that the client—if a person of advanced knowledge and "art-culture"—would, himself, countenance so flagrant an exhibition of "artistic ignorance." Herefrom, then, to a great extent arose the disfavour accorded this imitative art, and which has continued, although to a less extent, down to the present day.

The authoritative decorators who uphold graining and marbling number amongst themselves, however, men of eminence, not only as writers upon art, but far more so as practical workers, than even Mr. Ruskin. For instance, we have the valuable opinions of both the late Sir Digby Wyatt and Owen Jones—of "Grammar of Ornament" fame—that such imitations are permissible and commendable, provided they are introduced in situations consistent with utility and common sense: that is to say, where the genuine article could properly be used. That this is but a rational view of the matter no unbiassed person of intelligence will deny, since, if the use of graining and marbling be objected to—notwithstanding fitness or merit of execution—solely upon the principles of being imitations or "shams," the argument will carry one into most absurd extremes. No staining of simple deal or pine to imitate a more costly or pleasing wood! No cast plaster imitations of carved stone-work! No putty composition or papier-mâché enrichments to the surface of apartment or furniture: not even to embellish a mirror-frame—lest some poor creature may be deceived into thinking it is genuine carved work! The amount of pleasure that may be derived from the beauty of the ornament is not worthy of consideration in such work: so, at least, appears to be the creed of the "anti-sham" party. Gilding a picture-frame or similar ornament must also come under condemnation, since where lies the difference between so imitating a carved surface of metal and covering a wall with an imitation veneer of marble?

An extract from the *Architect*, published some years back during one of those periodical occasions at which this question comes to the front, offers so suitable a closing judgment upon the controversy herein considered, that I am tempted to quote it—with the promise, however, that quotations shall not hereafter be substituted for that personal knowledge and experience of my theme which, I am aware, readers of WORK expect and look for. "Graining and marbling, of course, are quite an inferior art to veneering, and, to speak plainly, are more directly a make-believe. A slab-slate table, for instance, enamelled to imitate Aberdeen granite, has been known to deceive for more than a moment the expert eye of an Aberdeen stone polisher; and it is quite a common thing for a sufficiently subdued imitation of satin-wood or mahogany to be mistaken for veneer, or an unpretentious panel of griotte or malachite for the real marble. So cleverly, indeed, do grainers accomplish their work—when they permit themselves to operate with due reserve—that vast surfaces of wall, as in Buckingham Palace and Stafford House, are found panelled out in the likeness of costly materials with such excessive liberality and faithful resemblance as to create in the mind of a modest stranger the feeling that he is being made a fool of. Nevertheless, for common woodwork in a common house—setting aside for the moment the fashion of green paint and other sad colours which

happen to be in vogue—what can be more satisfactory than well and discreetly executed wainscot graining? Let us bear in mind one thing that seems to be quite overlooked at present. Why is a woman's cotton dress printed with a pattern? Not for the sake of the decoration—a plain colour would often be far more preferable—but for the simple purpose that it shall not 'show the dirt.' The object of graining a door is, in like manner, that it shall not be too readily soiled and stained. Our popular colour decorators know only too well how far this vulgar consideration applies to the melancholy tints of painted woodwork which it is their function just now to make supreme. Perhaps we may put the case of graining and marbling thus:—When the imitation is too pretentious for possibility, it is no better than the too majestic mimicry of the stage, where the jewels are glass and the gold tinsel; but so long as it is kept within the limits of common sense, for the mere purpose of producing a decorative finish by confessed imitation, the better that imitation is the more graceful is the effort of workmanship, and the more to be encouraged as a thing that ought not to become a lost or even a degraded art. As for the varnished deal-work now so common (in every sense), although it would be quite an error to disparage it in principle, one may safely ask whether, in order to make it really presentable to a fastidious age, it does not require much better workmanship than is customary, and better material than it would pay to use."

The Stafford House imitations of marble, I may here mention, are not of the ordinary painted nature, as the above able writer appears to class them, but consist of a kind of imitation *veneer*, known as the *scagliola* process. This noble building, the town residence of the Duke of Sutherland, is noted for possessing a grand hall and suite of State apartments which compare favourably with any building in London, those of Buckingham Palace in some respects not excepted. The hall and staircase to which the writer evidently refers is a magnificent piece of work. Some idea of its imposing aspect may be gathered from the fact that it occupies, on a rectangular base, the whole of the centre of this mansion. Its height from floor to roof is about seventy feet, and it is computed that a thousand foot soldiers can be placed upon the ground floor. Its connection with my paper will be fully justified when I explain that the greater portion of the wall surfaces and the massive Corinthian columns of this staircase are all decorated with the "scag," marble imitation. Thousands of square yards there must be; and a grand effect it gives, being moulded and panelled out, and with immense oil paintings in the centre of the wall flanks. I believe it is without a rival of its kind in the kingdom; and as a noble example of imitative work its existence is one of the best answers to John Ruskin's tirade that the student of such work can find comfort and encouragement in.

The papers on house painting which appeared in Vol. I. of WORK have made the earnest reader who accompanied us through that series familiar with most of the materials required for graining and marbling, as well as with the practical elementary stages of "brush work," as the plain painting is termed. Although no effort will be spared to make this set of technical papers complete in itself, it must be understood that the contents of the former series are invaluable to the student of graining and marbling, and that in compiling these lessons on "the art of graining" I have assumed, necessarily, that the primary knowledge above mentioned is common to both writer and student.

Grounds for Graining and Graining Colour are terms denoting two very important factors in connection with the imitation of woods, the meaning and practical working of which the student must thoroughly master before he endeavours to produce the features and markings characteristic of any specie of wood. The "ground" is a technical term involving two distinct ideas: namely, *surface* and *colour*. A properly prepared and painted *surface* should be free from grittiness, coarse brush-markings, dents, or excrescences, and should present a smooth and hard appearance. The amount of *gloss*—dependent upon the proportions of linseed oil and turpentine used in mixing the grounding paint—is scarcely a matter of strict rule, but rather a consideration of circumstance and the personal preferment of the grainer. Some skilled workers advocate about three parts linseed oil to one of turpentine, whilst others fully practised in the work use equal proportions, or even the reverse of those first mentioned. The student may with advantage bear these points in mind: where oil-graining with steel combs is used, the first-named, "hard-gloss," is the best. A dull gloss is more pleasant to work upon in graining by water or distemper process; the water-colour has more affinity thereto, and does not "cess" or run off. For the best class of this distemper graining I, personally, prefer a dull gloss, in which imitations, however, two coats of varnish are necessary for a good finish. On the other hand, there is a distinct advantage in using a hard oily ground for water-graining, since the oil has a considerable binding nature upon the pigment (when the water has evaporated from the work), and, consequently, one coat of varnish will "bear out" much better upon this latter than upon work executed on a dull paint. In no case can a good "ground" be obtained with dead or "flatting" paint; for there must always be sufficient oil in the colour to allow the paint to be thoroughly spread and lightly "laid off," and hence ensure the above quality of freedom from coarse brush-markings. As to the *colour* of the ground employed, this, of course, is principally defined by the wood we are about to imitate, whether oak, mahogany, or maple, and so forth. Beyond this leading fact, however, there is a wide range of knowledge to be acquired, by careful observation and experience, ere the student can correctly judge the combined effect of the two distinct factors, *ground colour* and *graining colour*, when manipulated together in the likeness of a wood.

Properly prepared Graining Colour should be characterised by two distinct qualities. Firstly, that of *working freely* and cleanly, not only from the brush, whilst being spread, but during the subsequent manipulation. Secondly, that correct and *particular colour* combined with the transparency of the pigment, which, when superimposed upon the "ground," shall imitate the colour of the genuine polished article. This matter of combined colour effect must be thoroughly grasped by the mind of the would-be grainer, since it is the chief working principle upon which the imitation of the wood is based. It is no uncommon occurrence for a writer upon such kindred subjects as painting and graining to be asked for directions to make "graining paint": that is to say, an opaque "body" mixture which shall give the appearance, without the two distinct "grounding" and "graining" processes, of oak wood. A little study of the above will show that this is impossible. So soon as *white lead* is mixed with the pigments from which the graining colour is made, the transparency and richness of the latter are practically nullified; whilst the graining colour alone, being only of the nature of a *stain*, lacks the preservative and protective qualities of a white lead or other "body" preparation.

The Preparation of Woodwork for Graining is a matter here calling for our attention. Although the imitation of oak is very often adopted for woodwork that is very rough and imperfectly "got up" by the joiner—as much on account of the figure "taking the eye off" this defect as for the serviceability of the graining—a smooth surface and ground are a desideratum. The "filling up," that is, making level, of such poor woodwork is a matter that must be relegated to a future series of papers; but, given a fairly good door, the following processes will ensure for us a satisfactory ground for working upon. The door should first be lightly papered, unless the joiner has done it for us, with No. 1½ glass-paper, and then thoroughly brushed down with the dusting brush (shown in illustration of painters' brushes, Vol I., page 820). The knots in the wood are then coated thinly once or twice, according to the nature of the knot, with "patent knotting" composition, the most transparent of which is the best. This dries in a few minutes, when the work is coated with priming made from three parts white to one part red lead, one-tenth in weight or bulk of paste or liquid driers added, and the whole diluted to a thin paint with three parts linseed oil to one part, or less, of turpentine. When dry and hard, the second coat is made of an oily nature also—say one-third of turpentine to two of oil. This should be used "rounder," or thicker, and be made from white lead and driers, but stained a few shades darker than the desired ground, and which latter we obtain by the third coat. It should always be borne in mind that any coloured paint will cover far better upon a previous coat a *few shades darker* than if the reverse is tried. Suppose we are desirous to imitate light oak—that is, new oak without any artificial darkening—our second coating may advantageously be used of the depth of colour given by the real oak wood. The ground colour—in this case the third coat, and which is the least number we can prepare new work with—will then be decidedly lighter than the second coat, and will cover much better than upon white paint. It may be advisable to mention that any nail holes should be "puttied up" after the priming, when it is advisable to let the work stand a day before painting again. Paint should always be strained before using, and the work lightly papered down and dusted previous to each coating. The pigments required for staining the white lead paint to the required ground colour is a matter governed by the colour of the wood we are imitating.

Samples of the Genuine Woods are equally as necessary to the study and practical proficiency in the imitative arts for copying from as are alphabets for the practice of sign-writing. The graining of figured oak is very analogous to hand writing: so much so, indeed, that if an employer has several good grainers working for him he is easily able, if himself a practical man, to say which of them has executed a piece of work; just

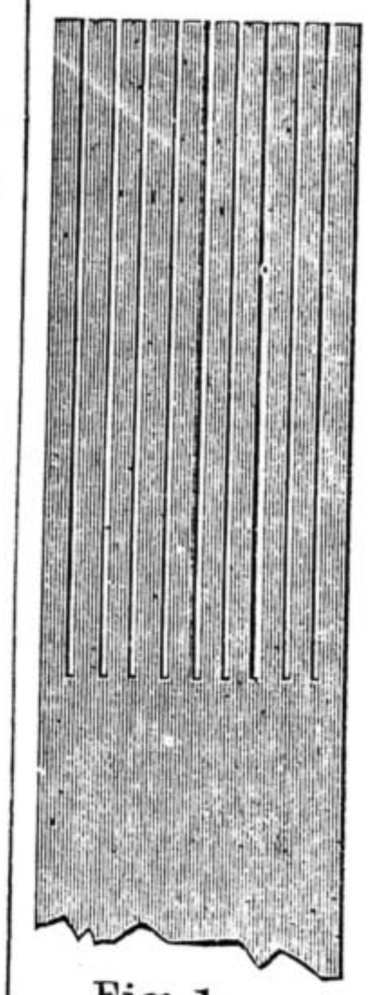
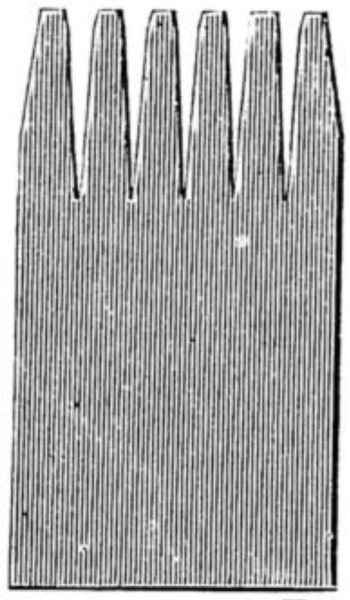


Fig. 1.



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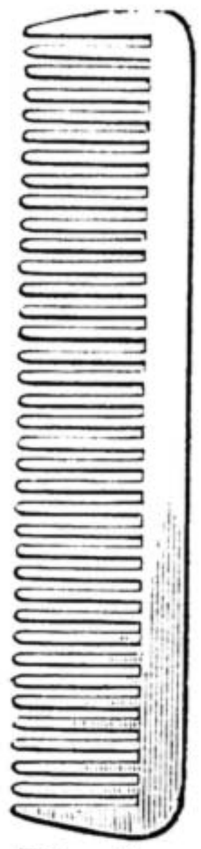

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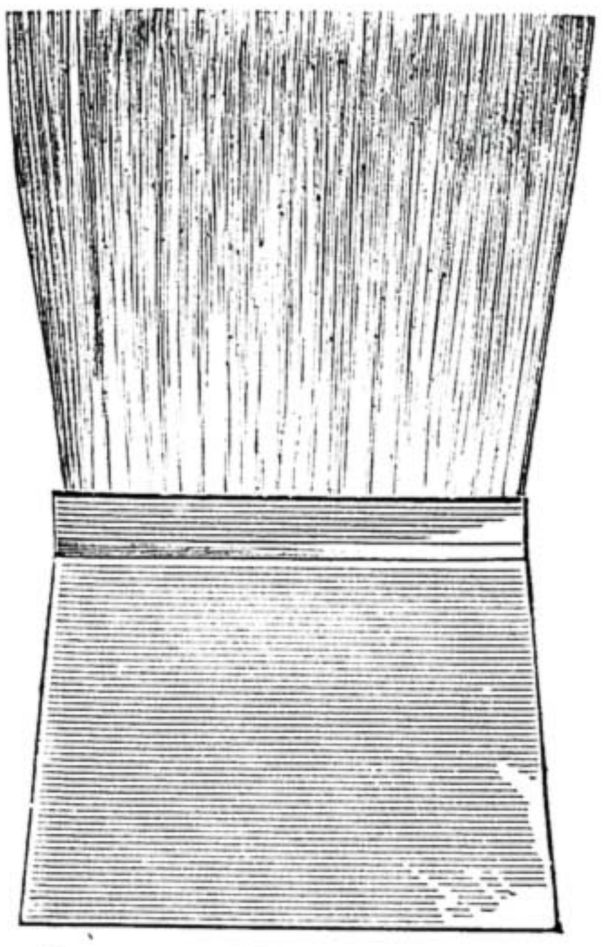
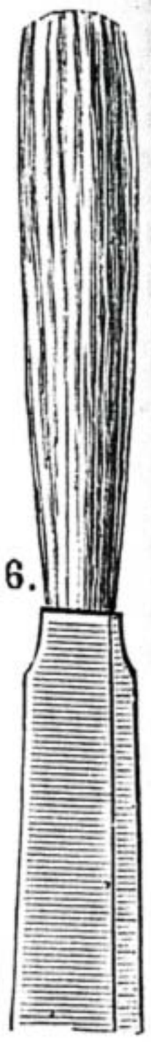


Fig. 4.

Fig. 5.



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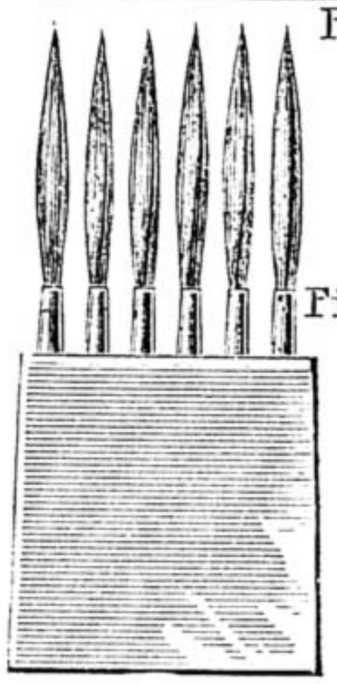


Fig. 8.

Fig. 7.

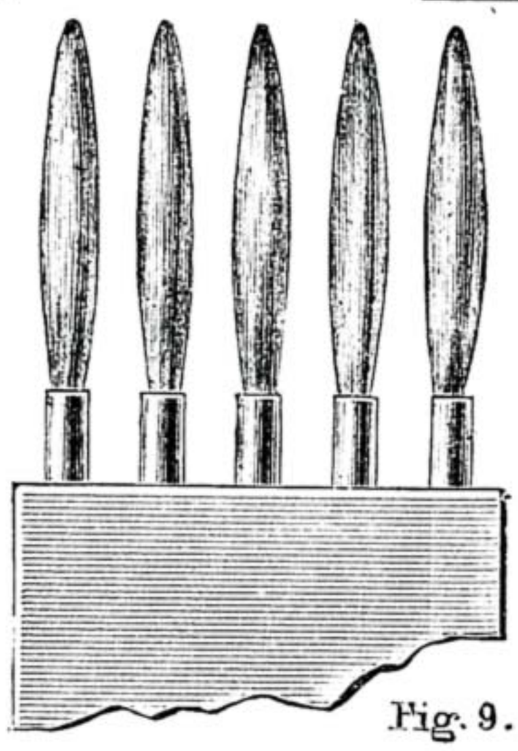


Fig. 9.

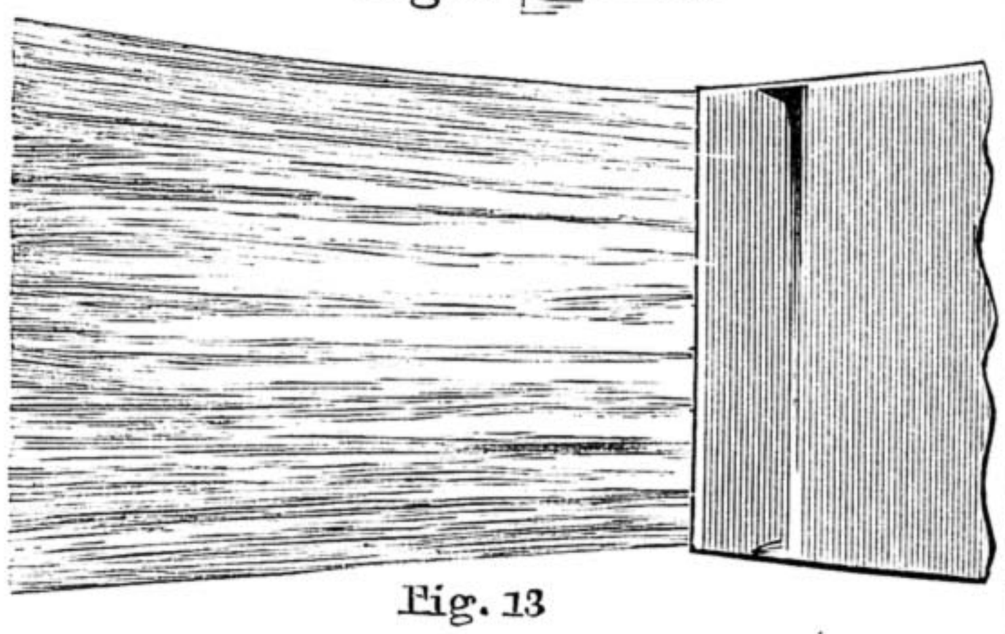


Fig. 13

Fig. 10.

Fig. 11.

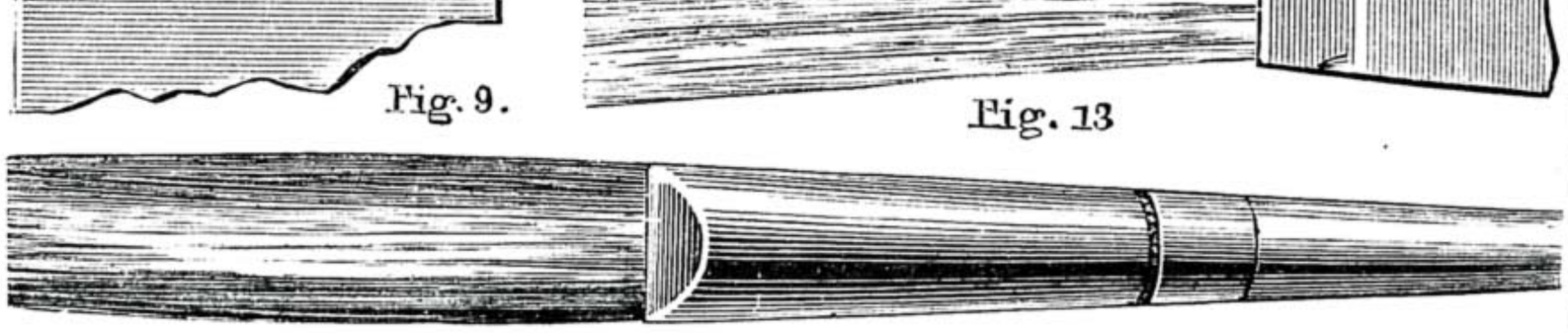


Fig. 12.

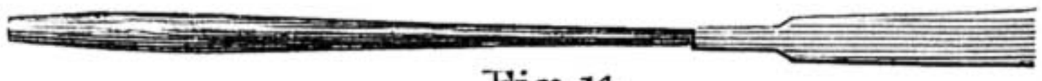


Fig. 14.

Fig. 15.

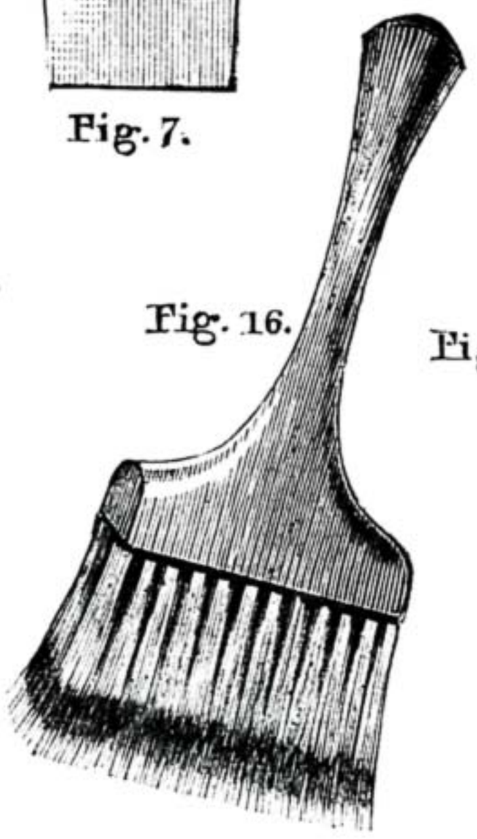


Fig. 16.

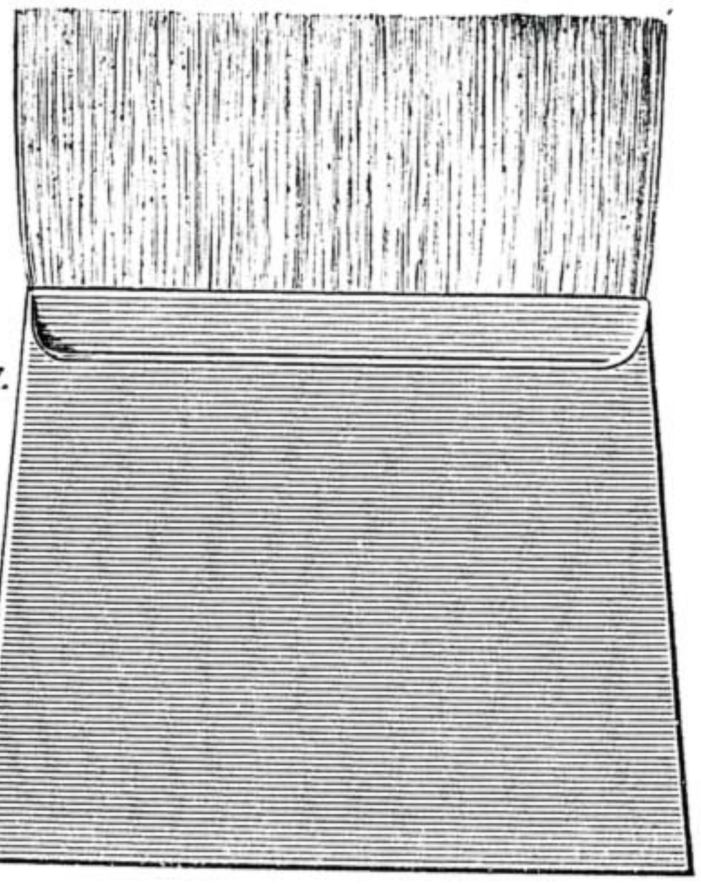


Fig. 17.

Fig. 18.

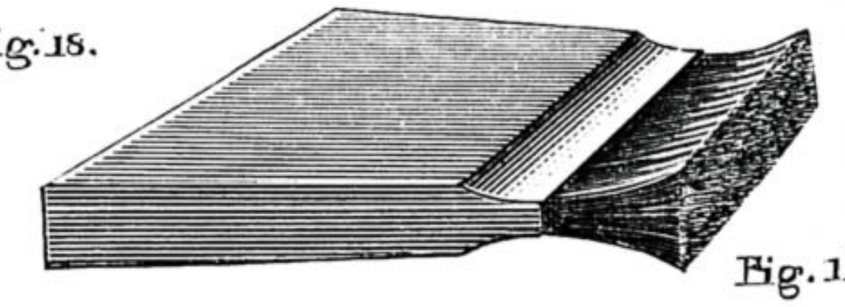


Fig. 19.

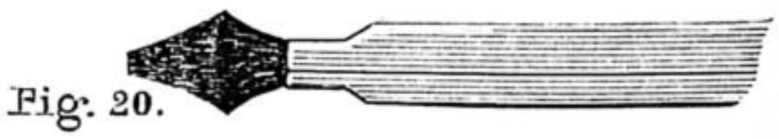


Fig. 20.

Fig. 21.

TOOLS USED IN GRAINING. Fig. 1.—Steel Comb. Fig. 2.—Leather Comb. Fig. 3.—Comb for Overgrainer. Fig. 4.—Mottler. Fig. 5.—Side View of Thick Mottler. Fig. 6.—Medium Mottler. Fig. 7.—Thumb-Piece. Fig. 8.—Sable Overgrainer in Tubes. Fig. 9.—Hog-Hair ditto. Fig. 10.—Maple-Eye Shader. Fig. 11.—Dotter. Fig. 12.—Veining Fitch. Fig. 13.—Thin Oak Overgrainer. Fig. 14.—Ditto, side view. Fig. 15.—Medium Overgrainer, side view. Fig. 16.—Badger Softener. Fig. 17.—Hog-Hair Mottler. Fig. 18.—Ditto, side view. Fig. 19.—Camel-Hair Mottler. Fig. 20.—Side View Burnt Edge ditto. Fig. 21.—Goose Sable Pencil.

as an accountant can distinguish between the handwriting of his half-dozen clerks, all writing a good hand. For the correct reproduction of oak figure especially, the necessity is a very imperative one. The student of graining cannot do better than invest in a *picked* sample of veneer of such woods as mahogany, satin-wood, maple, and walnut. Although other papers in WORK will furnish instructions for veneering them on to boards or "panels" of yellow pine, I should not advise a novice to risk injuring expensive samples by making his first "essay" with them. As they will be of life-long value, rather have them mounted by an expert hand—although there is no reason why the student should not *polish* his panels, and at the same time *well study the characteristics of each wood*. Respecting the oak pattern, it is the better plan to purchase a solid piece of good figured English oak: for this reason, that after mastering the growth and nature of the "lights" or cross-markings of one sample, we can get a friend to take a thin shaving off the surface, and thereby obtain for us another aspect of the natural growth to imitate. It is one of the peculiar charms of figured oak that with every planing of a panel some variation in the figure is apparent: a fact which the student should take advantage of.

The accompanying Illustration of Grainers' Tools represents a collection required for the ordinary imitative processes, to be hereinafter explained. Their cost and particular use will be briefly indicated in the next paper, and will be further fully considered as each tool is brought into its proper use. In my next article the graining of figured oak by the ordinary oil process will be described; and, following this, all varieties of oak graining, walnut, mahogany, maple, and other decorative woods, will be carefully and practically treated. The "present day" and artistic value of graining will be duly considered; and useful papers, interspersed amongst the above, will be given on graining furniture, plain staining and varnishing, inlaying, and decorating with woods generally. The paper on house-painters' brushes, which appeared in Vol. I., page 820, should be studied in conjunction with the subjoined illustration of grainers' tools.

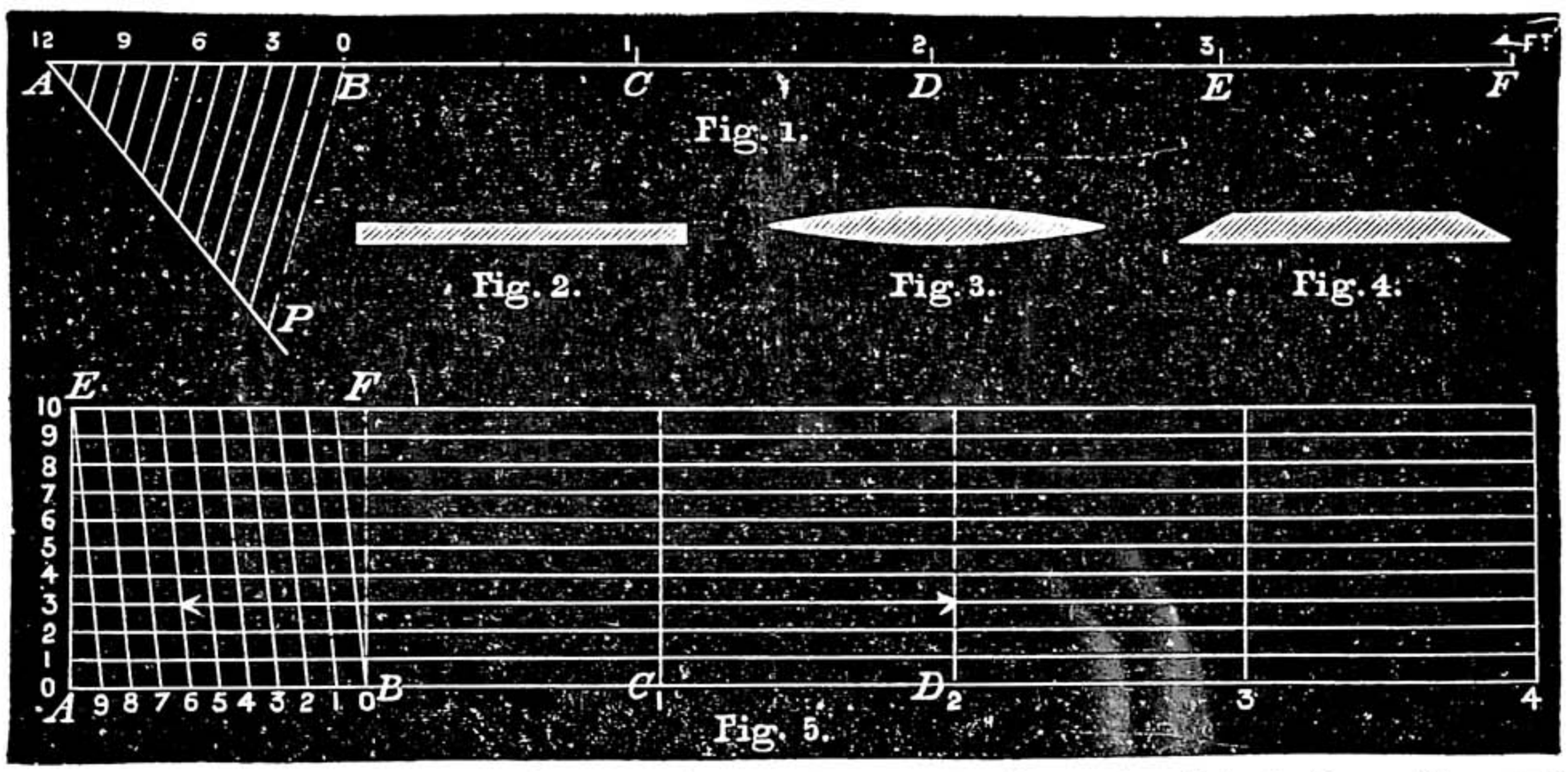


Fig. 1.—Mode of Setting out Scale in proportion of 1 in. to 1 ft. Figs. 2, 3, and 4.—Sections of Ivory and Boxwood Scales. Fig. 5.—Example of Diagonal Scale.

NOTES ON SCALES AND SCALE-DRAWING.

BY A WHITWORTH SCHOLAR.

To the vast number of the readers of WORK, who are engaged in any of the various branches of constructive industry, an acquaintance with the subject of scale-drawing cannot fail to be of interest and value. I propose, therefore, to indicate briefly the principle involved, and to illustrate my remarks by the aid of practical examples.

In the first place we may note that it is only in exceptional cases that we are enabled to make drawings equal in size to the objects they are intended to represent. For example, in plans of buildings, maps, surveys, and in fact the great majority of the instances in which drawings are employed, it becomes as necessary to reduce the representation of the object as in cases of minute mechanism (as a chronometer) it is desirable to increase them.

It is to be distinctly borne in mind, however, that to whatever extent the representation of the object is diminished or increased, the relative proportion of every part of the drawing to the corresponding part of the object remains uniform throughout. It is evident, therefore, that in constructing a drawing to scale we must provide ourselves with an artificial standard of measurement which shall bear the same relationship to the real standard of length as our drawing is to bear to the real object.

For example, in the case of a map or plan, this artificial standard or "scale," as it is called, may have an actual length of, say, 5 in., and at the same time represent a distance of 10 miles in the drawing. In this instance the scale would be divided into ten equal parts, each indicating miles, while by subdividing one of these divisions into eight equal parts, furlongs may be represented.

Here, then, we have an actual length of half an inch, which is understood to represent one mile, and the map or plan would be described as been drawn to a scale of half an inch to the mile. There is, however, another way in which this fact may be stated. The number of half-inches in a mile is $1760 \times 3 \times 12 \times 2 = 126{,}720$; and as this number of half-inches is represented by one half-inch, it is evident that our drawing is only $\frac{1}{126720}$ of the real object it is intended to depict. This expression $\frac{1}{126720}$ is known as the "representative fraction" of the scale, and is sometimes used to define any particular scale in place of the equivalent expression previously explained.

In order to illustrate our remarks, we will proceed to construct a scale for a drawing, in which one foot may be conveniently represented by one inch, and of which the representative fraction is therefore $\frac{1}{12}$.

We commence by setting out upon a straight line, A F (Fig. 1), successive lengths A B, B C, C D, etc., each 1 in. in length. As these divisions represent feet in the drawing, by subdividing one of them into twelve equal parts we shall be enabled to denote inches upon our scale.

To divide each of the larger divisions into inches would be both tedious and unnecessary, for, as will presently be seen, the first division only requires to be so divided.

To satisfactorily fulfil their purpose, scales must be constructed with the greatest possible care in order to ensure accuracy. It therefore becomes necessary to explain how the first division, A B, may be accurately divided into the required number of parts. To do this from the point A, a straight line, A P, is drawn, making any convenient angle with the line to be divided. Commencing at A, we step along this line twelve equal divisions of a convenient length, as shown. From P, the end of the last division, a straight line is drawn to the point B. Then lines drawn parallel to P B through each of the divisions of A P will divide A B as desired. If due care is exercised, very accurate results may be obtained by this method. Practically, however, an expert draughtsman would directly divide the line into the required number of parts without any difficulty.

If now we examine the scale, we shall notice that the end of the first division representing feet is figured 0, and that the remainder of these large divisions are numbered 1, 2, 3, etc., in the direction from left to right: But in the case of the smaller divisions we commence at the same zero point, and figure the successive divisions so as to read from right to left. The advantage of this arrangement will be made evident by an example of the use of the scale. Suppose, for instance, that we wish to indicate upon our drawing a length of, say, 3 ft. 9 in. Placing one foot of the dividers on the division marked 3 ft. and opening the instrument until the other foot rests upon the point marked 9 in the inch divisions, we have evidently obtained the required length, which may then be transferred to the drawing.

Ivory or boxwood scales may be purchased at any mathematical instrument maker's. They are usually supplied in the form of strips rather more than 1 ft. in length by about 1 in. in width, and of various sections, some of which are shown in Figs. 2, 3, and 4. A strip containing eight different scales will be found very useful for general purposes.

These separate scales are undoubtedly very convenient. It is well to bear in mind, however, that drawing-paper expands and contracts, according as the humidity of the atmosphere varies, so that when the drawing is on a very small scale, and the measurement requires to be very accurately determined, a scale constructed, as previously explained, upon the margin of the drawing-paper will be found most serviceable. With this arrangement, both the drawing

and scale are equally affected by atmospheric changes, and the accuracy of the drawing is not impaired. Separate paper scales may be obtained, but as the various kinds of paper are not equally affected, it follows that the error arising from this cause is only partially rectified by their use.

There is another and ingenious form of scale known as the "diagonal" scale. By means of this device, very minute measurements, impossible to define in a plain scale, may be accurately and readily obtained. The principle of its construction is shown in Fig. 5, a diagonal scale showing inches, tenths, and hundredths of an inch.

In this case the divisions A B, B C, C D, etc., are each 1 in. in length, the zero point being at B, and the first division, B A, being divided into ten equal parts. The vertical height of the scale, which, in this instance, is much greater than in ordinary scales, is also divided into ten equal parts, through which divisions horizontal lines are drawn. The upper horizontal line, E F, is also divided into ten equal parts, and oblique lines drawn from the points in A B to those in E F, the point B being joined to the first point in F E, and the remaining lines drawn parallel, as shown.

Suppose now that we wish to obtain a length of 2 in. $\frac{6}{10}$ths and $\frac{3}{100}$ths of an inch; or, as it would be generally expressed, 2·63 in. To obtain this length we place one foot of the dividers upon the point where the vertical line, D, and the horizontal line, 3, intersect, and the other foot on the point where this horizontal line cuts the oblique line figured 6; the distance so obtained will be 2·63 in. as required. That this is so may be seen from the following considerations:—The distance between F and the first oblique line is, by construction, $\frac{1}{10}$th of an inch, and this distance uniformly decreases until at the point B it vanishes completely. It is evident that as we descend from F to B, at each of the horizontal lines this distance becomes $\frac{1}{10}$th less than at the previous one; and therefore at the horizontal line, 3, we have remaining $\frac{3}{10}$ths of $\frac{1}{10}$th $= \frac{3}{100}$ths of an inch. The distance D 6 taken along the base line gives 2·6 in., and by measuring on the third horizontal line we add the $\frac{3}{100}$ths just referred to, and obtain the required length, 2·63 in. Diagonal scales may be used for a variety of purposes, and, when carefully constructed, give very accurate results.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

5.—MOSELEY'S "COMPACTUM" TOOL CABINET.

SINCE the amateur workman went into action in downright earnest, and aspired to turn out specimens of handicraft in wood that would compare favourably in point of construction, finish, and utility with articles made by his professional brethren, tool-makers and dealers have certainly done their best and utmost to provide him, not only with good-looking and well-contrived tools, but with handy bits of furniture—for so the tool cabinets of the present day really are—to serve not only as fitting repositories of his tools, but also to be utilised as a work-bench, and to spare him the necessity of cumbering his "den" with an ordinary work-bench if the exigencies of space and conditions of life are such as compel him either to indulge in his liking for manual work in his own special room or to leave it alone altogether.

The latest in the field is the "Compactum" Tool Cabinet, invented, manufactured, and supplied by Messrs. Moseley and Son, 323, High Holborn, London, W.C., of which an illustration when closed is given in Fig. 1, and another, showing it open, in Fig. 2. When shut up, it presents the appearance of a handsome-looking tool cabinet, 3 ft. 6 in. long, 3 ft. high, and 1 ft. 5 in. deep, with a carpenter's bench at top of the length just named, but slightly wider. The bench is fitted with a thoroughly good parallel bench vice and a bench stop, as shown in Fig. 1. If kept in a room that is used for other purposes than joinery and cabinet-making, a cloth can be thrown over the bench and the general purpose of the cabinet kept out of sight, or, at all events, in the background. One of the chief claims of the cabinet lies in the admirable way in which every inch of space within its bounds is utilised. Immediately below the bench is a long narrow drawer, with compartments for nails, screws, etc., and, as shown in Fig. 1, there are other drawers on the left-hand side of the cabinet, about half its width and length, forming a useful place of deposit for carving tools, etc. These drawers occupy an intermediate space between the cupboard in front of the cabinet, which is closed with two doors, and is fitted up with tools arranged on the back of the cupboard and within the doors, as shown in Fig. 2, and a rising and sinking tool rack. This rack, when raised up, forms a back for the cabinet, and is fitted up with tools, as shown. When it is lowered it gives width to the bench and makes a flush top, affording a sufficient surface for fitting and planing up wide work. The compartment on the right of the cabinet between the front cupboard and the space occupied by the tool rack is utilised for the reception of an extension piece for the work-bench, a leg for its support, and large planes and other tools for which room cannot be conveniently found in the cupboard in front or the rack behind. It will be seen in Fig. 2 how this extension piece is utilised. On the inside edge are two dowels, which enter holes in the edge of fixed part of the bench. Under this piece is fixed a leg, which supports the extension piece and imparts to it a necessary firmness and rigidity. It will be noticed that there are two holes in the front edge of the bench, which enable the extension piece to be fitted on in front as well as to the end, forming a convenient addition for wood carving, etc., the workman being able to sit at work of this kind on a stool provided for the purpose. The three special points claimed for this bench over any other that is in the market are (1) The sinking tool rack, which makes a flush top to the bench, and thus does away with the necessity of having a raised back to the cabinet; (2) the extension piece, which, when fitted to end of bench, makes its entire length 5 ft.; and (3) the fitting of the extension piece to the front of the bench, forming a compact and handy carver's table, so that when the operator is at work all the necessary tools can be arranged for use nicely within his reach. The price of the cabinet, with tools, is £16 16s.; without tools £9.

THE EDITOR.

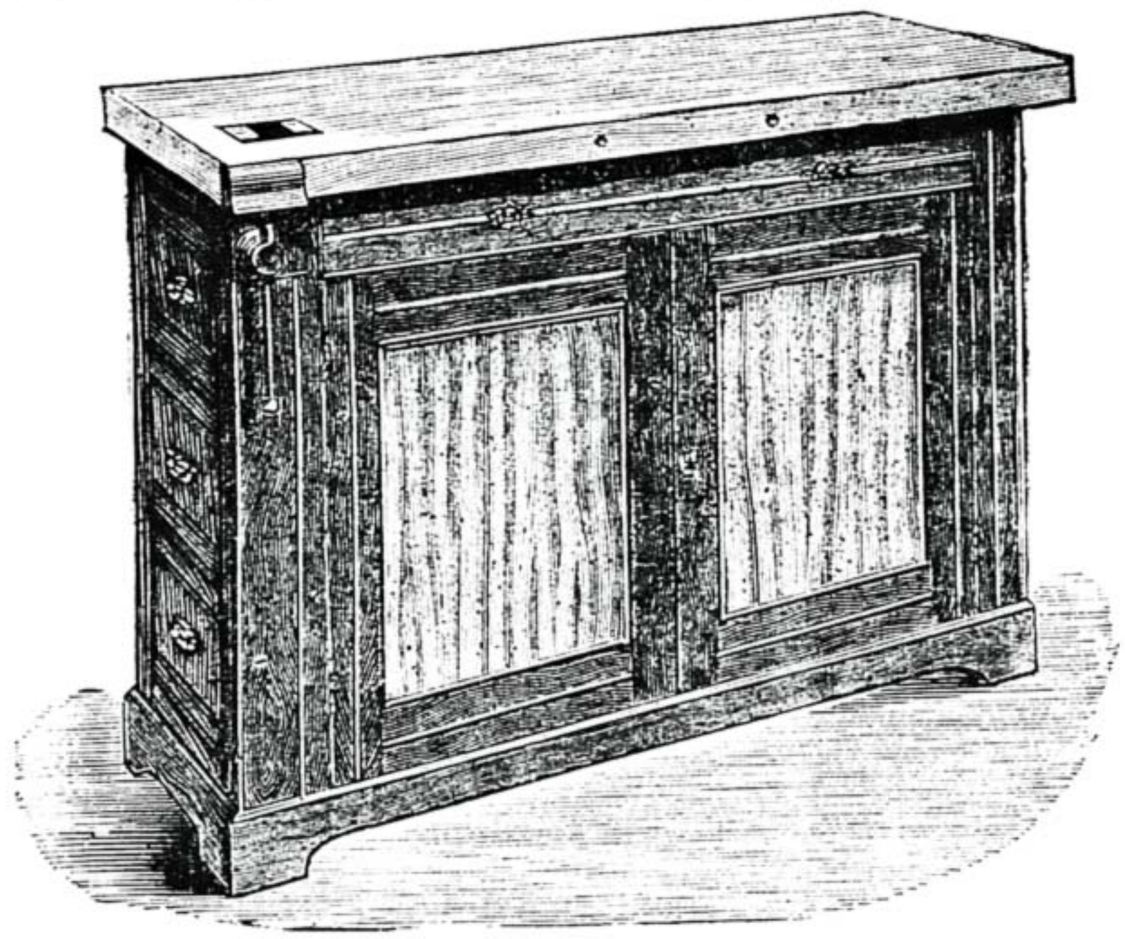


Fig. 1.—Moseley's "Compactum" Tool Cabinet, closed.

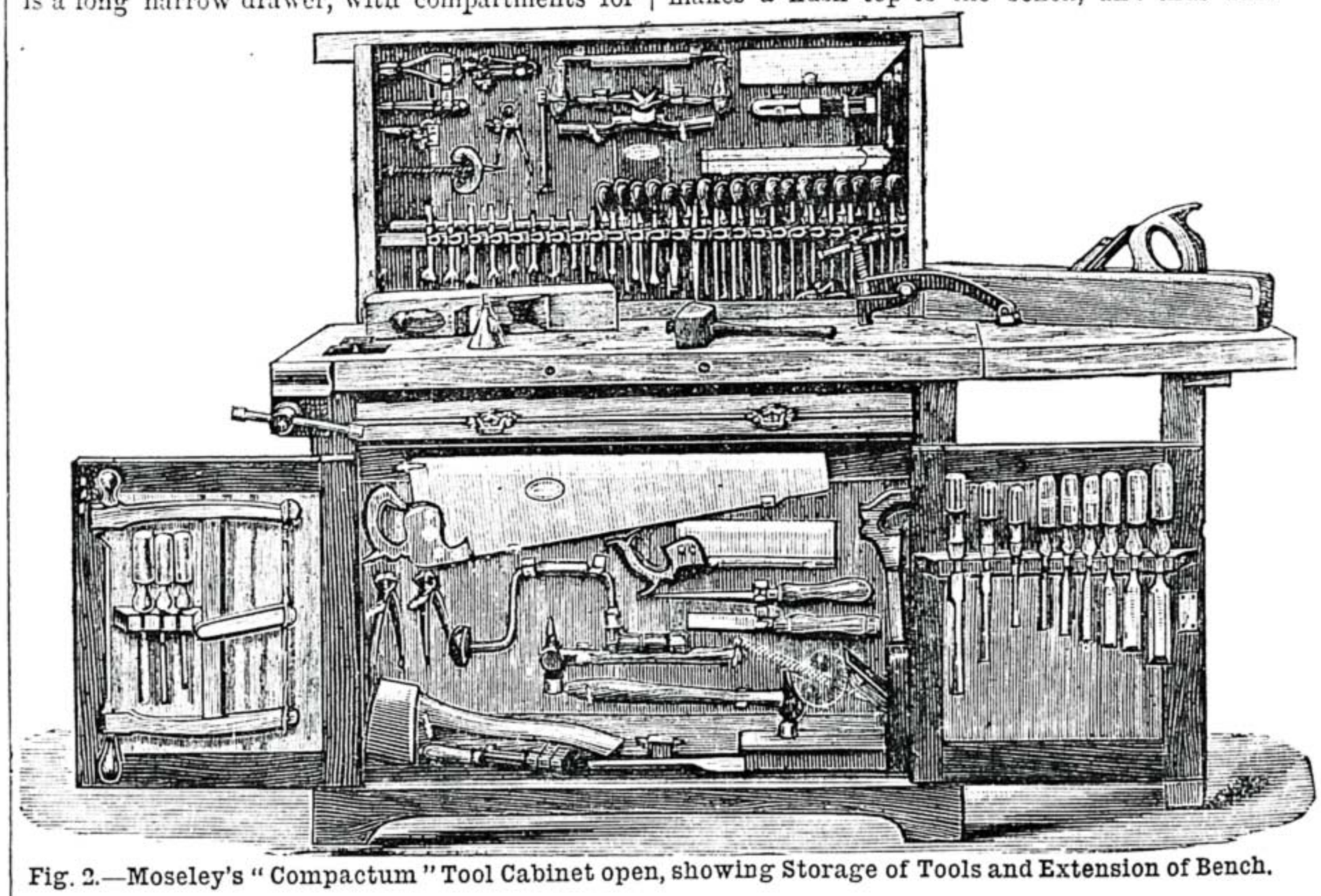


Fig. 2.—Moseley's "Compactum" Tool Cabinet open, showing Storage of Tools and Extension of Bench.

SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

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

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Timber Measuring.—A. R. (*Scorrier Saw Mills*) writes:—"The following simple rules may be of benefit to many amateur readers of WORK:—To bring scantling to 1 in. board measure, multiply the breadth by its thickness, and by its length, and divide by 12. Suppose a piece to be 4 in. by 5 in, and 12 ft. long, example—

5
4
—
20
12
—
12)240(20 ft. super.
24
—
0

Again, to find the number of square feet in a board or plank of any length or breadth, multiply its length by its breadth and divide by 12. Example, a plank is 14 in. broad by 20 ft. long—20
14
—
12)280(23⅓ ft.
24
—
40
36
—
4

To find the contents of round timber, multiply ¼ girt by ¼ girt and by length of log and divide by 144; for instance, a log 52 in. around the centre, ¼ would be 13 in. or ¼ girt; suppose the log to be 24 ft. long the following will be the contents— 13
13
—
39
13
—
169
24
—
676
338
—
144)4056(28⅛ ft.
288
—
1176
1152
—
24

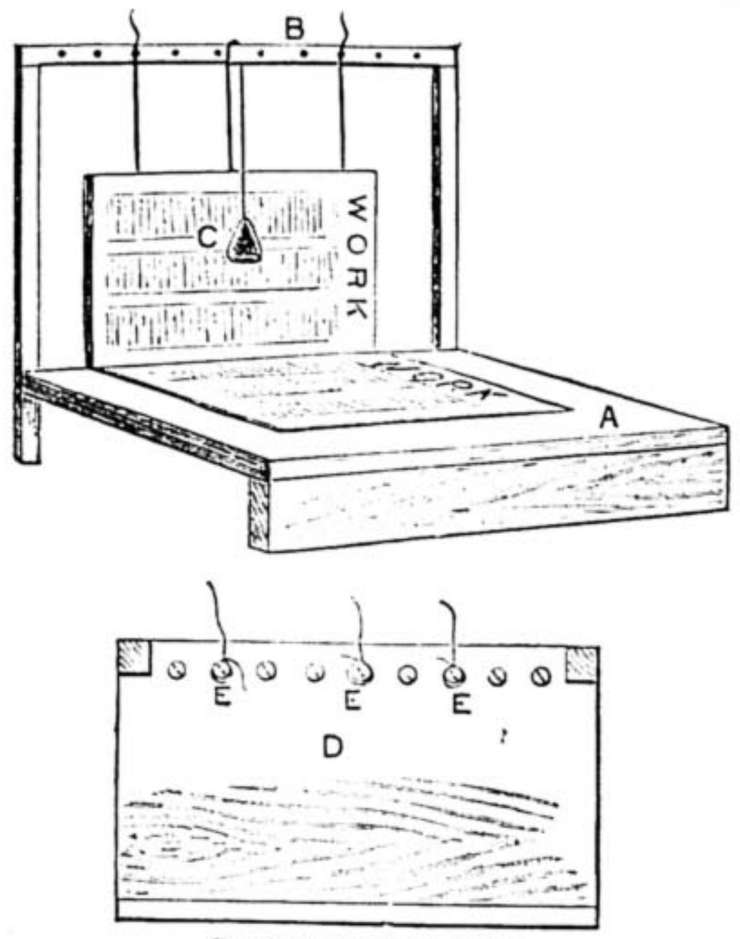
The above remarks may appear very simple to many professionals who read the pages of WORK, but many an amateur may be enlightened by them."

Slide Valve.—ERRATUM.—T. R. B. (*Newcastle-on-Tyne*) writes:—"For steam-post (see page 810, Vol. I.) please read steam port."

Mitre Cramps.—KILBURN writes:—"The Kildonan (see page 636, Vol. I.) Combined Mitre Block and Cramp is the best design I have seen yet. It is far before H. J L. J. M. (*Ealing*) (see page 766, Vol. I.). I can't see how he is going to nail his frame. He speaks of inserting thin wedges. I understand a wedge as having a thin and a thick end which won't answer in that kind of work I think. I should like enlightening on the triangular piece of Kildonan's cramp—whether it is first made in one whole piece and then cut, or is it made in two small triangles as represented in design?"

An Easily-Made Fret Machine.—F. R. C. B. (*Camberwell*) writes:—"I have seen W. R. S.'s fret machine (see page 332, Vol. I.) and I consider it the best of any I have seen. For an amateur who intends to make his own machine there is no better than this. It is cheap, simple, and last, but not least, it has a vertical cut. If there is any one who does not quite understand what W. R. S. means, he has only to communicate with him, and I have no doubt he will be as glad to let him see the machine for himself as he was me."

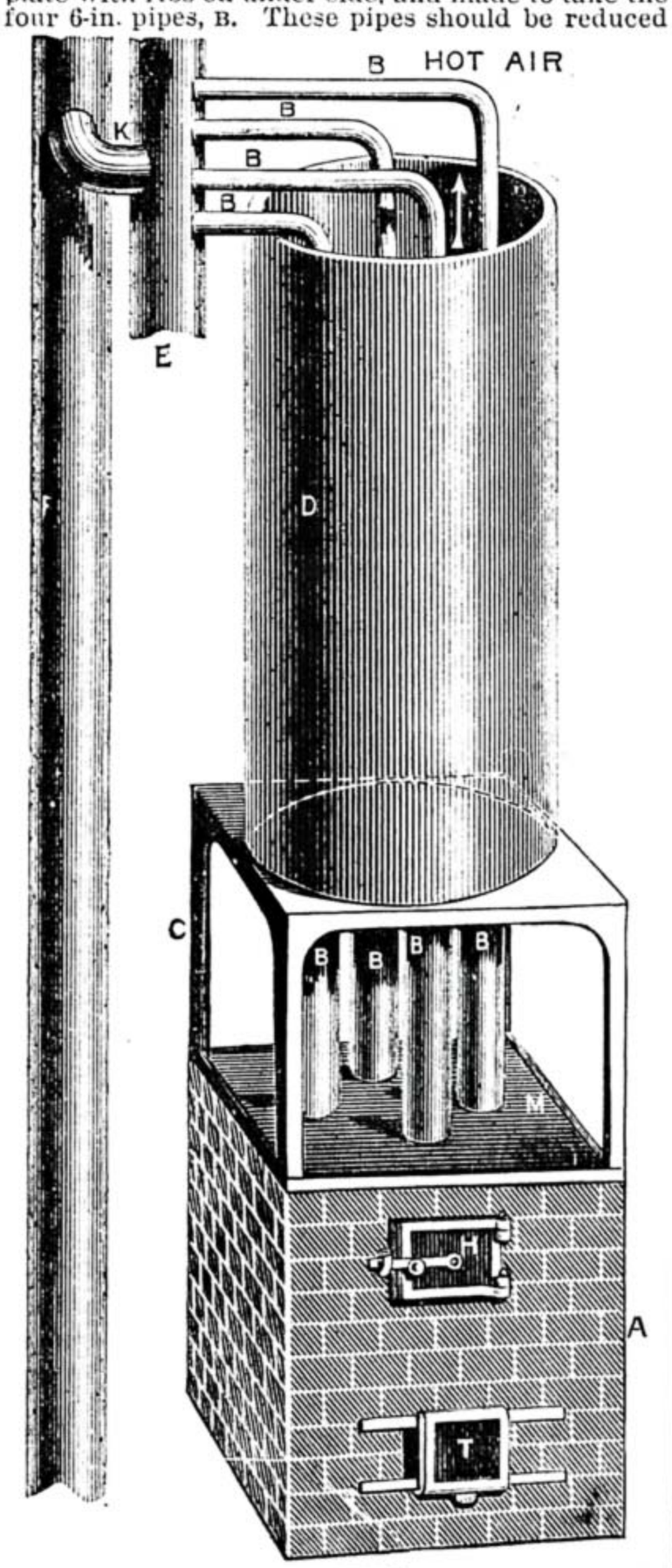
Bookbinding, etc.—J. S. A. (*Manchester*) writes:—"I am pleased to see this subject is being treated (see page 716, Vol. I.), as I have taken in WORK from its commencement, and should like to bind it myself. I have made a frame for stitching books, a rough drawing of which I send, as it may be helpful to some of the readers of this valuable paper. The following are the parts of the little appliance":—



Bookbinding Frame.

A, Table for book to rest on.
B, Top rail with holes bored through for receiving string.
C, Piece of lead tied to the top to hold half of the leaves up while stitching.
D, Table turned over to show how strings are fastened underneath the table by means of a row of screws marked E, to correspond with the holes on top. The frame is all wood, and is easily made and very cheap.

Hot Air Fitting.—ARTIST IN WOOD writes:—"I forward you a sketch showing how best a top room may be filled with hot air from a furnace in the basement of building. A, furnace of fire-brick or grate wanted; size for very large one 2 ft. square, 3 ft. deep inside. H, door to put the coke in; T, door to admit air, and take out ash; M, cast-iron plate with ribs on under side, and made to take the four 6-in. pipes, B. These pipes should be reduced to 2-in. where they enter the soot box, E. F, chimney; K, 6-in. pipe from soot box to chimney; C, cast-iron frame, open spaces 17 in. deep all round to admit air; D, drain pipe 26-in. to enclose the pipes, B. There should be a good thickness of fire-brick at bottom of furnace. Make the furnace top so that it can expand with heat. Do not let the other casting rest upon it, but on brickwork fix a thick fire-tile to the doors. If the fire burn too fast, open door H, and close door T. May be made any height from 12 ft. length of stove pipe. A large volume of air will blow very quickly up the shaft. D, made of drain pipe. This is the cheapest and most effective of all heating operations that the world has ever seen."



Hot Air Fittings.

How to lay out Saw Mill Machinery.—A. R. (*Scorrier*) writes:—"Many and varied are the opinions of engineers and others as to the best way to lay out the above, and it is a question that requires a deal of study before a commencement should be made to fix the machinery; if not properly fixed, much power may be taken that otherwise might be saved. Although I do not class myself an engineer, I take great interest in such work, and have studied it a great deal. As this paper is open to criticism, should I make a wrong statement I shall expect to hear of it. In going through a saw mills I always take notice how and where each machine is fixed, and in three cases out of four I consider a deal of power is wasted, which means cost, and lost cost, unless the machinery is refixed, which is an expensive affair. Whenever machinery of any kind is to be fixed, there should be forethought; if put in by random, when it is too late, it is said, if I knew or thought of it I would have had my machinery laid out different. I have seen fixed, and helped to fix, more than one machine, for saw mill work, and will try to show what I consider the best and easiest way to drive such machinery. In the first place, you should know what machines you are going to fix, and about the average power it will take to drive each machine, then the size and length of shafting, and number and size of pulleys to be keyed on the shafting, allowing for each ton weight 1 H.P.; this will give an idea what power engine will be required. The kind of engine I prefer for saw mills generally is a semi-portable. I will give my reasons. First, it takes little room; 2nd, it is easily fixed; (3), steam is soon got up; (4) it is very steady, the boiler being over the workings, and resting on the frame of engine; (5) it takes but little time in cleansing the boiler; (6) it runs at a good speed, which is an important point, as the main shaft should run at a speed of from 220 to 250 revolutions per minute. If the engine runs very slow, a large wheel is required on it, and a small one on the main shaft to get up the speed, therefore the main belt has to be at a great tension, which means waste of power and a short life to the belt. Again, as a rule the main belt is driven from the fly wheel. I consider this a great mistake, as it is a check on the engine, and the engine often gets centred, when there is a difficulty in starting again. The better way is to have a belt wheel on the opposite end of crank shaft smaller than the fly wheel, and a much tighter rim than the rim of fly wheel, the fly wheel being larger and the rim heavier; when it gets up to a certain velocity there will be a force in it which will greatly help the engine, and do more work and with greater ease than if the belt was on the fly wheel. Again, if possible (I use the word possible, because there are exceptions), it is not at all times that the ground room can be had to do as we should wish; therefore I say, if possible, fix the engine so as to drive the main shaft from the centre, as it will drive with less power than if driven from the end; and on either side of drum or pulley, over which the main belt runs, there should be a bearing to take the pull of belt, and to keep the shaft from vibrating; this should be the case wherever there is any great strain by belt. I would also recommend a friction clutch as made by Bagshaw & Co., Yorkshire, one on either side of bearings taking pull of main belt, so that at any time should there only be work for a part of the machinery, the clutch can be thrown out of gear, and that part of the shafting and machinery thrown idle. Again, if you have several machines to drive, key the pulleys that are to drive the heaviest machines one on either side of main belt pulley, then the next to the heaviest on either side of them, and so on, so that the lighter machines may be farthest from the centre of shaft; this will regulate the load, and the engine will do her work with less steam, which means a saving of fuel. Again, counter shafting should be avoided as much as possible, but if it cannot be avoided drive off from as near the centre as possible, not forgetting to reserve the lightest machines for the counter shafting, and if convenient run the shafting from underneath, as the bearings can be fixed more firm, and shaft will not vibrate as if driven overhead; vibration is injurious to all saw mill machinery, and causes the brasses of bearings to cut quickly; again, much power is wasted by having too small a pulley, and too narrow. This is a very important point. If belts are run over good size pulleys they need less tension, and do not give so much trouble by frequent slipping, and will last much longer. In a future issue, with Editor's permission, I hope to write briefly on the slipping of belts. In a back number a correspondent writes in reference to jaw-cracking words, and condemns such; I feel sure if any one looks for such in this letter he will be deceived. I think the most illiterate may understand the above, and I hope it will benefit many of the readers of WORK."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Colour Mixing.—£ S. D. (*Navan*).—You will understand by the date at which your answer is given, how utterly impossible it is to reply to technical questions in "Shop" without a long interval transpiring. The two pieces of wall paper you enclose are in colours that are usually called "light sage" green or "lettuce" green — terms usually adopted to give the unprofessional worker a notion of what particular hue of green is meant. Olive green would hardly be a correct term: this word is usually associated with a much darker and more blue kind of green. Should your woodwork still be waiting, as a professional worker of varied experience, I should advise painting the panels about the colour of trimmed edge sent, and the remainder of woodwork, skirting, etc., a much deeper shade, more approaching a russet brown. The panel mouldings might then be picked out with either a dark rich marone, burnt umber, or soft coral colour. Either would be harmonious—the coral would be the prettiest, and the umber the most sober. You should then varnish all of it with inside oak varnish. There is but a very slight difference between the two shades you send and have marked; that on the flower is slightly lighter and more yellow. To mix the paints recommended, you will require for the light about 3 lb., made from about 1½ lb. of white lead, ¼ lb. patent driers, mixed well, with equal parts raw linseed oil and turpentine, to working consistency. To get the desired colour, stain with yellow ochre and a little green or blue pigment, purchased ready ground in oil; should your colour appear too bright, tone it down with a very little umber. This would be, as you desire, a paint composed of the least harmful pigments, and such as nearly all inside work is done with. For the styles, etc., if you prefer merely a darker shade of same colour, more yellow, green, or blue and umber will give it you; but if desiring the brown, this would require but little white or green—principally ochre and umber. For mouldings, burnt umber and a little ochre mixed in turps and varnish; if marone, use deep Indian red: purchase twopennyworth, dry, and this with white will make coral. The turps and varnish will dry the latter, but, of course, the style colour will require some patent driers—about one-eighth part. Strain all your colours before using through fine muslin.—F. P.

Silvering Glass.—A SUBSCRIBER asks:—"Will you inform me what are the ingredients used and the routine for using of same in silvering plate glass?"—I have already, within the last few weeks, replied to similar questions. If A SUBSCRIBER thinks of silvering plate glass of any considerable size, my advice is the same as *Punch*, under other circumstances, has given—"Don't." It requires skill such as is only to be got by much practice; besides, to do it on a limited scale would be more expensive than to purchase the glass silvered. I have succeeded in doing small pieces fairly well, but should never attempt a considerable plate of glass. The work must be done on a perfectly level table, marble by preference, with a gutter around it to save the mercury. Spread a sheet, or sheets, of tinfoil, which must be larger than the glass. Lay the foil perfectly smooth without creases. On this pour pure mercury, and carefully spread it over the foil with a haresfoot. See that the glass is perfectly clean and free from all grease. On the amalgam place a sheet of smooth paper, and on the paper lay the glass. Now by a steady pull draw away the paper; by so doing any dirt on the surface of the mercury will be removed, also the film of air. Place a weight on the plate and leave for some hours, then tilt it on its edge for the mercury to drain. There is also a chemical method, but from A SUBSCRIBER'S letter, I presume the above is the one desired; if not, write again. The tinfoil can be procured at any mathematical instrument maker's; sometimes druggists keep it.—O. B.

Graph Composition.—AMOR SCRIBENDI (*Castlejohn*).—Soak two ounces of best thin Russian glue in four ounces of cold water for twelve hours, then put over a gentle fire, and when melted, add eight ounces of common glycerine and five drops of carbolic acid as a preservative. Paris whiting must now be added until the mixture is of the consistency of thickish cream. Thoroughly mix and set in a shallow tin tray to set. This preparation must not be allowed to boil when on the fire. I have other formulas, but this is the most simple and the cheapest. For ink, purchase a bottle of aniline ink from any rubber stamp maker, or, for home-made article, dissolve a penny packet of Judson's purple dye in two tablespoonfuls of hot water.—H. L. B.

Magazines for Decorators.—M. T. C. C. (*Belfast*).—"The Journal of Decorative Art," price 7d. monthly (postage 4d.), is *the* decorator's paper, and full of useful designs and information. The publishers brought out a Christmas number, price 1s. 6d., post free, which shows how to decorate a drawing-room from start to finish, and for which purpose it contained a coloured plate and eighteen full-sized stencil designs ready for cutting. The publishing offices are at 15, St. Ann Street, Manchester. Order through any newsagent.—H. L. B.

Cleaning Silver-Plated Goods. — WAITER (*Ganton*). — Get some carbonate of ammonia or some hartshorn shavings, and dissolve in the water used for washing the silver-plated articles. This will remove newly-formed black stains. To remove those old black marks mentioned in your letter, powder up a little of the carbonate of ammonia, and mix with some plate powder; make the whole into a paste, and rub it on the stain until it has been removed. You might try a little of Brooke's Monkey Brand Soap, it is an excellent thing to remove stains from metal articles.—G. E. B.

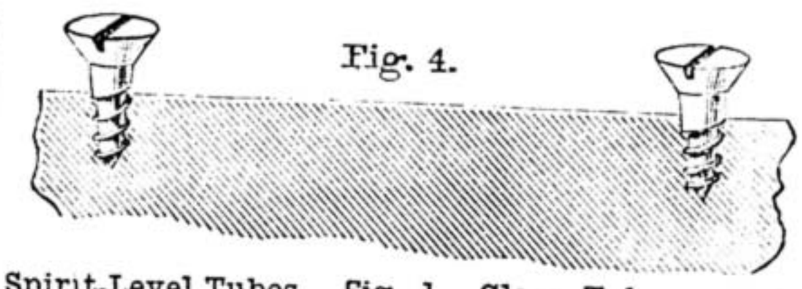
Spirit-Level Tubes.—D. J. (*Oldham*).—The knowledge of how to choose and fix a spirit-level tube may be useful to others besides the querist. These tubes are of glass, and are made by drawing out when hot in the glass-blower's blowpipe flame glass tubes of a suitable size; a tube becomes smaller and smaller as drawn out, but with care, does not cease to be a tube, though when twisted hot, or broken cold, and placed for a moment in the flame, the small tube existing at the thin point is easily sealed up. These tubes are not straight, though their crookedness is so little as hardly to be seen; the most crooked of them form the tubes known to workmen as quick, because the bubble quickly comes to the highest portion of the tube; if, therefore, quickness of movement is desired, let D. J. (*Oldham*) get a crooked tube. Now, if he considers for a moment, he will see that in fixing the rounding side must be uppermost, as in Fig. 2. A tube like Fig. 1 would be quite useless, as the bubble would divide into two portions, as shown, and no indication be possible; but let the tube be turned over in its receptacle, and be placed as in Fig. 2, the bubble comes to the centre with great promptitude. These sketches, which are exaggerated in order to appeal more strongly to the eye, will give some idea of how to choose a tube, reminding ourselves, however, that for the sake of accuracy, a tube nearest straight is best; further, a tube which is quite straight for a portion of its length, and curves off towards one end, is very undesirable; of course, if the tubes could be uniformly larger in the centre, as if formed on a turned model, no care would be necessary in mounting, as in Fig. 3.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



Spirit-Level Tubes. Fig. 1.—Glass Tube wrongly set, curvature exaggerated. Fig. 2.—Glass Tube rightly set, curvature exaggerated. Fig. 3.—Tube that might be placed any portion upwards. Fig. 4.—Screws in Bench to adjust Level; need not be level at first, can be brought level by trial and reversal of level.

However placed in the body of the level, the highest point of the tube must almost inevitably be in or near the middle of the top interior surface; but this condition never obtains, and to attain it would cause needless expense. It is also desirable that a tube, when set in its place, should give similar indications when reversed, as in Fig. 3, although the surface is not level; this cannot be unless the curvature of the tube is uniform, and is uniformly set in its socket. The bought levels are set on a tin foil film, which makes the bubble more easily seen; if D. J. and others cannot mount so, obtain some plaster of Paris and a little powdered blue; mix dry, or else mix plaster with water and blue ink; quickly set convex side upwards, so that the bubble reverses equally at a slight inclination. This adjustable inclination is easily obtained by inserting in the bench two wood screws for a portion of their length, as in Fig. 4. By this means, trying and reversing the bubble ought to occupy similar positions as regards distance from the centre; then adjusting the screws until the bubble rests in the same place when reversed the centre can be marked. I need scarcely remind D. J., or any other reader, that long before this has been accomplished the plaster will have set; but it does not matter, a sharp trying plane will adjust it by planing the under side better than any fingers could adjust the tube; and if the tube has been deeply bedded, as it should be, the block containing it can be made parallel after the under surface is adjusted. Finally, I find it useful to have a level 12 or 18 in. long, because it is easy to estimate if you know the length of your level and the length of the work—say, a 12-in. level sideboard for instance, 8 ft. long; level requires to bring the bubble to its centre ⅛ in. under one end, it is obvious that 1 in. under one end of the sideboard will be required to level it.—B. A. B.

Bookbinding Articles.—P. B. (*Westmoreland*).—All the articles necessary for bookbinding, whether amateur or professional, may be purchased from Messrs. George Royle & Son, 6, Lovell's Court, Paternoster Row, London, E.C. I should advise P. B. to write to them for their list and make a selection. But as he is only an amateur, I may give him an idea of what articles he really requires: a sewing press or "bench," as it is called in the workshop, costing about 10s.; half a dozen keys, costing 2s.; needles and thread; a lying press, with runners on one side for cutting, a plough and knife, a press pin, costing from 40s. to 50s.; pressing boards, cutting boards, and backing boards, assorted sizes—not less than 20s. worth will be required; a hammer, 5s.; a knife for cutting and paring, 6d.; a knocking-down iron, about 3s. 6d.; a marbling trough, 5s., with marbling combs costing from 7s. 6d. each; marbling colours from 3s. 6d. per lb. There will also be required burnishers, a tooth agate, a flat agate, a blood-stone or iron-stone, cost about 20s.; a glue pot and brush, 4s. 6d.; gold-knife and cushion, with drawer, costing 10s.; a gas-stove, costing about 40s. or 50s. Then the finishing tools: sets of handle letters, ranging from 10s. to 50s., according to size and style; ornaments of all kinds: sprigs, corners, centres, lines, rolls, pallets, tail-pieces—the cheapest piece being about 3s. 6d., while some will run as high as 25s. Besides these things, bodkins, folders, compasses, scissors, and quite a host of other things, that can only be added as the necessity for them presents itself. There is, after all these things have been procured, the material to be provided, such as leather, cloth, paper, strawboard and millboard, glue, gold, etc., in the selection of which I shall be most happy to assist in whatever way I can. In the meantime, if P. B. writes to the address given for the list, he will find it a great help. Many of the articles he could easily make for himself, if he is handy with carpenters' tools. If he should think of making any of them, I will be happy to give him sketches and instructions to guide him.—G. C.

Dulcimer Articles.—DULCIMER (*London, W.*).—Before this meets your eye, you will have noticed that these papers *are* continued. It is impossible, having regard to the requirements of very many thousands of readers, to continue any one subject in consecutive weekly numbers of WORK. Each subscriber wants his or her subject brought forward.—ED.

Leather Lace Machines.—G. L. (*Gainsboro'*).—I am not acquainted with, nor can I learn about, any machine which would be likely to be more useful for your purpose than the one you name. You do not say what the laces are for, nor the quantity you want to produce, so that I am not able to advise you as fully as I might otherwise. The most suitable tool I can suggest is a knife.—D. A.

Staining.—E. J. (*Leith*).—Your first letter was replied to in due course, and long ere this appears you will have seen the answer to it. I am sorry to hear you are at a standstill because you have not seen your former inquiry replied to, but it is really quite impossible for answers to letters to be published directly, even though they may be written at once. You will easily understand that the magazine must be printed some time in advance, and I am sure after this hint you will not think you have been neglected.—D. A.

Gas Burners and Electric Lamps.—CHROMOS (*Brixton Hill*).—(1) I cannot give you the candle powers of Bray's gas burners, from No. 1 to No. 6 respectively. Perhaps some one of our correspondents can furnish CHROMOS with the desired information. I should think, however, that no definite reply could be given, unless one knows the pressure and quality of gas to be consumed in the respective burners. (2) Your second question also will not command an exact reply, since the battery power needed to light up an incandescent lamp will depend upon the resistance of the carbon filament, and the necessary voltage to overcome that resistance. A 12-volt 5 c.p. Swan lamp will require a battery of 6 quart Bunsen cells, arranged in series. This would be the best kind of lamp to use with this battery. (3) As you want to light up six of these lamps with quart Bunsens, you will have to use 36 cells, arranged in series, the lamps also being in series. If the lamps are arranged in parallel, less cells will be required; but in this case the battery will soon run down, because it will have to furnish a larger volume of current.—G. E. B.

Storage Battery.—COTTINGHAM (*Hull*).—If the red lead paste has been pressed well into the perforations of the plates, it is just probable that the cause of peeling off is due to a too rapid charge or discharge of the battery. The plates should be gradually "formed" by repeated and increasing charges and discharges, not too rapid at first. Four cells of any size above six square inches of plate surface will light up a 2½ c.p. lamp, ranging in voltage from 5 to 8 volts, but not those having a voltage of over 8 volts. You must choose the voltage of the lamp to suit the battery. An 8-volt lamp is most suitable to a 4-celled storage battery. Your battery, when fully charged, should light up an 8-volt 5 c.p. lamp for six hours.—G. E. B.

Decorative Process.—J. S. (*Bristol*).—I am not aware who the agent for the process to which you refer is. It seems to have disappeared altogether. An attempt was made to float a company to work it, but, I believe, without success, as shareholders' money, I am informed, was returned.—D. D.

Piano Small Work.—ASPIRANT (*Glasgow*).—The butts are made in lengths, and worked complete, then they are cut with a small circular saw to the size required, and the holes drilled afterwards. Of course, to do this, you would require a small lathe fitted up to saw and bore with: you would also require a hammer rail for the butts to fit in; the metal of the rail is cut with a wheel, with a cutting edge. The cloth used for bushing the butts is of a special kind, being silky on one side. For bushing, it is cut into strips the size of the hole, and the ends are cut pointed; then put a little glue on your finger and thumb, and roll the ends to a fine point, and leave to dry. When dry it is threaded through the butt, and a touch of glue or shoemaker's paste is put on the part that is to remain in the butt, and the cloth is cut off level with the sides. Then the holes are broached to fit the centre wire. The cut for the vellum to fit in the levers is made with a circular saw, but if you will examine a lever, you will see that there is a small cut across it; this gives freedom for the cut where the vellum goes to open. The levers are made in lengths of wood, worked with planes to the size required, and the vellum is sized with thin glue, and hung up to dry, then cut in strips, and put into the saw-cuts of the levers. Then the wood is made damp with a sponge and clear water, and narrow plates of iron, made warm, are placed on over the hinge, with pressure from small hand-screws; this sends steam through the pores of the wood, and softens the glue on the vellum. I do not know where you get your smallwork in London. Try V. A. Hallpike, 213, Mare Street, Hackney, London, E., for cheap and good smallwork, then consider whether it is worth your while making your own. Small goods, such as vellum, bushing cloth, or leather, he would send by post.—T. E.

Repairs to Piano.—G. R. (*Manchester*).—It is very gratifying to all concerned in the production of WORK to read such praise as yours, as it stimulates us to further endeavour to meet the wishes of our numerous subscribers. Thanks for introducing it to your friends. You will find on examining the bent sides of your piano that the glue has given way, and pulled the bolts in the manner described by you. To remedy this you will need to slacken the strings with a tuning hammer where they are attached to the bent sides, and if necessary take off the pins. Now you will have to take out the bolts, and try to make a good gluing with hot glue to the bracings of your bent sides. It will probably come away altogether on the removal of the bolts, as I expect these are all that hold it. If you can get some pressure with cramps or hand-screws all the better; if not, when nicely fitted into its original place, put your bolts in temporarily to hold it in position and bore some holes, say a dozen, along both edges of your bent side into the bracings for 4-in. No. 18 screws; and having fitted it to your satisfaction, you can make it warm and glue it down, putting your screws and bolts in as quickly as possible; also glue blocks in behind the bent side to attach to the bracings. Before pulling your strings tight leave a day or two to dry in a warm room. The cause of the soundboard bulging is because the bent side, as it pulled away, pressed it against the wrest plank. If you take out the back of your piano you will find that the soundboard has been forced away (where it is bulged) from the vertical bars crossing the soundboard. You had better run some thin glue in between the bar and soundboard, and put some 1-in. screws in from the front.—T. E.

Piano Alterations.—W. H. S. (*Crieff*).—It is our wish to be courteous at all times, and shall always deem it a pleasure to answer any question submitted to us by our subscribers. Thanks for the pamphlet you sent, and your good wishes for the success of WORK. Your square piano must be a very old one, judging, from the early mechanism of the action, by the sections you sent. It was probably made in the eighteenth century. It would be no advantage to extend the soundboard, but you may fill the cracks up with some dry pine wood and keep it in position by gluing some strips of linen underneath, gluing the cracks at the same time; also put a screw or two through the bridge into the soundboard and try to run thin glue in the opening and draw close. I should think the cause of absence of tone is that the soundboard has sunk, and that the strings have no bearing on the bridge of the soundboard. You can ascertain whether this is the case by laying a string clear of the pins of the bridge, and see if it rests on the bridge when tight; if it does not do so, then your soundboard has sunk. This is a very common occurrence in old square pianos, the bars on the under side of the soundboard not being strong enough to resist the downward pressure, and often they have been strung with heavier wire than the original to try and increase the tone. But heavier stringing would have the reverse effect, pressing the soundboard down. You say you are ingenious, and so, I take it, you have plenty of patience, and don't mind a little trouble. The only way to improve it would be to take the soundboard out, and put a couple of stouter bars on the under side, making them a little round in their length, to throw the soundboard up.—T. E.

Telephone Transmitter.—AMATEUR ELECTRICIAN.—It is a very difficult matter to advise AMATEUR ELECTRICIAN as to the best transmitter, and how to construct it, for the reason that transmitters and receivers are the subjects of so many patents; and although one may make and use a patented article for experimental purposes, it becomes rather risky when made for "actual and continual use." When I wrote the article on the telephone I had this fact before me, and purposely abstained from going into the subject further than the experimental stage. If the receivers which you have made are of the pattern described in the article referred to, you must be careful how you use them, as they are substantially the same as the instrument used by the United Telephone Company, who are the proprietors of the Bell patents. One of the best transmitters, the "Blake," is also owned by this company, and they are very jealous of their rights. So it will be best to give a description of a transmitter which does not trespass on forbidden ground. As all transmitters are simply modifications of Professor Hughes' "Microphone" already described, if you have caught the principle of that instrument I do not think it would be a very difficult matter for you to devise a transmitter which would then be your very own. I have experimented a good deal in this way, and find that almost anything will transmit speech provided of course you have a battery to produce the necessary current and a shaky connection close to the speaker. However, I will give directions for making an excellent transmitter, which may be used without fear of

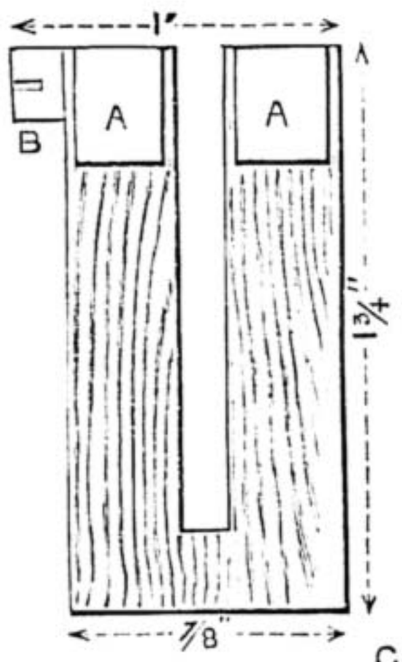


Fig. 1.

Fig. 2.

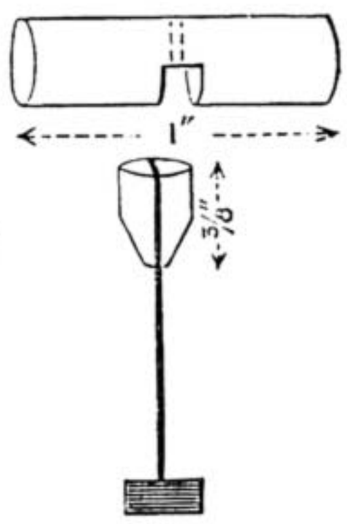


Fig. 3.

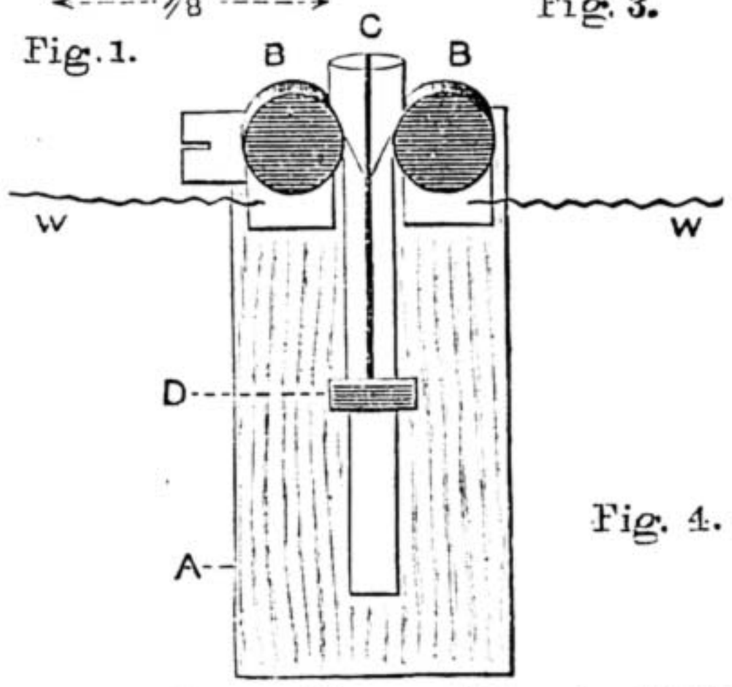


Fig. 4.

Telephone Transmitter, section — A, Wooden Piece; B B, Carbon Rods; C, Carbon Cone; D, Head-weight; W W, Wires.

any trouble with the telephone companies. Two instruments of course will be required, and the description of one applies to the other. A little box 4 in. square by 1½ in. deep, and without a lid, is made. The four sides are made of ¼ in. stuff. The bottom, or, as I should say, front, as it becomes the front when the instrument is complete, is made of very thin pine about $\frac{1}{16}$ in. thick. This should be well made, and the sides nicely polished. A small piece of wood ⅛ in. thick, shaped like Fig. 1, with a cut down the centre, and of the sizes given in the figures, is also required. The centre cut divides it into two pieces, joined at the bottom, over the tops, and coming down the sides about ⅜ in.; fix with screw or pins two little pieces of sheet brass, shown in Fig. 3, for the purpose of soldering the connecting wires to; two little pieces of ¼ in. carbon rod with a hollow filed in the centre of each to fit tightly over the brass-covered ends of the wood piece; a hole is also drilled in the centre of each carbon to pass a screw or pin through for fastening up to the wood. The shape and size of the carbons are shown at Fig. 2. I prefer to make these carbons from the rough carbon of the gas-works by breaking off pieces and patiently filing them to the required size and shape. Other two small pieces, each provided with a little lead weight, are necessary, and when these are made the instrument is complete. These two pieces are made as small as possible, and cone-shaped like Fig. 3; in each make a cut right round in which to imbed a small fine wire for the purpose of attaching a small piece of lead to serve as a weight so as to ensure a connection between the cones and the carbon rods. Fig. 4 shows the complete instrument in section. The cones rest on the carbon rods, and it is attached to the box by a single screw passing through the front into the small projection shown at B in Fig. 1. After all is complete a piece of paste-board with a small hole in the centre about 1 in. in diameter should be glued over the front to damp the vibrations, as the thin pine vibrates too much, and the sound of the speaker's voice would thus be heard in the receiver a little confused. I hope that with these directions A. E. may be able to make his instrument complete and capable of doing the work he requires. I presume he understands that he will also require call-bells to complete his system, and that all should be mounted on a switch-board. Other information for the necessary connections has been given in "Shop." If anything else is wanted I will be pleased to help. I am glad that you like my article, and that it has been a help to you.—W. D.

Connecting Time Alarum.—L. T. (*Glasgow*).—Following the idea presented in your sketch, and calling the battery A, the bell B, the switch S, and the clock C, connect a wire to the carbon of A, and lead to one of the binding screws on B; from the other screw lead a wire to one of the stops on S; from the pivot of S, lead a wire to the works of the clock, C; from the alarum hand on C, lead a wire back to battery and connect to the zinc element. This will complete the circuit when the switch is on, and the hand of the clock makes contact with the alarum hand. See also replies to ONE IN NEED (*Coventry*) (see page 813, Vol. I.) and IRON TURNER (*Bolton*) (see page 829, Vol. I.).—G. E. B.

Sealing Gassner Cells.—R. L. (*Plymouth*).—The composition appears to be marine glue, but pitch will do equally well for the purpose. Shoemakers' wax will also serve as a substitute, or a mixture of resin and beeswax melted and poured on the top of the cell.—G. E. B.

Electric Light Installation.—NIMO (*Ireland*). This correspondent wishes to light up his house with electric light, employing from 8 to 10 incandescent lights, of 16 c.p. each, fed with current from accumulators, charged by day with current from a dynamo driven by 1½ h.p. engine. As his requirements are probably a type representative of others, I answer the questions in detail. (1) The requirements for current are ten 16 c.p. lamps. Supposing these to be 48-volt lamps, taking 0·8 ampères of current each lamp, 0·8 ampères × 10 lamps = 8 ampères, and 8 ampères × 48 volts = 364 watts of current. As 746 watts of electric current equal 1 h.p. of energy, we shall get ample power out of the engine, even if we allow 50 per cent. loss for power consumed in conversion, resistance of wires, friction, etc. This power would be most economically employed if used direct, without the intervention of accumulators. (2) As accumulators cannot be expected to yield more than 80 per cent. of the power employed in charging them, you would have to charge them for nine hours to get six hours' work out of them in return. (3) As we are about to use 48-volt lamps, we shall need a pressure of at least 50 volts, and this can be supplied by 25 cells, arranged in series, since each cell has an E.M.F. of 2 volts. As these cells will have to yield 8 ampères of current for six hours (equal to 48 ampère hours of current), and 1 square foot of positive plate will only yield 6 ampères of current, we shall need positive plates exposing at least 9 square feet of surface, since the plates will be injured if fully discharged each time. The cost of each cell (D. and G. type) will be about 18s. per cell, or a total of £22 10s. for accumulators. (4) Any good type of ring dynamo, such as the Gramme, Simplex, or Manchester, will serve your purpose. It must yield 8 ampères of current, at a pressure of at least 62·5 volts, if the accumulator cells are to be charged in series, since the charging current must always have a surplus voltage over that of the combined E.M.F. of the accumulator cells, to prevent injurious reversal of current. The dynamo would have to be driven at a speed of from 1,500 to 1,800 revolutions per minute. Mr. S. R. Bottone, electrical engineer, Carshalton, Surrey, will supply you with such a machine for about £15. (5) I cannot exactly tell you what wires you will need. This can only be determined by personally inspecting the premises, engine, etc. The size of main conducting cable will depend upon the distance of the dynamo from the accumulators, and of these from the house. Anything under fifty yards will be served with a cable of seven stranded No. 20 B.W.G. copper wire. Branch wires may be of No. 20 double cotton-covered copper wire. In addition to the wires you will need 1 main switch-board between the dynamo and accumulators (this will cost about £1); 10 small switches, at 1s. each; 10 lamp-holders, at 1s. each; 10 brackets, or pendants, costing from 7s. 6d. each, or upwards, according to style and finish; and a few lengths of safety fuse wire, at about 2s. per lb. Lamps will cost 48s. per dozen. (6) The above-named gentleman can supply all that is necessary, if required.—G. E. B.

Model Telegraph.—C. J. G. C. (*Brighton*).—This subject may be treated a little time hence.—G. E. B.

"Lathes and Turning."—C. J. G. C. (*Brighton*).—If you will kindly refer again to the notice of this book on page 443, Vol. I., you will see that it is not published by the London Lathe and Tool Company, but by Messrs. E. & F. Spon, 125, Strand, W.C. The company publish the little pamphlet mentioned in the same notice.—G. E. B.

Elastic Wheel.—J. S. (*Bristol*).—I am very sorry to say I can afford you no assistance with this. If it is still made, perhaps some of our readers can oblige with name and address of maker, but I think it very likely if you were to inquire of some of the travellers who call on you, you might elicit the desired information.—D. D.

Canada Balsam Cement.—E. H. N. (*Highbury*).—The bottles mentioned on page 503, Vol. I., of

WORK can be procured from any of the leading opticians in London or the provinces, and it would therefore be invidious to mention any one in particular. In reply to the second part of your question, I have tried many cements for the purpose of resisting the action of glycerine and spirit, and find that for glycerine, gold size, or a solution of pure india-rubber in wood naphtha, is the best. For spirit the latter is about the only safe cement, and even that is not very reliable. I find it is best to use spirit as little as possible, on the principle that prevention is better than cure.—A. T. S.

Smoky Chimney.—F. W. B. (*Lancashire*).—If it were possible for me to tell you how to cure the above, I should at once confer a blessing on hundreds of people. There are so many things to be considered, for instance:—1st. Was the chimney properly cored or swept when built? 2nd. Is the opening between the grate and fireplace, or the throat, or that portion of flue directly above the grate, too large, and therefore admitting more fresh air than is warmed? 3rd. Does the flue communicate with another flue? 4th. Is the fire properly supplied with fresh air? 5th. Is the chimney surrounded by high buildings, hills, cliffs, etc., or built against a gable end or other wall higher than the chimney itself? 6th. Can you see the sky when you look up the chimney? I will now give you some methods that I have seen adopted, which have to a great extent had the desired result. I think the simplest way of doing so will be to consider all the above questions apply to your case. 1st. Have the chimney properly swept with the view of removing any obstruction, and not only soot. 2nd. Put a board or a piece of zinc across the fireplace, so as to reduce the opening. Of course this may be as ornamental as you wish. In one slight case, I remember, a deep valance to the mantelboard got over the difficulty, and in another instance (as in yours), where the fire was only occasionally lit, a large sheet of newspaper lighted and thrust up the chimney before lighting the fire to warm the accumulated cold air met the case. 3rd. Close the opening of the other fireplace if not in use. 4th. A small hole through the wall at the level of or under the floor, opening out just above the hearth, and admitting fresh air from outside, behind, or at the side of the grate, would give this; but both the internal and external openings should be covered with a grating. Another but very unpleasant remedy is to leave the room door slightly ajar. A brick cut out of the chimney above the roof in the most sheltered position will sometimes quicken the draught. 5th. This is generally the cause of what we call a blow-down, and the only reliable way I know of is to fix a tall-boy or blow-down cowl in place of chimney pot. I have used R. Boyle and Son's cowls with success in several cases of this description. 6th. A simple zinc or galvanised iron pot with two elbows, just sufficiently bent to prevent you seeing the sky when you look up the flue (the area of the inside of the pot should not on any account be larger than that of the flue), might get over this trouble. I must also state that I have known cases where most of the above methods have failed. There are more elaborate ways of endeavouring to get over this problem, but as you ask for something you can do yourself I hope they will meet your views.—E. D.

Veneer Purchasing.—NOVICE (*Cardiff*).—Write to the following firms, who will quote you for all kinds of veneers:—J. Wright, 51, Great Eastern Street, E.C.; A. Farmer, 49, Austin Street, Shoreditch; W. and J. R. Hunter, New Bethnal Green Road, E.; Maple & Co., Tottenham Court Road, W.; or A. J. Hall, Barrington Road, Brixton, S.W. Have you tried Messrs. Sessions & Sons, timber merchants, Cardiff?—A. J. H.

Turned Articles.—S. S. (*Walmer*).—You can easily obtain the turned parts for any piece of furniture you may wish to make from any cabinet maker. It will not cost you more than if you went to a wholesale house, and you will be able to get exactly what you want. It seems almost a pity, though, not to get a lathe of your own, or to club with other amateurs in your neighbourhood to purchase one for general use. The best wood for turned parts depends entirely on circumstances.—D. A.

Overmantel.—F. D. (*Salisbury*).—Several designs for these have already been given, but though none of them seem exactly what you want, you ought to experience no insuperable difficulty in getting up one to suit yourself if you will carefully study the hints and instructions which have appeared. As some idea of the mode of procedure the following remarks will be of assistance to you. First make your back framing. To this from behind screw the side shelves, which should either be supported on brackets or turned columns at the front corners. Glad to hear you found the construction of your table so interesting, and your success ought to be an encouragement to other amateurs.—D. A.

China and Glass Riveting.—CAROLUS (*York*).—An article on the above subject appeared in No. 53 of WORK. You would probably be able to get the necessary tools, etc., through any good tool shop in your city. If not, write to Melhuish & Son, Fetter Lane, London, E.C., who will no doubt be able to supply you.—D. A.

Polishing.—F. P. (*London*).—If you will kindly refer to the "Shop" columns in our back numbers, you will find that most of your questions have been anticipated by other readers and duly answered. Without knowing something about your mode of working it is impossible to assign the correct reason for your work going dull. If you will let me know precisely how you have polished anything which has not kept its brilliancy I may be able to help you. I do not understand your inquiry about "glazing of the polish." By "glazing" you may intend the technical expression, but from the rest of your letter I am inclined to think you mean rather to ask how to get the brilliant gloss seen on a well French polished surface. This is got by using the spirit rubber. "Glaze" is simply rubbed or varnished on. No doubt the articles on polishing will be of more assistance than any of the already published handbooks, none of which we care to recommend.—D. A.

Glass-Burning Kiln.—VITRÉ.—The kiln I had for burning glass was one of Thompson's patent gas kilns. It consisted of a fire-brick chamber open at one end, but shut in with iron doors, and a small trolley was run into this chamber, upon which the glass was laid; a series of Bunsen gas jets on the two sides of the kiln played over the under side of the top of the brick chamber, and made the bricks red hot, and the heat was then deflected on to the glass, and soon turned it to a bright red heat. Two peep-holes were placed in the iron doors, so that you could watch the glass, and know when to turn off the gas. These kilns are rather expensive, the smallest one costing, I believe, about £30. Small terra-cotta muffles, capable of turning a small quantity of glass at a time, can be bought of Lechertier, Barbe and Co., Regent Street. These are heated with coke, and are comparatively inexpensive. If only a small quantity of glass is required to be burnt at a time, it would be both a saving of trouble and expense to send it to a professional kiln man. The charge is only between 4d. and 6d. a foot for firing.—F. M.

Glass Kiln.—J. J. D. (*Bournemouth*).—A kiln could be constructed of brick with flues, heated from below, and the iron box to contain the glass would be placed in the brick oven but with space at sides, top, and back to allow the flames to play around the box. The front of the muffle (as the iron box is termed) would consist of a movable iron door with a peep-hole in it to watch how the glass is getting on. It would depend upon how much of the work you could do yourself in the way of laying bricks and setting the muffle as to its cost, but by inquiring of a kilnman, such as Tames, 78, High Street, Camden Town, some idea of total cost could be ascertained. Doulton's sell terra-cotta muffles which are better for firing delicate work in than iron and can be fired to a much higher temperature, and these would require setting in brick work as above. Lechertier, Barbe & Co., Regent Street, sell small portable terra cotta muffles which do not require setting in brick work, but these do not hold very much at a time. If much work has to be fired it would be cheaper to build a kiln. Thompson's gas kilns are very admirable for firing glass. (See answer to VITRÉ above.)—F. M.

Elementary Tool Book.—A GROWING ENTHUSIAST.—The book you should buy is "Cutting Tools Worked by Hand and Machine," by R. H. Smith (3s. 6d.), published by Cassell & Company.—F. J. C.

Future Subjects.—H. R. (*Manchester*).—The subject you mention will be fully treated in WORK as soon as some of the present papers are completed. From time to time further supplements will be given.—ED.

Carpentering.—E. C. S. (*Stoke Bishop, near Bristol*).—Papers on dovetailing (*i.e.*, jointing wood) are in preparation, as well as some on sash-making, for this volume.—ED.

Photographic Appliances.—CONSTANT READER (*Somerset*) will be able to procure all he requires from most apparatus manufacturers, or from Henry Park, 1, Orchard Buildings, Acton Street, Kingsland Road, London, E., who advertises to supply any parts of photographic apparatus.—E. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Flux for Solder.—H. J. (*Bristol*) writes:—"If BLOWPIPE (see page 732, Vol. I.) finds he cannot succeed in making a flux for soldering by the use of borax, the simplest and best way of getting out of the difficulty is to purchase a bottle of soldering fluid prepared especially for silversmiths, which he can obtain of H. Isaac, 32, Trinity Street, Leeds, at 6d. per bottle."

Varnish for Pipes.—C. W. B. (*Plymouth*) asks:—"Will any one kindly inform me of the most approved varnish for meerschaum-washed clay pipes—also for 'torrified'—and the method of procedure?"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. W. F. (*Mansfield*); W. S. (*Appleby*); C. H. L. (*Lancashire*); J. M. H. (*Wallsend-on-Tyne*); T. F. F. (*Bower Park*); A. R. (*Haslingden*); A. G. C. (*Tottenham, N.*); A. F. (*Stockbridge*); ONE OF YOUR REGULAR SUBSCRIBERS TO "WORK"; WOOD WORKER; J. S. (*Sheffield*); C. S. (*Glasgow*); E. J. B. (*Burton-on-Trent*); H. N. C. (*South Norwood*); ONE IN A FIX; L. W. H. (*Liverpool*); C. E. T. (*Liverpool*); A. D. (*South Hackney*); X. E. A. (*Sheffield*); W. S. M. (*Leeds*); E. W. (*Peckham, S.E.*); L. J. P. (*Wellingborough*); PLUMBER; A. M. (*Hull*); A. K. (*Glasgow*); A. P. (*Girvan*); E. R. B.; J. F. (*Elgin*); J. D. T. (*Leeds*); F. H. A. (*India*); G. E. A. (*Newport*); W. A. (*Shildon*); JOE (*Liverpool*); A. B. (*Battersea Rise*); H. B. (*Chatham*); W. E. (*Launceston*); W. H. S. (*Salford*); VILLAGER; J. J. M. (*Ebbw Vale*); R. W. (*Pontefract*); N. H. (*Rainhill*); THEO; W. D. (*Newcastle-on-Tyne*); J. L. (*Carlisle*); C. (*North Shields*); LLEWELLYN (*Camelon*); ONE WHO IS NOT A SMOKER, WORKER BEE; H. C. (*Notting Hill*); ENGRAVER; J. F. (*Elgin*); AN ADMIRER OF "WORK"; W. P. (*London, E.C.*); W. H. C. (*Tipton*); J. R. C. (*Bacup*); T. D. P. (*Dalston*); ALPHA; PARK AVENUE; W. P. (*Southport*).

Trade Notes and Memoranda.

IN the exhaustive Chinese report referred to in WORK, page 750, Vol. I., we have summaries of the numbers of members belonging to the unions, the contributions per head, the percentage of members on unemployed, sick, and superannuation benefits, and the amount per head of membership paid for these several benefits. Then follow detailed tables of particulars of the different societies' reports, which occupy the bulk of the book; also tables showing the causes of death with average ages, and the kinds of accidents and diseases for which benefits are paid by certain unions. An appendix of extracts from the latest annual statements of certain unions completes a bulky and by no means dry volume of 262 pages full of interesting facts for working people. What a contrast this government report affords to the time when combinations of artisans were illegal and punishable with imprisonment!

A SENSIBLE decrease of the natural gas issuing from the earth in the region of Pittsburg, U.S., has lately been spoken of. But it must be insignificant, since there are figures published to show that, in Pittsburg alone, there are 500 miles of main for conveying the natural gas. These supply 37 glass-houses, 40 iron factories, 83 foundries, 450 other establishments, and 4,268 private houses. The annual amount of gas consumed is represented as being equivalent to 7,000,000 tons of coal.

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