WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. III.—No. 127.] SATURDAY, AUGUST 22, 1891. [PRICE ONE PENNY.

DESIGN FOR WRITING-TABLE AND BOOKCASE.

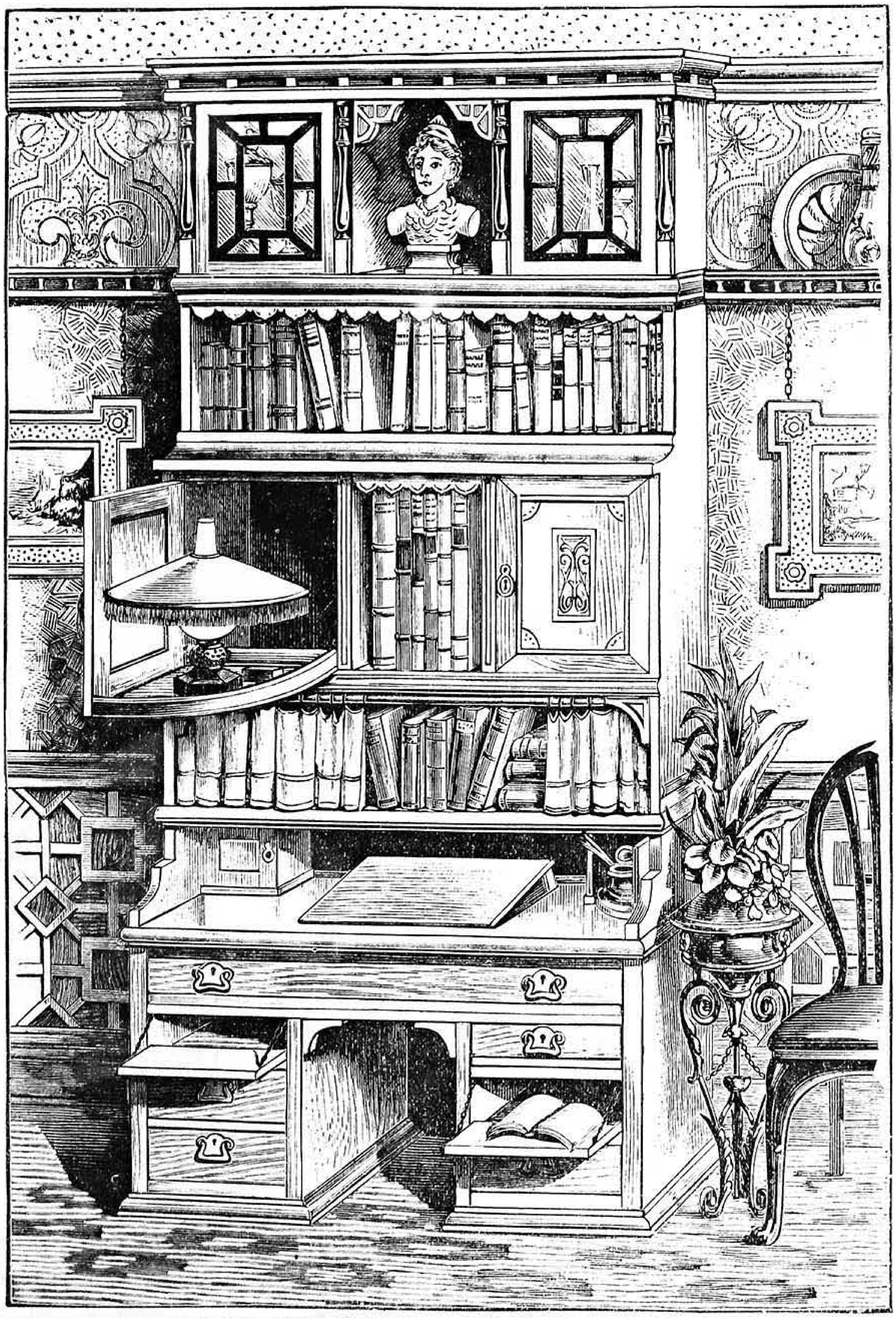
BY MISS FLORENCE M. GARDINER.

IT having been my lot, while staying in expensively and otherwise well-furnished houses, to suffer such physical and mental torture, owing to the inadequate and often total absence of some simple and compact arrangement for holding books and writing materials, that in self-defence I have been compelled to evolve a piece of furniture for this purpose, of which the accompanying design will give a fair idea. I feel sure it would be a welcome addition to most households, as it is well adapted to the requirements of every-day life; could be obtained at a moderate price, and would, doubtless; be within the capabilities of numerous amateur readers of WORK, with clever fingers and a taste for cabinet-making.

Though it is the lot of only a few to add to their income by the pen, yet every-one has more or less writing to do, and it is a priceless boon to have one's books (those companions of prosperous and evil days, and soothers of our idle hours) close at hand, instead of—as they often are—difficult of access when we most require them. Happily, there are few of us in this enlightened nineteenth century, with "souls so dead" that we have no favourite authors to whom, from time to time, we may turn for amusement, guidance, and comfort.

Here, then, is a design of a useful and handsome piece of furniture, appropriate to almost any room. Where the cost need not be considered, mahogany, walnut, or satin-wood may be employed in its construction; but if it is necessary to practise economy, I would suggest deal, simply stained or enamelled in some suitable shade. In the latter alternative, I can personally recommend the excellent Foo-chow enamel paints of Messrs. Macpherson & Co., Knott Mill, Manchester, owing to their quick drying qualities, and the large range of colours to select from. In either case, brass fittings for the drawers should be used. The dimensions must, of course, depend upon individual convenience; but if one of the recesses found on either side of the fireplace in many rooms is utilised for this piece of furniture, the width would then regulate the size.

The table contains six small drawers and one large one. The fronts of the former fold down, and are firmly secured, thus serving the double purpose of library steps or shelves. The long one is divided into different compartments to suit the various kinds of paper, postal wrappers, telegraphic forms, etc., which are constantly needed, and so should always be close at hand. Under the sloping flap, space is left for placing letters and papers uncompleted. If desired, greater privacy could be secured by the addition of a revolving flap, which would entirely cover



A Writing Table, Bookshelves, and Cupboards in Combination.

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the top of the table, when not in use; but as the object has been to minimise the cost as far as possible, this is not shown in the illustration.

The two small cupboards are respectively for the inkstand and pens, stamps, etc. The larger ones hold a lamp and different supplies, such as paste, gum, and the ink bottle.

The lower shelf is concealed by a curtain of plush, or other appropriate material, attached by rings to a brass rod. This forms a convenient receptacle for the various small articles which accumulate around one —for instance, pen and paper-knives, scissors, twine, rulers, etc. The central compartment and the shelf above are for books of reference; and the upper portion is divided into china cabinets with glazed doors. There is a niche between for bust, bronze, or any suitable ornament.

ENGINE AND BOILER MANAGEMENT.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

Author of "A Handbook for Steam Users," "Wood-working Machinery," "Stone-working Machinery," "Pumps and Pumping," etc.

RULES FOR ENGINE DRIVERS AND BOILER ATTENDANTS.

STEAM BOILER FEEDING—INCRUSTATION IN STEAM BOILERS—FIRE BARS WARPING, ETC.—CONDENSED STEAM IN PIPES—PRIMING OF STEAM BOILERS—PLUGGING LEAKY TUBES—DRAWING TUBES—GRINDING IN COCKS—FIRING STEAM BOILERS.

I SHALL now continue my remarks on this subject and complete them in another paper. It may be as well to say that Rules 1-18 were dealt with in page 229 (*et seq.*) and Rules 19-30 in page 290.

31. *Steam Boiler Feeding.*—In working steam boilers, a certain and constant supply of water is of very great importance. It should be as hot as can be forced into the boiler. In small powers the pump may be attached to and worked by the engine, but with large powers we prefer to have a separate pump of simple construction, such as the donkey pump, as, should the engine break down, a supply of water may still be kept up in the boilers. If a plunger pump is used, care must be taken that the plunger is a tight fit; if it is worn, the pump may be working without forcing any water into the boiler, and should this not be detected, dangerously low water may be the result. Pumps for boiler feeding are best run at a moderate rate of speed—say, a plunger speed of about 300 feet per minute. Several successful automatic self-feeding water supply apparatus are also now in use. If feed-water is drawn directly from a river, a strainer should in all cases be employed, as dirt or sand may be drawn into the pump and disable it. In large establishments, and to avoid the chance of being laid idle, in addition to the pump it is advisable to have a second feeder; for this purpose an injector may be used. The chief advantages of using an injector are that it may be worked without running the steam-engine, and the steam admitted to the injector is condensed and re-enters the boiler, and from the absence of working parts the wear and tear is less than with a donkey pump. Injectors, however, should be carefully managed, or they may give some trouble.

In working injectors, which may be fixed horizontally or vertically, a continuous supply of dry steam is necessary. This should be regulated by a valve on the boiler or steam-pipe. The water supply must be continuous, and should not be hotter than 135 deg. Fahr. with low pressure, or 105 deg. Fahr. with the highest pressures. Injectors may be fixed either above or below the water supply, and they will draw from two feet to twelve feet, according to size. An injector has one advantage over a pump—that is, it will usually stop forcing water before the pressure in a boiler becomes dangerous, owing to a jambed safety-valve or what not, whilst a pump will go on forcing water and raising the pressure till the boiler has to give way unless the valve is released. An injector will not work if allowed to get hot or any dirt to get in it; the suction-pipe should in all cases be fitted with a nozzle. Suction and delivery pipes should be kept as free from bends as possible, as the friction of the water through the pipes is considerably increased by them.

Injectors, like pumps, must be kept very clean, and all pipes and joints perfectly tight, or they will not work. It is advisable to fit injector and pump pipes with cocks for draining off waste water; these will be found particularly useful in case of frost. For automatically regulating the water supply to about one level in the boiler—an important factor in economical working—several plans have been introduced; one of the simplest with which we are acquainted consists in the arrangement of a small single-acting steam cylinder mounted on the feed-chest, and having the piston-rod connected to the feed-valve, which is kept closed by the downward pressure of a spring on the steam piston. A pipe connected to the cylinder leads to the steam space of the boiler; the lower end of this pipe is closed by a valve, the spindle of which is connected to a counterbalanced lever having a float suspended from one end. When the float sinks below a certain point, the steam-valve opens and admits steam under the piston, which, being forced up, admits water into the boiler till the normal level is attained.

Sandy water should not be used as a feed-water, as it will rapidly cut the pump plunger to pieces and jamb the valves.

32. *Incrustation in Steam Boilers.*—Dr. Joseph Rogers, of Indiana, who has studied closely the question of incrustation in steam boilers, gives tannate of soda the preference over any other preparation with which he is acquainted for the chemical purification of the feed-water, and it is without doubt the principal ingredient of many of the boiler-cleansing fluids sold, about which the vendors profess to make a great secret. The action of tannate of soda may be described as follows: The tannates of lime and magnesia are insoluble in water; hence when tannate of soda is present the carbonates of lime and magnesia in the feed-water (and held in solution therein by the carbonic acid in the water) are precipitated as they enter the boiler in the form of tannates of lime and magnesia. These compounds are not crystalline, pulverulent, and heavy like the carbonates, but light, flocculent, and amorphous, so that they do not subside in the boiler, but are held in suspension in the circulating water, gradually finding their way to the mud, collected, from which they can be blown out as may be convenient. The soda of the decomposed tannate of soda appropriates the carbonic acid of the lime and magnesia, forming a bicarbonate of soda, which in turn decomposes the troublesome sulphate of lime, forming sulphate of soda, which remains in solution, while the carbonate of lime formed is decomposed, as above stated, into tannate by fresh portions of the tannate of soda present. The solvent action of the tannate upon hardened scale is slow, but when the boiler is once clear there is little doubt that it is a most excellent preventive, and, unlike other remedies used, it has no injurious effect upon the iron of the boiler.

Numerous other remedies have been used to prevent incrustation, with varying success. Some of these we give herewith, but it must be understood we do not in any way guarantee their success. (1) Potatoes, $\frac{1}{50}$ of weight of water, is said to prevent adherence of scale. (2) 12 parts salt, $2\frac{1}{2}$ caustic soda, $\frac{1}{8}$ extract of oak bark, $\frac{1}{2}$ potash. (3) Pieces of oak-wood suspended in boiler and renewed monthly. (4) 2 oz. muriate of ammonia in boiler twice a week. (5) A coating 3 parts of blacklead, 18 tallow, applied hot to the inside of the boiler every few weeks. (6) 12 lb. of molasses fed into an 8 horse-power boiler at intervals is said to have prevented incrustation for six months. (7) Mahogany or oak sawdust in small quantities. Use this with caution, as the tannic acid attracts iron. (8) Carbonate of soda. (9) Slippery elm bark. (10) Chloride of tin. (11) Spent tanner's bark. (12) Frequent blowing off.

Hard feed-water containing lime, etc., may be softened to a very considerable degree by treating it with a mixture of lime and soda, allowing the precipitate to settle before the water is used. This will largely prevent incrustation.

33. *Fire-bars Warping, etc.*—One of the reasons for grate-bars warping is insufficiency of air space between the bars; this should be arranged to suit the fuel burnt, as some coal requires much more air space than others. Another reason is that in many boilers the fire-bar bearers are fitted close up to the bridge and head-plate, consequently hot ashes and clinkers accumulate, having no place to escape. This may be obviated by putting the bearers a short distance from the end of the bars, so that the ashes, etc., have room to escape into the pit. Long fire-bars warp more than short ones, and thick bars more than thin ones. The air spaces between the bars should be wider at the bottom of the bar than at the top, as this facilitates the admission of air and the escape of ashes. Air and water bars have their advocates, and doubtless possess some advantages; but the water-bar, although long known, has made little progress, probably owing to the cost of maintenance and the danger arising should they burn out or rupture suddenly. In burning anthracite coal, water hearths are used to some extent. A very great variety of fire-bars have been introduced, but I cannot discuss their merits or demerits here; it will be sufficient to say that good fire-bars should give ample air space, so that the amount of oxygen necessary for complete combustion is readily distributed through the fire, and at the same time should not be given to warp, and should be easily cleaned or renewed.

34. *Condensed Steam in Pipes, etc.*—There are two ways of effectively getting rid of this—viz., by using a steam trap for getting rid of the water after it is made, or by the use of a steam separator, which acts directly on the steam itself and relieves it of the water. To prevent radiation and reduce the amount of condensation to a minimum, all steam-pipes should in the first place be carefully covered with some good non-conducting composition, such as silicate cotton, slag wool, or asbestos. If the engine is situated more than 25 ft. from the boiler, it will be advis-

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able to fix a steam trap or separator in the pipe. Choose a simple form of trap; a good one is arranged with a cam motion for quick opening, combined with a loose valve, which reduces the friction considerably and renders it less liable to stick. We have recently seen a new form of separator in use which appears to give capital results. It consists, briefly, of a circular cast-iron chamber with a branch connecting it to, and forming part of, the main steam-pipe. The steam on entering the chamber is conducted to one side by a partition narrowed down at its orifice, so that in rushing in it acquires a whirlwind motion at a high velocity. The particles of water being of greater specific gravity than the vapour, are thrown outwards and run down the sides of the chamber, whilst the steam at the centre of the vortex, free from water, passes to the engine cylinder through a centre pipe provided for the purpose. This pipe is of trumpet form. The condensed water collects at the bottom of the chamber, and is released by a drain-cock. Expansion steam-traps should be used with caution.

Stop and starting valves should in all cases be turned off or on gradually, in the first case not to stop the flow of steam suddenly and cause a recoil, and in the second to allow the pipes to warm and gradually expand. We have known many cases of fracture from steam being suddenly turned into cold pipes. All steam-pipes should have as few joints and elbows as possible; the pipe carrying the exhaust steam away should be of ample size; small exhaust-pipes cause back pressure on the piston, and consequent loss of power. The beats or pulsations made by the escape of the exhaust steam should be at regular intervals; if they are intermittent or irregular, steam is probably passing the piston or slide-valve, which should be examined and adjusted. In conecting feed and steam pipes, allowance should in all cases be made for expansion.

35. *Priming of Steam Boilers.*—Priming or "foaming," or, in other words, the production of "wet" steam, may generally be said to arise from one of the following causes:—(1) Want of steam space; (2) too much water in the boiler; (3) dirty feed-water; (4) bad circulation of water or badly-proportioned boiler; (5) grease in the boiler, and some kinds of boiler fluids, especially if put in in quantities, will cause priming; (6) too much steam drawn from the boiler, causing a whirling motion on the water; (7) by forcing the fire. The amount of priming varies considerably with different boilers, and is to some extent under the control of the attendant. Perforated pipes or baffle-plates will usually check priming to a certain extent, and a wooden grating, fastened by chains, and allowed to float on the water immediately under where the steam is drawn from the boiler, will usually stop priming almost entirely.

36. *Plugging Leaky Tubes.*—Split or leaky tubes may be plugged for temporary use with iron or wooden plugs. Care should be taken that the plugs are not too tight a fit, or the evil may be increased in driving. In using wooden plugs, unless the split is a short one and at the extreme end of the tube, it is a good plan to use two plugs, driving one in past the split and another to follow it. Iron plugs, with a collar on the one end to close the end of the tube, are also used. Small leaks at the tube ends may often be stopped by expanding the tube with an expander, but care must be taken that this operation is not carried too far, or the tube may be split. Many boiler-makers prefer to plug tubes with well-fitted ferrules. The author has used the following plan with success, and can recommend it. Make taper plugs of pine about 4 in. long, bore a hole through them, and drive them in flush with the end of the tube. Take a round rod or bar of wrought-iron, and screw a thread on each end; pass the bar through the plugs, and put on saucer-shaped washers filled with red lead, to cover each end of the tube; put on nuts and tighten up. If tubes are plugged under steam, damp down the fire with small coal, and close the dampers.

Leaky feed-pipes, etc., may usually be temporarily repaired by wrapping them tightly round with narrow bands of canvas coated with white lead. The bands should be, say, 3 in. wide, and overlap each other half way; they should be very tightly tied on with waxed or tarred rope. Soft pine wood is the best to use for plugs, as the water penetrates the pores of the wood, causing it to swell, and the plug is thus held firmly in position. Oatmeal or any similar substance should not be introduced in a boiler to stop leaks, as they clog the water-gauge passages and valve-seats, which may result in serious accident; at the same time, they are liable to cause priming.

37. *Drawing Tubes.*—If the proper appliances are not to hand, drawing tubes is often a troublesome job, from accumulation scale of and other causes; but as a competent engine driver should be able to draw a tube, I give a note thereon. If the scale on the tubes is very hard, it may be cracked off by putting a red-hot bar into each tube before drawing. In the first place, cut off or bend in the ends of the tube, then pass a rod—arranged with an eye at one end, and a nut and strong steel washer at the other—through the tube; if you cannot draw by hand, fasten a pair of blocks on to the eye, and pull the tube out. Be careful not to damage the tube-plate. Several handy appliances are now made for extracting ferrules.

38. *Grinding in Cocks.*—In case of leakage of the various cocks, a boiler attendant should be capable of setting them right by re-grinding, unless they are very much worn, when they should be renewed. If the plugs are worn irregularly, draw-file them first of all with a smooth file as true as may be, then take either flour of emery or powdered glass, and mix with oil, and grind in the plug till it is a true fit, but not too tight, or it will be more apt to stick when expanded by the heat. Do not use a file unless absolutely necessary, and grease the cocks well when replaced.

39. *Firing Steam Boilers.*—The economical working and longevity of a steam boiler depends, in the first place, largely on the following points:—(1) The type of boiler employed; (2) how it is fixed; (3) the fuel and feed-water used. In selecting a boiler, the chief points to bear in mind are what kind of water and fuel it will be necessary to use. The feed-water should in all cases be tested, and, if found impure, of course a simple form of boiler, easily cleaned, should be selected. In any case, for economical firing—whatever type of boiler is selected—the author recommends the employment of a fire-box or combustion chamber of ample dimensions. There is little doubt that hundreds of boilers are in use in which the combustion chambers are far too cramped; consequently, to keep up a fair head of steam, excessive firing has to be resorted to, the result being the reverse of economical, both as regards the consumption of fuel and the longevity of the boiler.

Having selected the best type of boiler for the special purpose to which it has to be put, the very important question presents itself, which is the best way of firing it—or, in other words, the best way to consume the fuel employed—so as to ensure perfect combustion, at the same time securing the largest possible amount of duty from each ton of fuel employed? The effective combustion of fuel may be said to depend chiefly on the following points:—

(1) Construction of the combustion chamber or fire-box. (2) The admission of the right quantity of air to the furnace. (3) The proper regulation of the draught. (4) Regular and even firing. (1) Many Cornish and Lancashire boilers have been built in which the combustion chamber has been made much too shallow and of too small cubic capacity, with intention, probably, of bringing the fire as near the boiler as possible, and thus extracting more heat from it. This idea must be held to be altogether wrong, as in the confined space the draught is much increased, and the heat, therefore, is carried rapidly away. The small size of the furnace also will not alllow of the perfect combustion of the various gases; and, lastly, the fire itself comes in direct contact with the boiler-plates, which should be avoided. (2) The admission of the right quantity of air to the furnace is a matter of great importance, but one often neglected. In the first place, care must be taken that sufficient air space between the fire-bars is allowed. It is impossible, however, to lay down an absolute rule as to what is the proper amount of air space to secure the most perfect combustion, as much depends on the nature of the fuel and the velocity of the draught through the flues; but, roughly speaking, an area of from five to six square inches for each square foot of grate surface should be provided. The air admitted through the fire-bars is not, as a rule, sufficient to promote efficient combustion, and air is usually admitted through the door or bridge of the furnace. The author is of opinion that hot air admitted from the bridge is efficacious in promoting combustion and preventing smoke, and several very excellent plans for supplying and regulating the hot air are in use. Forcing a boiler has a tendency to produce smoke; the great factor in perfect combustion I take to be plenty of grate area and combustion space. It must be borne in mind that when fuel in a furnace is in a state of combustion, it burns of the carbon it contains only an amount proportionate to the amount of oxygen that is brought in contact with it. In order to enable that combustion to take place, the oxygen must be raised to a high temperature before it will combine with the fluid carbon. If it does not combine with the fluid carbon, it drives the latter before it until it reaches the outside air, and disperses in the form of carbonic oxide or carbonic acid gas, as the case may be. Where the atmospheric air (or oxygen) is admitted through the door and front bars of the grate, the velocity of the draught is usually such as to drive the atmospheric air straight over the bed of the furnace, and, before it has reached a degree of heat high enough to enable it to combine with the fluid carbon evolved from the coal, it is driven over the fire, and, consequently, instead of combining with the fluid carbon, it drives it to the upper air unconsumed. Various systems of mechanical stoking have been introduced during late

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years, in some cases with considerable success; but exigencies of space prevent more than a passing notice here. Whatever kind of stoking is pursued, it may be taken as an axiom that the shallower the combustion chamber is, the lighter should be the fire in proportion.

THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

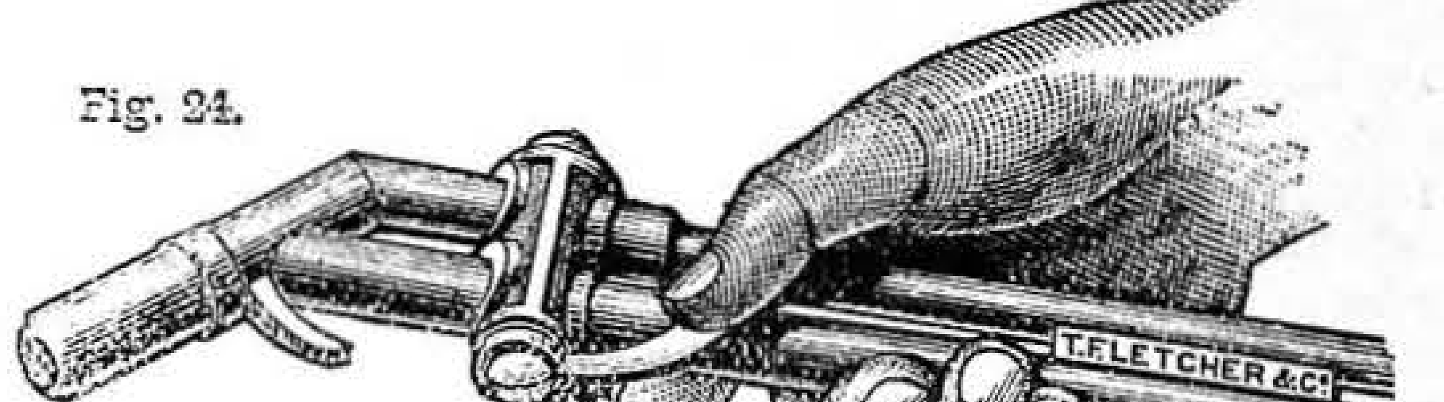
BY A. S. P.

Brazing Frame—Brazing with Fire—Brazing with Blow-pipe—Brazing with Fire and Pipe—Brazing: how done—Simple Brazings—Socket Joints—Precautions in Brazing—Brazing Lug of Handle-Bar—Brake Work.

We have now arrived at the brazing of our frame. By brazing is meant hard soldering—or brass soldering, as it is called. Brass solder is not merely brass filings, as many imagine, although soft brass filings may be used for that purpose. Brazing metal is specially prepared for brazing, and the proportions, as given in "Spon," are: copper 2 parts, zinc 1 part. Brazing may be done with a fire only, with a blow-pipe only, or with both in combination. For my own part, I use a charcoal fire only, raising the wind with a small fan worked by a lever. The forge, with its wheel gear and 7 in. fan, cost me £3 5s. Charcoal is preferable as a fuel, as it gives greater heat than coal, and has little or no smoke.

The mischief of brazing with a fire only is that the under side of the part being brazed gets more heat than the upper, whereas the heat should be equal all round. The mischief, therefore, to guard against is the burning of the tubes on the under side before the upperside is sufficiently heated to make the brazing metal or spelter run. If a tube, which is at best but $\frac{1}{16}$ in. thick, gets partially burned, or even blistered, it is practically ruined for its purpose, and had better be thrown aside. To braze without a fire requires a good strong blow-pipe, with a gas supply of not less than $\frac{5}{8}$ in. pipe, inside measure. The blow-pipe, as most folks are aware, is fed with gas (common house gas) and air in combination, the air serving to intensify the gas flame; the air blast is produced by a bellows, and the blast must be sufficiently strong to make the most of the gas combined with it in producing heat.

Fig. 24.



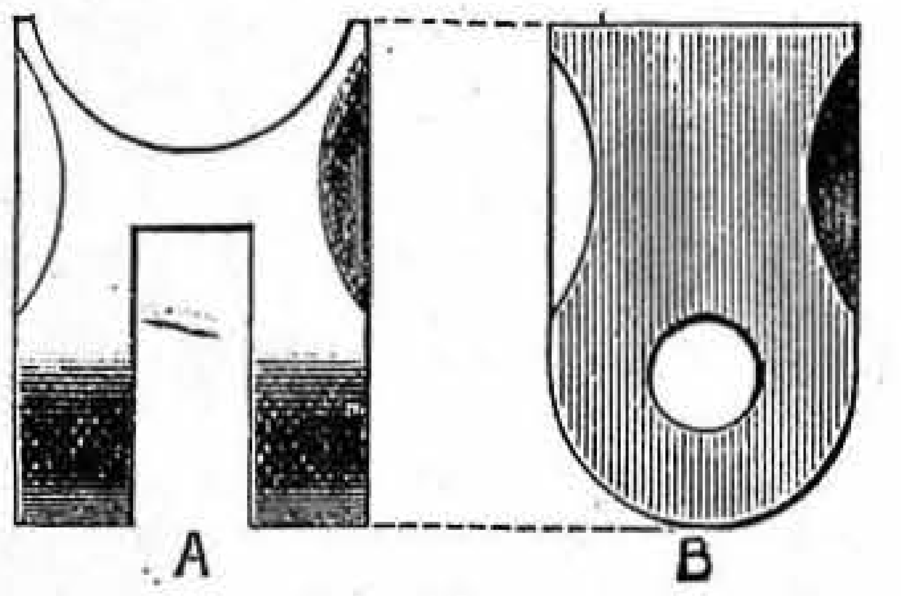
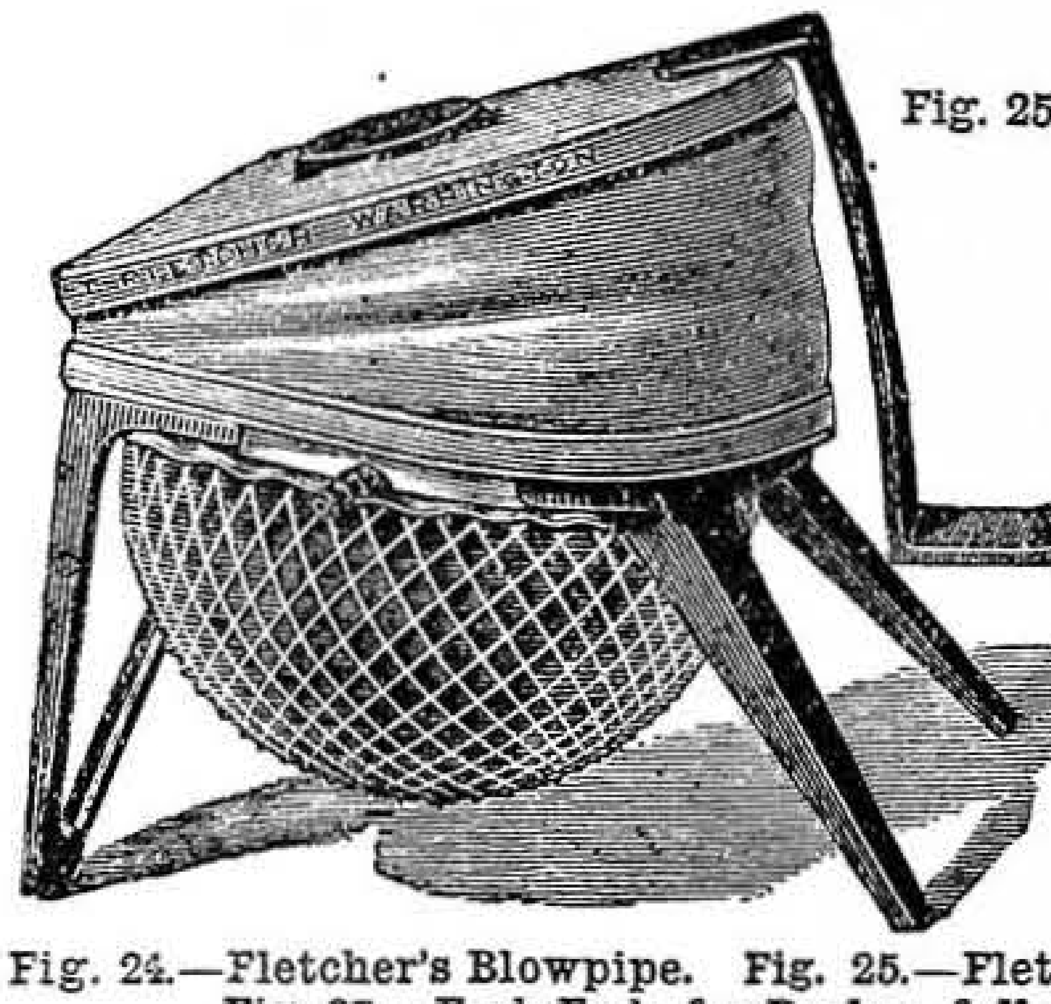


Fig. 26.

Fig. 25.



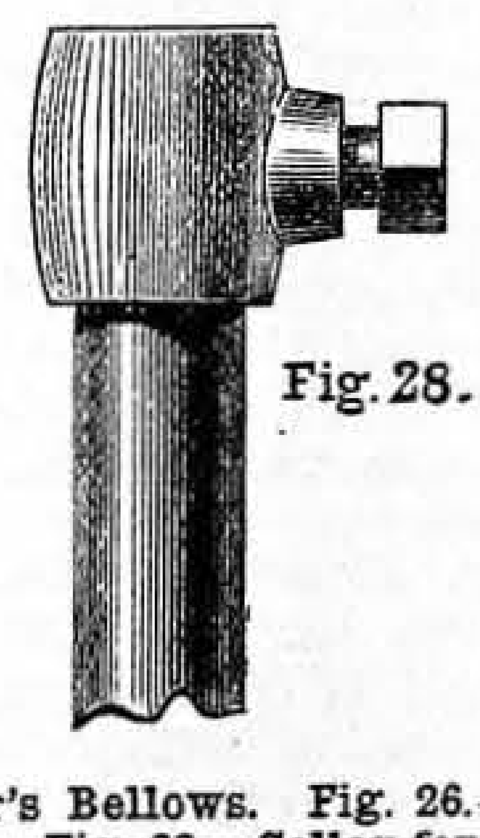


Fig. 28.

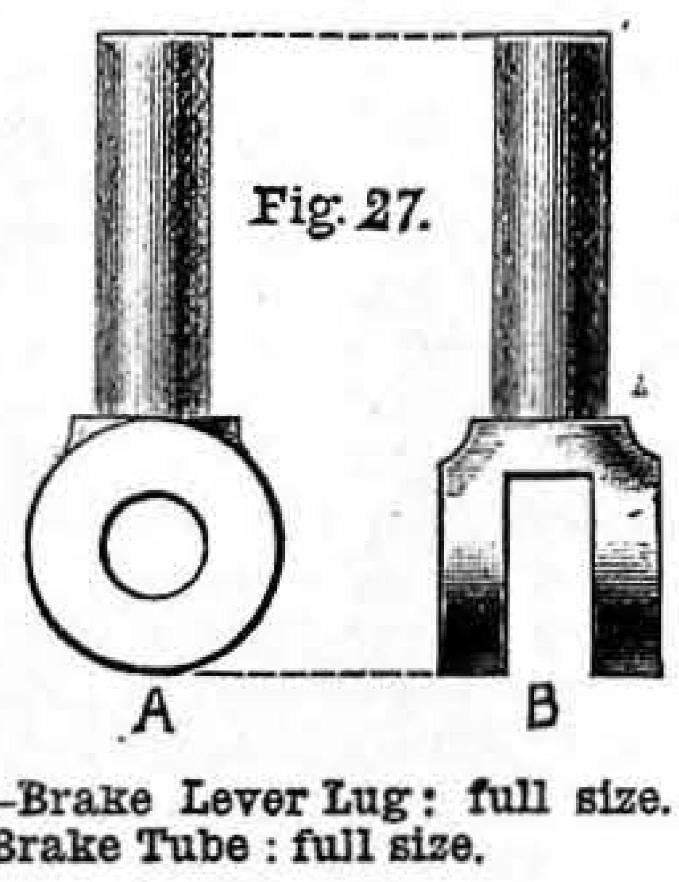


Fig. 27.

Fig. 24.—Fletcher's Blowpipe. Fig. 25.—Fletcher's Bellows. Fig. 26.—Brake Lever Lug: full size. Fig. 27.—Fork Ends for Brake: full size. Fig. 28.—Collar for Brake Tube: full size.

To braze with a blow-pipe only, a carbon brick or a lump of good charcoal is placed beneath the joint to be brazed. The blow-pipe, if efficient, will heat up the metal to a proper degree in a few minutes, also the charcoal block, thus practically heating the metal all round. This is the cleanest and safest method of brazing, as the upper side is, if anything, heated in a higher degree than the under, and if it is removed as soon as the spelter runs there is no danger of burning; the heat also has been concentrated on the desired spot, and a much less length of the article has been heated than with the open fire.

To braze with the fire and the pipe in combination is the speediest, but great care must be taken that the fire does not heat the under side to burning before the pipe which is operating on the upper side has made the solder run. Brazing by this requires, of course, the fan forge, and also a separate bellows for the blow-pipe, which means a lot of money, and need not be adopted if the blow-pipe alone is of sufficient capacity. Thomas Fletcher, of Warrington, supplies a blow-pipe and foot bellows suitable for bicycle work, the price for the two being about 50s. He also sells the carbon bricks. Now, as I use only the charcoal forge for brazing, I will describe the process usually followed.

Suppose you are ready to begin brazing, you provide yourself with spelter and borax, the borax, which is bought in a powdered state, being used to act as a flux to make the spelter penetrate the joint. We will take the simplest joints first.

We will go back to Fig. 1, which accompanies the first paper of this series (page 33) and where the parts are all lettered, or if you have a working drawing prepared and lettered, as directed in a former paper, you will find the tubes E and F converge at the rear forked stamping. Here we have two joints which are about the easiest to braze in the whole frame. There are a pair of these V-shaped parts of the frame, and, assuming that they are properly fitted, both set at the same angle, and pinned ready for brazing, fill all screwed holes with moistened clay—pipe-clay will do; tie a bit of No. 16 soft brass wire round both tubes just over the joints, moisten a little of the powdered borax in a dish with water to the consistency of thick cream, drop a little of this into each tube, along with as much spelter as a threepenny-bit would lift, and let them settle on the solid tenons inside the tubes. Having made a small clear fire of charcoal, place the work over it, heat up the parts a little, and put some of the moistened borax just over the brass wire at the joints; the steel should be hot enough to make the borax fizzle, and it, in conjunction with the borax inside the tube, will run in all over the parts to be brazed. Now provide a bit of pine wood to burn over the joint; this is the substitute for a blow-pipe: its purpose is to help heating the upper side of the work, which it does surprisingly well if properly managed. Now place the work over the centre of the fire, and blow, not too strongly; apply a little dry borax over the wire, and take care to hold the work so that the solder inside the tube does not run out. Now, while blowing, place the bit of wood over the joint, when it will burn fiercely, and throw its flame downwards on the work. When the under side gets nearly up to white heat, turn the work over, and apply more borax to the upturned side, and keep the wood still burning. In a few minutes the wire will run and disappear, and a yellow flame will indicate that the spelter inside has also dissolved. The instant the wire disappears lift the work from the fire, and hold it so that the spelter inside will settle in the bottom, which is the solid tenon. Throw a little common salt over the heated part, then scrape off all scale with a bit of iron, which will leave the work much easier to file up afterwards. To cool the work, it should stand till the red heat disappears; then it should be dipped in and out of water several times, or water allowed to trickle on to it till nearly cold. If it were left to cool without water, the thin tube would be cold long before the solid part at the joint, and the tube would be found to be hard and brittle; so in cooling with water the object is to cool down the solid parts as quickly as the tube. The two joints on this part of the frame would both be brazed at once, as, being so near each other, there is no difficulty in heating up both at once; the thing to watch is to have both up to the same degree of heat, so that the wires on both will go simultaneously. Another simple brazing joint is the T-piece to the handle bar. This, of course, must previously be set to the angle shown in Fig. 1, formed by K, the extension tube, and L, the handle bar. Here there are also two joints, but they are so close together that they are brazed as one. The extension tube, K, must be pinned to the T-piece, and that piece to the handle bar; bits of wire are tied round as before, and spelter and borax applied in the same way. Care should be taken to tilt the job in such a way on the fire that the wire on the handle bar will run into the joint. This part will heat up and braze very quickly, there being hardly any solid metal. A rather more difficult brazing is the triple joint at the front fork crown. The two fork ends (Fig. 20, page 308) should first be brazed into the lower fork ends before pinning on to the crown piece. These ends, after being brazed, should also be filed up and bored for the axle, after which they may be pinned to the crown piece, as also the steering tube, G (Fig. 1). These three joints will be heated

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and brazed all at once, with the forks lying on the fire edges up, and the steering tube somewhat elevated, so that the solder inside it may lie at the bottom, where it is wanted. The two forks, which are now closed at their lower ends, should have each a small ventilating hole bored, and before pinning on, each fork should have some moist borax and spelter placed inside; the vent holes are to allow the steam to escape. Tie bits of wire round all three joints as before, and have a bit of wood at least 3 in. broad to burn over. Turn the job upside down, as before, to prevent burning, which would be sure to happen before the upper side was hot enough to dissolve the wires. The object of turning over is to get the cold side heated up, as the other, the upturned hot side being kept so by the aid of the burning wood. With a blow-pipe all these joints would be done separately, one after the other, and no wood used. I would strongly advise any one attempting the brazing of a piece of work such as this, if he can at all afford it, to provide himself with a good blow-pipe and foot blower. There is then no risk of burning, the work is much cleaner, and much easier filed up afterwards. In the illustrations accompanying this chapter, Fig. 24 is Fletcher's No. 8 C blow-pipe, price 10s. 6d. This pipe, with a sufficient supply of gas and air, is ample for all the brazing of a bicycle frame.

Fig. 25 is Fletcher's 9 C foot blower, No. 5, for supplying air to the above blow-pipe. It is priced in his list at 35s.

We have two small simple brazings in our frame before we tackle the socket joints—namely, the two small cross-pieces on the forward ends of the lower rear tubes, E. These pieces are not at right angles with the tubes, but slope a little backwards, as will be seen by reference to Fig. 1, and in detail, Fig. 5 (page 168). These two pieces should be brazed into their tubes before the latter are brazed into the rear fork stamping. Now, as to the socket joints. We have six of these—two at the steering barrel, two at the bottom bracket, one at the top of tube D (Fig. 1), and one on the front of seat pillar socket. Four of these joints are $1\frac{1}{8}$ in. tube, let into the sockets, and two are $\frac{3}{8}$ in., also in sockets. The inside of all the sockets should be bored out clean, and the tubes outside, for an inch of their length, cleaned by filing; also when the tubes are all fitted in their places, that part of the frame, when laid over the full-size working drawing, should coincide exactly. Before pinning these joints, care must be taken that the frame is out of twist—that is, the barrel part and the bent tube, D, part must be in line or in the same plane. When setting the frame, it is as well to have the front steering tube with fork in its place in the barrel. The frame may now be examined as to twist, and the joints may be pinned by inserting a screw through one side of each. In brazing these joints no spelter is put inside the tubes; a bit of brass wire is tied round each on the tube, close up to the socket end, and the same operation is gone through in brazing as before. These joints will heat up quickly, as there are no solids inside the tubes. When the borax placed over the wired joints melts and looks sticky, a little spelter may be added over the wire, in case the wire should be insufficient. There is no need to turn over the work in brazing these socket joints, as the burning wood over them is sufficient to heat up from the first.

A precaution in brazing is to protect all finished parts as much as possible from the fire, all screw holes or sockets being filled with clay. The steering barrel should be filled, at least at the ends, with it, as also L-pin socket and the two ears (Fig. 9, page 168) that receive the rear tubes, F.

We have still one or two small brazings; one of these is a lug (Fig. 26, A B), which is brazed to the underside of the handle bar, some four inches to the right of the T-piece. The hollow end is neatly fitted to the bar, then fixed with a screw, and brazed. Its purpose is to hinge the brake lever, it acting as a fulcrum.

Coming to the brake work we have a tube, M, some 9 in. long, and $\frac{5}{8}$ in. diameter; this has a brazing at both ends. On the lower end is a small fork (Fig. 27, A B). The shank of this is let into the tube, the tube being filed on the end to fit close. The upper end of the tube has a small split collar, or a collar with a snug on the back, as Fig. 28, for a set screw. It is used for the adjustment of the brake rod along with the handle bar, which will be noticed when we come to fit our brake work. Our frame being now brazed up, the filing up has to be gone into. All parts that have seen the fire will give most labour in filing. The rough scale should be removed from these parts with a used file, then better files may be employed; all parts that have seen borax must be filed up clean, as borax left on will soon show itself on the finished machine, even through the enamelling. If the tubes have a good clean surface they need not be filed in their length; a good rubbing with emery and oil will be sufficient, but for a nice job, when enamelled, all parts filed should be as smooth as the body of the tubes, for enamel is not intended to cover up rough work. I never use any other than files and emery to finish up frames for the enamel; for the parts to be polished for plating I use emery wheels of various grades. The emery wheels are wooden discs covered with leather, and coated with emery. Three or four of these wheels are sufficient; and for the final finish a wheel with pumice-stone or Tripoli powder, if a very fine finish is wanted. The emery wheels have each a spindle of their own, and they are mounted one at a time in a frame similar to a knife-grinder's, driven by two treadles. I use also an 8 in. grindstone in this frame, which is very useful for taking down rough parts, as well as for grinding small tools, twist-drills, &c. Having filed up our frame, which as yet is in three parts—the part in front of the driving wheel and the two V-shaped parts which constitute the rear portion. To fit these portions together we fit the upper ends of the tubes F into the lugs prepared for them. If the tubes have been cut the proper length and set aright, the forward ends of the lower tubes, E, should abut neatly against the edges of the bottom bracket, when they may be marked for boring the $\frac{5}{16}$ in. bolt holes. When these are bolted secure in their places and the upper ends of the tubes F fixed by a small flush set screw each, our frame may be considered finished and ready for the various attachments, such as brake, mud-guards, L-pin, &c., which I will treat of in my next paper.

In the meantime, if the reader has already started on making a bicycle for his own use, he may profitably occupy his time in studying what I have said about brazing, and in endeavouring to make himself a proficient in the art. Nothing can be effectually done in manual work of any kind without practice, and this is the reason why many a well-intentioned amateur fails in competition with the professional. He cannot have sufficient practice.

SOME SUGGESTIVE SCRAPS OF STONE CARVING.

BY ARTHUR YORKE.

The accompanying illustrations of architectural enrichment were sketched by the writer in the Chapel of the Velez family, Murcia Cathedral, Spain, and to carvers both in wood and stone they will probably suggest some departures from the beaten track.

In plan, the Chapel of the Velez differs in no respect from many chapels attached to foreign cathedrals, nor does it in the leading lines of its architecture; but in the ornamental details of its carved stone-work a style has been carried throughout which

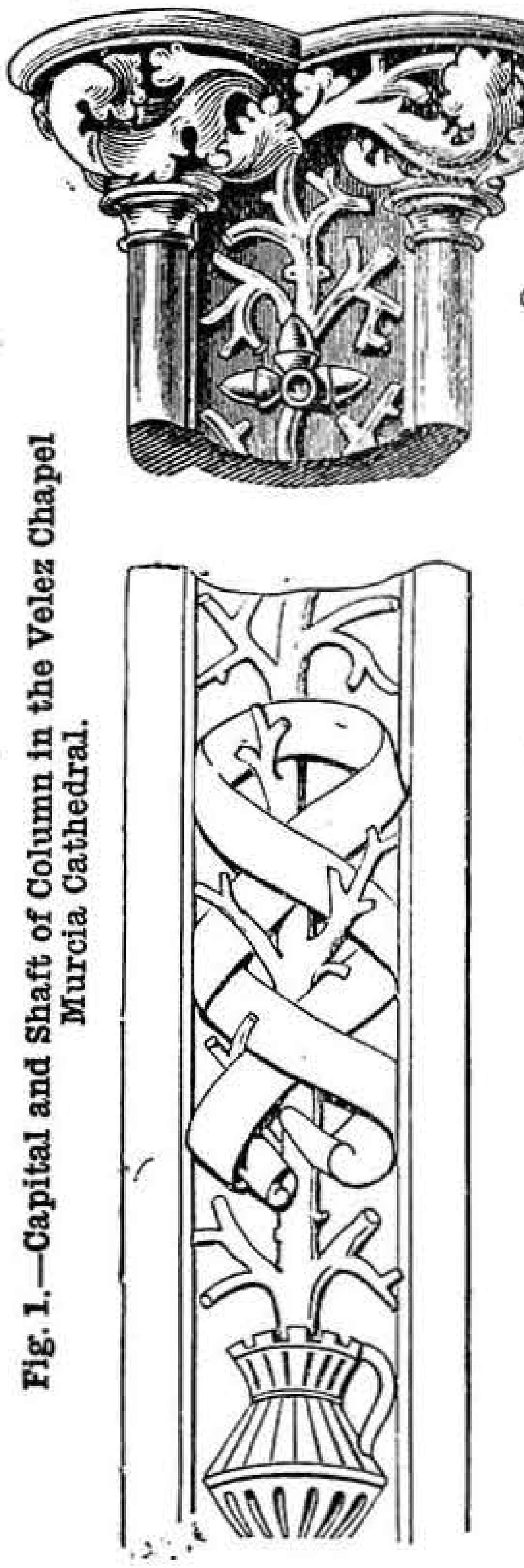

Fig. 1.—Capital and Shaft of Column in the Velez Chapel Murcia Cathedral.

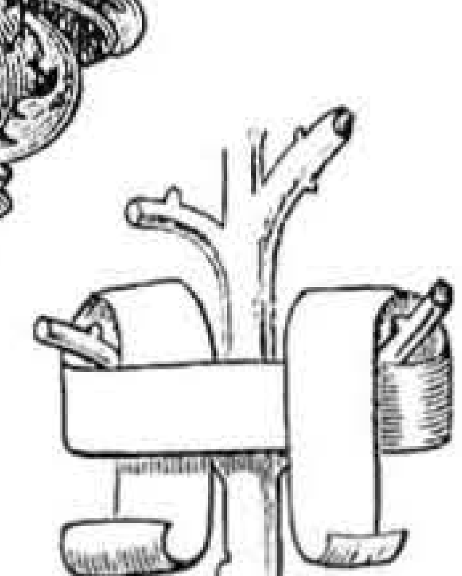

Fig. 2.—Ribbon on Leafless Twig.

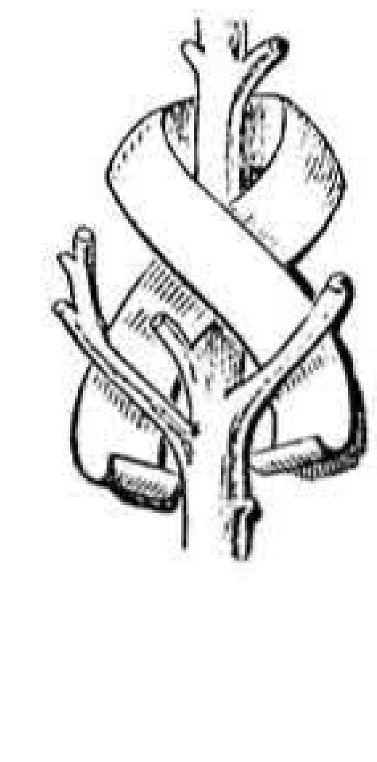

Fig. 3.—Ribbon on Leafless Twig.

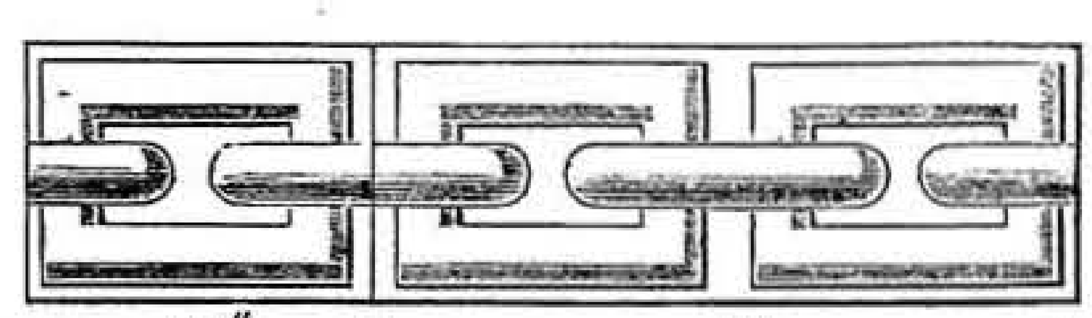

Fig. 4.—Example of Chain Moulding.

stamps it as the work of no mere copyist. In architectural decoration generally, foliage, either natural or conventional, has been depended upon for the purposes of enrichment, but in this instance the designer has almost entirely discarded leaf-work, and boldly relied upon stems and branches for his effect, foliage being reserved either for string-courses or else for capitals, as in the example (Fig. 1). To avoid monotony, and give the eye that pleasure which results from variety of form, he has hung here and there upon the bare twigs which shoot from the stems, ribbons arranged in various ways, examples of which may be seen in the lower part of Fig. 1 and in Figs. 2 and 3. He does, indeed, occasionally use a leaf, but it appears much like an exception put in to prove a rule. Even corbels are in many cases formed entirely of branch-work, the

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interlaced twigs being generally cut out clear of one another, except where contact was required for the sake of strength.

The style of the Velez Chapel is Transitional, of the time when late Gothic was merging into the Renaissance, as may be seen by the shape of the vases and the treatment of some nude figures introduced here and there. Grotesques occur in places, but these are by no means "strikingly expressed in fancy," as are those of about the same date found in our own country. On the outside of the chapel, however, is a string-course of very unusual design: it takes the form of a gigantic stone chain extending all round the building. The visitor is told that a chain was the badge of the house of Velez, and hence its introduction. Be that as it may, it might suggest an unhackneyed enrichment in stone carving apart from any such motive; or with still better effect, perhaps, it might be produced in moulded brick-work. Fig. 4 shows the pattern divided for this latter purpose into a "header" and a "stretcher."

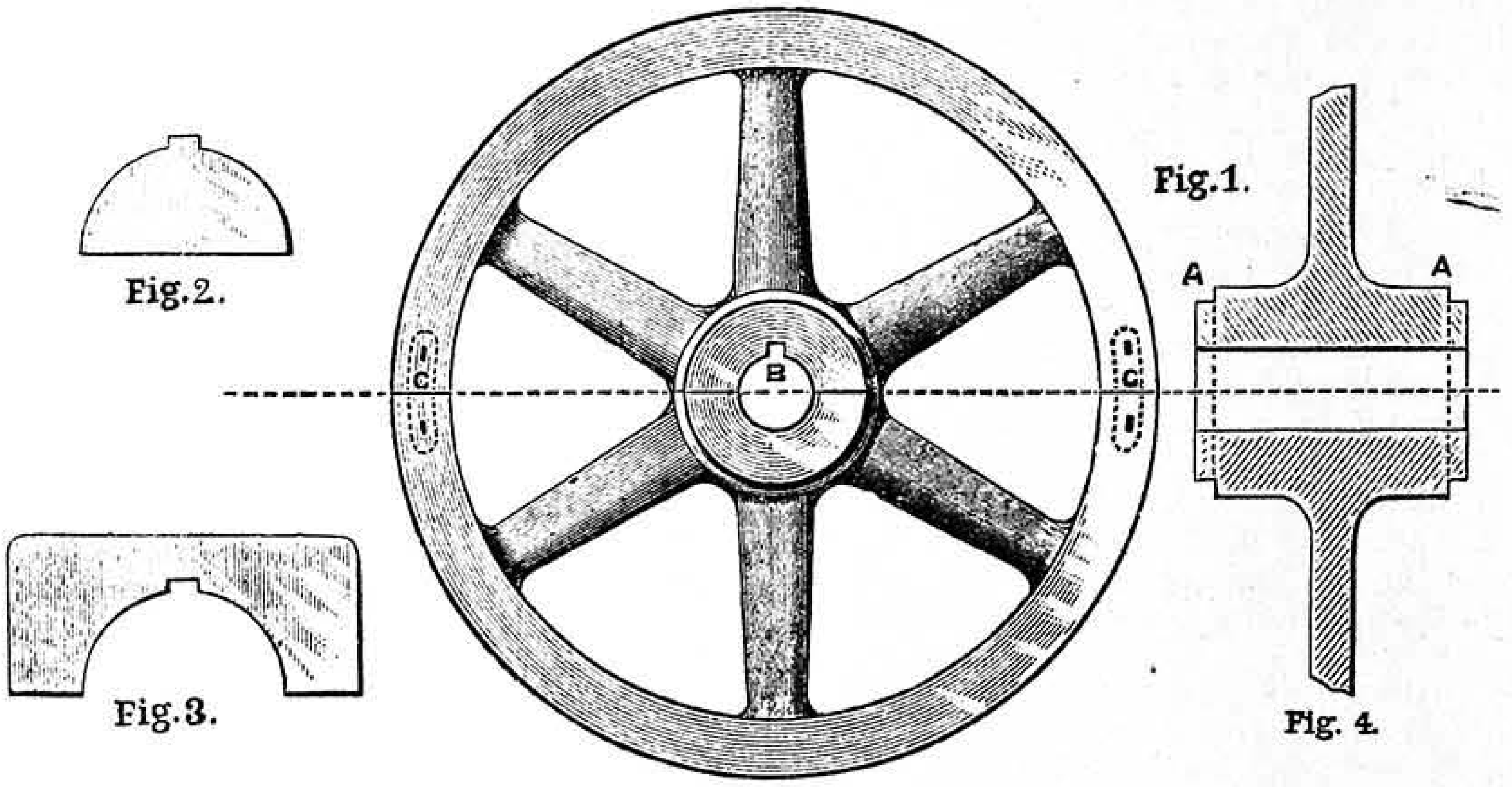

Fig. 1.—View of Wheel showing Keyway at B, and Dowels and Tapered Keys at C, C. Fig. 2.—Gauge to be fitted to Wheel. Fig. 3.—Gauge by which Key is to be fitted. Fig. 4.—Section of Boss, showing Recesses for Hoops at A, A.

SYSTEM OF FITTING FLY-WHEEL TO SHAFT.

BY T. R. BLACKETT.

Keying by Sunken Key in Shaft—Turning and Boring Wheel for Shaft—Cutting Key-way—Gauges—Twist in Key—Planing-down Key—Saving of Time and Labour by Proposed Method.

At the present time, when severe competition is the order of the day, it behoves workmen to acquire methods by which they can turn out their work with dispatch and accuracy to compete with the market.

The fitting of a heavy fly-wheel (say one of about 6 tons weight) is a job that has to be carefully done, so as to ensure an accuracy that we can depend upon.

Many engineers design fly-wheels with the arms keyed to the boss, the arms in their turn to be keyed to the rim of the wheel.

Let us consider as an example that we have to key a fly-wheel of 12 ft. diameter and about 6 tons in weight, cast in two pieces, and to be fitted to a shaft 14 in. diameter by a sunken key bedded into the shaft (Fig. 1).

After the faces of the wheel that go together have been turned up or planed, the rim is secured together by dowels and tapered keys, after which it can go to the lathe to be turned.

It will be as well to remark here that after the four tapered keys have been properly fitted, temporary keys are to be substituted while the wheel is being turned.

In the hands of the turner the wheel is turned and bored out to fit the shaft, as well as two recesses (A, A, Fig. 4) turned down at each side of the boss to take two wrought-iron hoops, which are shrunk on when the wheel is permanently fixed in position on the shaft.

Having been turned, the wheel is now taken apart, and the key-way slotted out (B, Fig. 1) in the strongest part of the boss of the one half wheel.

Assuming that the key-way has already been cut in the shaft, and the key made an accurate fit, but not caulked in, we now proceed to fit the wheel to the shaft.

Many of our mechanical readers are perfectly aware that while a key-way is being cut or slotted out in a wheel, there is a certain amount of spring on the tool, which will be rather considerable in the case of a boss some 14 in. or 15 in. in thickness. This has now to be removed.

We proceed to make a gauge similar to Fig. 2, and fix it to the deepest part of the key-way, which will be the side that was lying upwards on the slotting machine. With the assistance of a crane, we lay the fly-wheel in its rim with the boss upwards, and with a file file out the key-way so that the gauge will be an accurate fit from one end to the other.

Having satisfied ourselves that this is done, and that the corners are also nicely squared out, we go about making a second gauge, which is, so to speak, the negative of the other (Fig. 3). I may here remark that before cutting the key-space in this gauge, the gauge itself should be made a good fit to the shaft, or, better still, rough out the key-space, and finish it after the gauge has been fitted to the shaft.

We now take the first gauge that we have made, and make the second one (Fig. 3) an accurate fit to it. Having done this, we try our new gauge on to the key and shaft in the position the wheel will have to go, and perhaps we find that some $\frac{1}{8}$ in. or so has to come off the top of the key.

By this method we will see if the key has any *twist* or not, and whether it will fit the wheel. Supposing, however, that we have only $\frac{1}{8}$ in. to come off the top of the key, we fit the key to the gauge: that is, we cut the key down at each end for the space of $\frac{1}{2}$ in. along until the gauge is a perfect fit to both shaft and key.

We now take the key to the planing machine and get it planed down level from one end to the other, but not to go below the spaces at each end. Having gone through this process, we place it finally in its seat or bed and caulk it up: that is, caulk the edges of the key-way in the shaft all round the key.

Having tried the gauge on, and making sure that it fits accurately all the way along, we take off the sharp arris and try on a half-wheel, which, if the foregoing instructions have been properly carried out, will be an accurate fit.

What I have endeavoured to point out in this paper is the great advantage of a good method or system. Making a pair of gauges for a job like this out of $\frac{1}{16}$ in. sheet iron would take very little time and trouble, and in the end would prove a great deal handier than using callipers. If we had had to try the half wheel (some 3 tons) off and on while we were cutting down the key, we would have taken at least three times the time, as well as incurred an unnecessary waste of labour.

OVAL AND CYLINDRICAL VESSELS IN SHEET-METAL WORK.

BY R. ALEXANDER.

Cylindrical Vessels—Wire Bail Former—Fish Kettle and Oval Boilers—Sizing of Articles—Turning and Shaping—Drawing Patterns—Covers—Cutting out Covers—Other Straight-Sided Work: Water Pots, Boiler Filters, and Toilet Cans—Wiring Water-Pots, etc.—Handles.

Cylindrical Vessels.—The method of making a saucepan described in Vol. II., pages 468 and 661, will serve as a guide to the making up of other articles of a cylindrical form, such as camp kettles (Fig. 1). These are exactly the same in shape and size as saucepans; the difference is that, instead of a handle, boss, etc., they have two ears and a wire handle or bail. The mode of putting on ears has already been described: the bail should be of a length sufficient to drop one-third of the depth of the body when hooked in the ears; the ends of the bails should be annealed if they are of hard wire, and then bent round on the tip of the extinguisher.

Wire Bail Former.—A useful tool for bending wire bails quickly and truly is the wire bail former (Fig. 2). Care should be taken in fitting on the ears to keep them well out from the body, or when the bail is in it will be a difficult matter to get the cover on and off. The rims of the covers should be tacked a shade looser than the saucepans, as there is no handle to aid in taking the lid off to examine the contents whilst cooking—a loose-fitting lid is a fault that may be called a good one, but a tight lid is detestable.

Fish Kettles, etc.—Very similar in process of manufacture are fish kettles and oval boilers (Figs. 3 and 4). These are both of a similar shape: a kind of flattened ellipse or oblong, with rounding corners; Fig. 5 shows the correct shape, though it may be varied slightly in the case of the oval boiler by making the side a little more rounding (see dotted lines), but in the fish kettle the sides must be straight. Boilers or oval camp kettles are cut deeper than fish kettles, as a fish does not need a lot of water to cook it, and nothing else is cooked with it, whilst the boiler is often used for meat and vegetables at the same time, with, perhaps, a pudding into the bargain.

Sizing of Articles.—The following are

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the usual sizes for oval boilers, with the way of cutting the stuff: 2 gallons, 2 single lengths and piece, 2¼ in., depth, 8½ in.; 2½ gallons, 2 single lengths and piece, 3½ in., depth, 9 in.; 3 gallons, 2 single lengths and piece, 5 in., depth, 9 in.; 3½ gallons, 2 single lengths and piece, 7 in., depth, 9½ in.; 4 gallons, 3 single lengths, depth, 9½ in.; 5 gallons, 3 middle lengths, depth, 10¾ in.; 6 gallons, 3 double lengths, depth 12 in. These measures of capacity are only to be taken as approximate. Fish kettles are not stated as holding so many gallons or quarts, but run by numbers, as Nos. 1, 2, 3, and so on; the smallest size made is 2 single lengths cut 5 in. deep, and they may be made up to any size required, as follows: 2 middle lengths, 5½ in. deep; 2 double lengths, 6¼ in. deep; two 20 in. lengths, 7 in. deep; 4 double breadths, 8½ in. deep; and so on. It will be seen that these articles are sized to cut the stuff out nearly full, thus avoiding waste and simplifying the remembering of sizes. In the making up, all the directions previously given for the saucepan apply equally to these articles as far as "wiring."

Turning and Shaping.—In turning and shaping, several ways may be adopted; they may be turned in the roller to a smaller circle than would be found necessary if rolling round a saucepan (see Fig. 7); the part A is then pressed against the bench to flatten it in sufficiently; this releases the part B, which is flattened in the same way; this brings the article to the same shape shown in Fig. 8; it must then be placed on a stake, and the part C rounded in a little till D and E meet, when it can be grooved together and the shaping finished, when it should be as Fig. 9; if there are two seams, they should be at the two ends A and B; if four, they must be as A, B, C, and D. It is important to get the seams of these oval articles in the proper position; that is, supposing the sides are parallel. A line drawn from the seam at one end, parallel to one side, should pass through the other seam. Fig. 10 shows seams in wrong position, but exaggerated for clearness; it will be seen by the dotted lines where the seams should be; of course, if these end seams are wrong, the side ones will also be wrong (this refers to articles in four pieces). Another method that is adopted—especially where there are no rollers—is to work the bodies into shape on the block by placing the wired part over a hole, and striking it with a block hammer, commencing at the ends and then the centre; they can also be bent on the former.

Drawing Patterns.—To draw the pattern of any oblong with semi-circular ends, proceed as follows (see Fig. 10 A): Draw a line, A B, of any length longer than the longest diameter of the article, and through the centre of the line, and at right angles to it, draw another line, C D, of greater length than the shortest diameter. From the point of intersection of these two lines, set off F and E, equal to half the length of the pattern. From F and E, with radius equal to half the shortest diameter, describe the arcs H and G, and with the same radius, from G and H, describe circles, or arcs of circles, I J K L and M N O P. Produce diameters R S and T U through each circle parallel to C D; two straight lines joining them and touching the circumferences of the circles at ×, ×, ×, ×, complete the figure. In all patterns cut the true pattern first and allow for fold; turn up, wire, or lap afterwards. The edging, putting on bottoms, soldering, etc., will be much the same as previously described. I might remark here that it is rather difficult to turn up the edges of the bottoms in the jenny, as the sides being straight, they have a tendency to run out of the machine. The handles can next be put on; some have swing-bail handles and ears, some end handles.

Covers.—The covers next call for some explanation; the articles being oval, the rim that would do for a saucepan will not do for a boiler or fish kettle, because if flattened at the sides it would rise, and so not touch the body at that part. Some get over the difficulty by making the rims perfectly straight and tacking them very slack, and throwing off a wide edge; but this is not workmanship. The way to make them is as follows: let us suppose Fig. 11 to be a plan of the top; the parts of the rim from A to A and from B to B must be cut straight, and the other parts cut from the flue rim; and in tacking the rims they would have to be tacked as follows: one straight piece would be laid on the tacking-board along the straight line, and then a curved piece tacked to it, following the curved lines; draw this over to the curve on the left side of board, take another straight piece, and lastly the other curved pieces; it would then look like Fig. 12, and when folded and turned round, would be tapering inwards all round, and when edged laying level round the wire.

Cutting out Covers.—In cutting out the covers for oval goods, it must be noted that an allowance must be made different from that of round covers. In allowing for a round cover, there must of necessity be the same allowance for hollowing all round extra to the size of the rim, or it would not be a round cover. But in the case of an oval it is different: it is found in practice that in hollowing up an oval or oblong the sides contract, as it were, and that if extra allowance were not made at the sides, the hollowed up cover if laid upon a flat surface would leave at the side a space of about ⅜ in. from the table or surface on which it was placed; to obviate this, so much extra must be allowed on the pattern, as shown by the dotted lines in Fig. 11; also in hollowing up, the ends must receive the most attention; the sides will want very little (comparatively speaking), and should be hollowed over a shallower place in the bench than the ends. My father used to say "Hollow up the ends well, and the sides will look after themselves." The remainder of the process for the cover will be the same as for saucepans.

Other Straight-sided Work: Water Pots, Boiler Fillers, and Toilet Cans.—Water pots are usually round, though there are several registered designs that are oval in shape; boiler fillers are round, and toilet cans oval (see Figs. 13, 14, and 15); and notice difference. Fig. 13, the water pot, is round, with a hollowed top, longish spout with a rose at the end, cross and back handles. Fig. 14, the boiler filler, is round, with hollowed top, cross and back handles, but with a short spout fixed higher up the body, and with a bent nozzle. The toilet can (Fig. 15) is oval in shape, cross and back handles, with hinged cover, and a spout similar in shape and position to the boiler filler. So much for their shapes. Now a few words as to construction:—Each is made in varying sizes—the toilet can and boiler filler in about three or four; water pots in perhaps a dozen. Cut as in the previous example, as full out of the stuff as possible, as follows: Water pots, half a single, 14 × 5; half a middle, 15 × 5½; half double, 17 × 6¼; half 20, 20 × 7; middle in halves (middle plate cut in two pieces, 17 × 7½), and double in halves; two singles, two middles, and two doubles, and so on. Boiler fillers and toilet cans usually only the three last sizes. The marking-out, cutting, and notching will be the same as previously described; then, supposing there were six in number being made, which would be twelve pieces of stuff, six of them must have a hole cut in them for the spout; find the centre, and draw a perpendicular line through it from top to bottom, then two-thirds from the bottom (for toilet cans and boiler fillers), and one-third from the bottom for water pots is the proper position. Punch a hole with a large hollow punch, and flatten down. Some punch a hole and a half.

Wiring Water Pots, etc.—This class of articles are wired differently to those just described. They are what is called "sunk-wired." Figs. 16 and 17 will show what the difference is. This necessitates the bodies being grooved together in a different way. Instead of the folds for the wiring being uppermost on the tool, it must be turned down, so that when the wire is sunk it will be on the right side—the exception to this is when the grooving of the seams is to be inside, in which case proceed in exactly the way described for examples already given. The object of sinking the wire is for convenience in soldering on the tops. The wire can be sunk as it is put in by wiring over a suitable size crease in the crease-iron, or it can be plain wired first and then sunk, either in the jenny or crease-iron; turning, seaming, edging, etc., as before described. After the bottoms and studs are put on, the next thing will be to make and put on the back handles. Fig. 18 shows the shape of the flat pattern; Fig. 19 the flat pattern of the boss for same. The boss is bent on the beck iron or in the boss former (Fig. 6), which saves a lot of time in making up a lot.

Handles.—Handles for water pots are wired differently to those for toilet and boiler fillers. In the two latter the wire is cut off at the ends as short as possible; but in the case of water pots it is left out at the large end an inch (each side, of course). Fig. 20 shows the handle bent round into shape, and with the wire bent in position for putting on to the can. To put them on, mark a central line between the two seams, and punch two holes with an awl—one each side of the line, and the width apart of the handle. Push the wires through, and draw them tightly over the wired edge of the pot, and nip close with the flat-nose pliers. The bottom part is then riveted and soldered, and the iron just drawn across at the top part.

Toilet cans and boiler fillers have the back handles riveted on. They are first tacked at the top along the wiring of the cans, and then two rivets are put in the top part and one in the bottom, and the bottom part soldered. All back handles are "sunk-wired," and all have bosses, which are soldered in before they are put on to the cans, and all have thumb-pieces. Figs. 21 and 22 show flat pattern of same, and bent into shape.

Particulars of spouts, top, covers, roses, etc., will be given in my next paper on the subject. Sufficient has been said here to employ the mind and hands of each who reads these articles until the next of the series appears. The illustrations to which reference has been made above will be found grouped together on the next page on a sufficiently large scale to show very clearly the mode of procedure to be followed by readers who wish to be sheet-metal workers.

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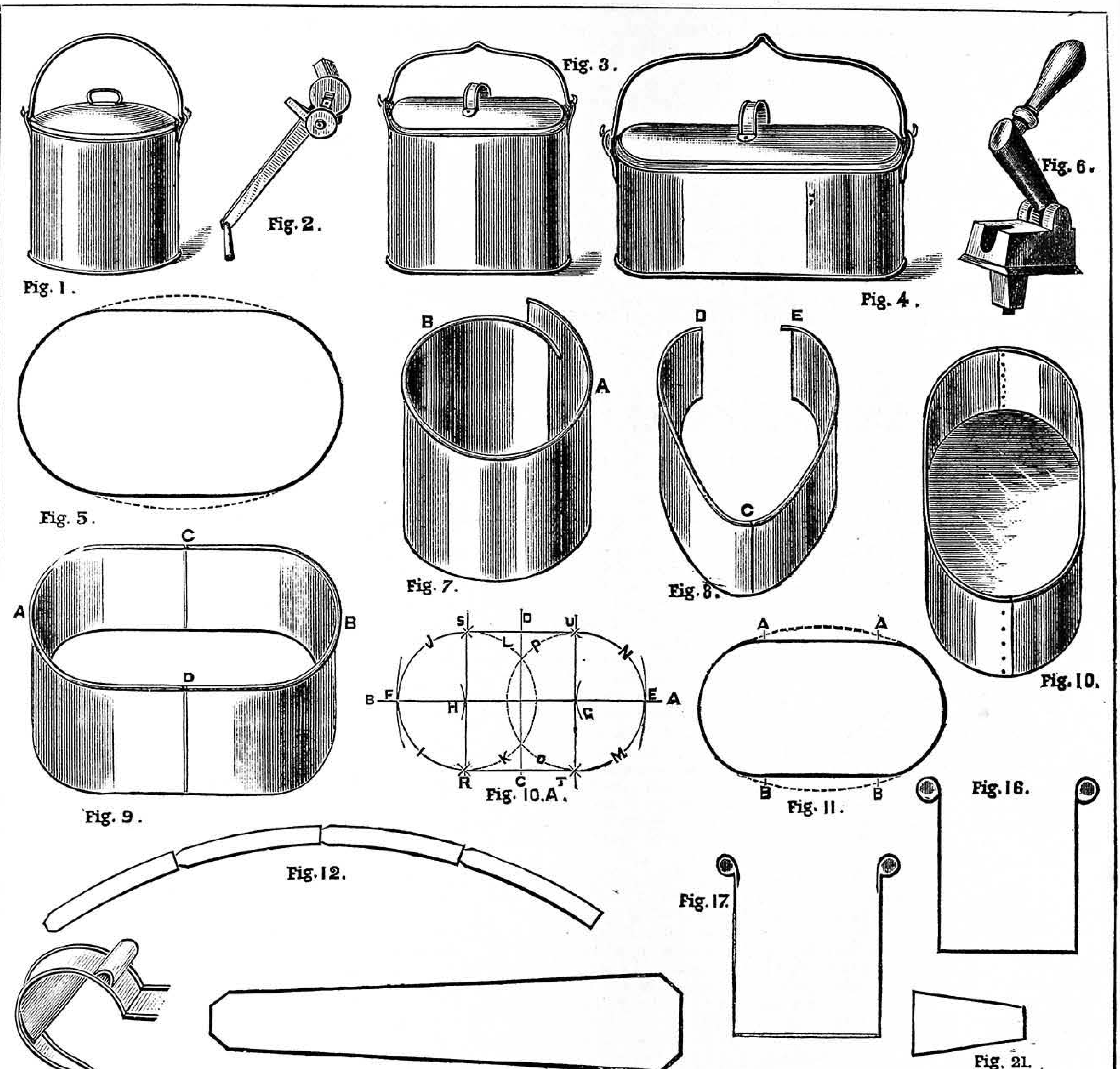

Fig. 1.—Round Camp Kettle. Fig. 2.—Wire Bail Former. Fig. 3.—Oval Boiler or Camp Kettle. Fig. 4.—Fish Kettle. Fig. 5.—Proper Shape of Kettles. Fig. 6.—Boss Former. Figs. 7, 8, 9.—Shaping of Boilers, etc. Fig. 10.—Sketch showing Seams in wrong Place. Fig. 10 A.—Diagram of Pattern for Long Boiler with Rounded Ends. Fig. 11.—Plan of Bottom to illustrate Directions for cutting Lines. Fig. 12.—Sketch of Rim tacked together. Fig. 13.—Water Pot. Fig. 14.—Boiler Filler. Fig. 15.—Toilet Can. Figs. 16, 17.—Sections of Wiring. Figs. 18, 19.—Sections of Handle and Boss. Fig. 20.—Handle Shaped and ready for Fixing. Figs. 21, 22.—Thumb Pieces Flat and Shaped.

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KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

TIES AND LASHINGS.

WEDDING KNOT, OR TIE—CHAIN KNOTS—CROSS LASHING—NECKLACE TIE—PACKING KNOT—FINISHING OFF AND WHIPPING — NIPPERING, OR RACKING—WEST COUNTRY WHIPPING—SECURING BLOCK TO ROPE—CATSPAW.

FIG. 68 is a "Wedding Knot" or tie, used for fastening together the eyes at the end of two ropes. It is made by passing rope-yarn or marline through the eyes backwards and forwards until it is strong enough; it is then fastened by taking several turns round the middle and fastening the ends with a reef knot. This forms a sort of hinge between the ropes.

Fig. 69.—"Chain Knot," for lashing to a spar. A clove-hitch is first formed round the spar, and as many single hitches as required are then made. It may be finished off with any secure knot.

Fig. 70 shows another and better way of making the "Chain Knot." In this case an overhand knot is formed at each turn, and consequently it is much more secure than Fig. 69. This is used for bending yachts' sails to the gaff. As each turn forms a knot if the cord parts, the remainder holds firm, and does not necessarily come adrift, as it would be almost sure to do if fastened as in Fig. 69.

Fig. 71 is a "Cross Lashing," used when a lever is used to a rope. After several turns round the rope, the lashing is crossed round the lever and fastened with a reef knot. All these lashings are used when several men are required to haul on large ropes at the same time.

Fig. 72 is the "Necklace Tie." Several turns are taken round the spar to be joined, then two turns round the lashings, and it is secured with a reef knot. When this is used as a lashing for shearlegs, the crossing of the two legs puts a strain on the knot, and effectually secures it. For this purpose it is called a Portuguese Knot

Fig. 73 is a "Packing Knot," used for securing large pieces of timber together. It is much employed in the neighbourhood of stone quarries in holding the blocks of stone on to the carriages on which they are taken to their destination. Fig. 73 represents a block of granite secured to a trolley with packing knots. Two or three turns are made somewhat loosely with cordage round the block and its carriage; a stout piece of wood is then inserted under the coils, and twisted round until all the slack is taken out and the cordage is taut. The end of the lever is then secured with twine to the side of the carriage, as shown in the right side of the figure. The other lashing is supposed to be already for tautening up. We have often to lash two things together where an external knot to finish off with would be objectionable, as it would spoil the smoothness and neatness of the work—as, for instance, in whipping the two parts of a broken fishing-rod together.

Fig. 74 shows one very common method of finishing off whipping without showing any knot. In commencing, we lay one end forward, as shown at A, then pass the other end round and round a sufficient number of times—hauling taut as we go; three or four loose turns are now made, and the end passed under them backwards; these are worked down into their places, and when the ends are hauled taut and cut off the job is completed. The end A need not come so far as shown in the figure, but may be hidden under the coils.

Fig. 75 is another method of accomplishing

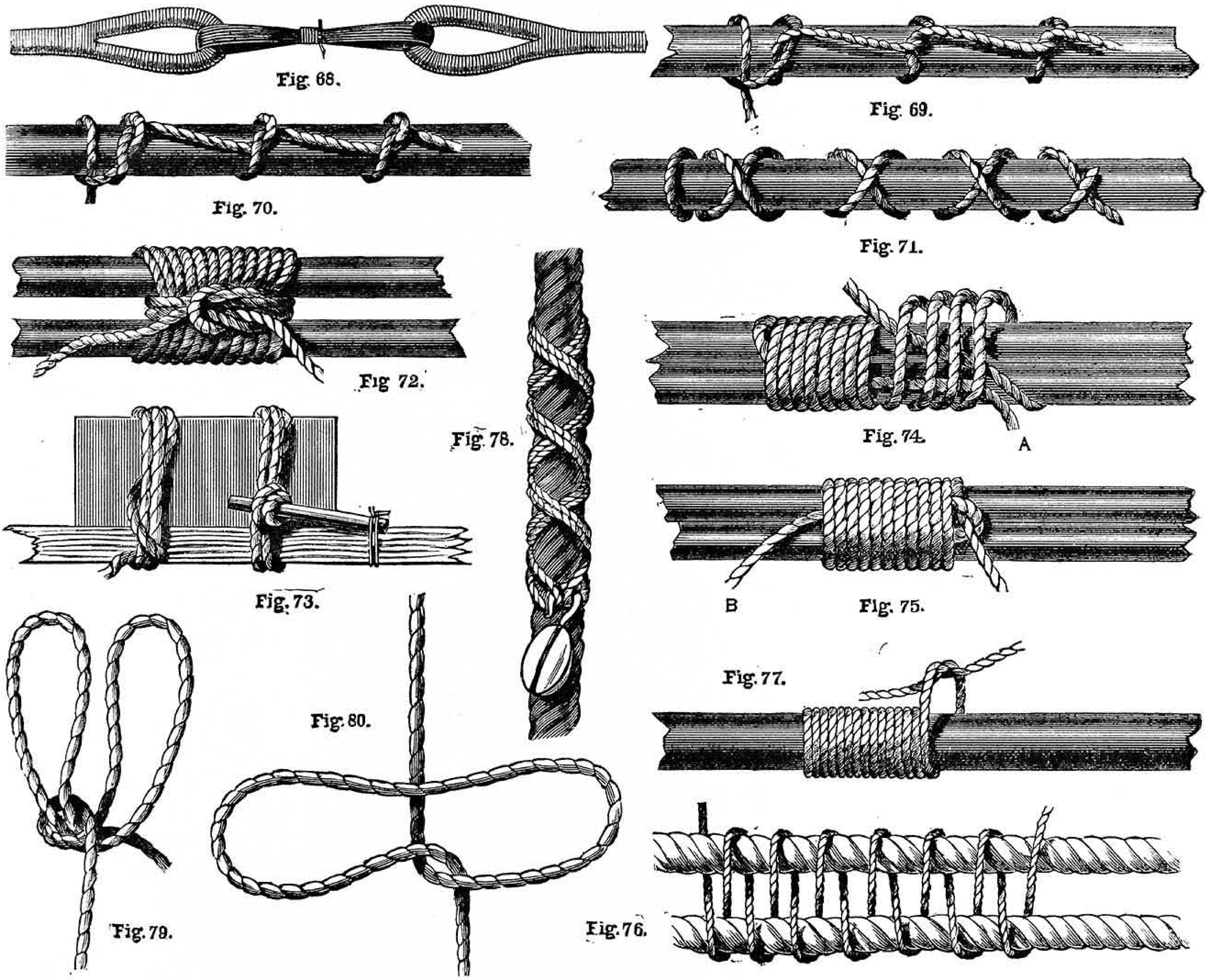

Fig. 68.—Wedding Knot. Figs. 69, 70.—Chain Knots. Fig. 71.—Cross Lashing. Fig. 72.—Necklace Tie. Fig. 73.—Packing Knot. Figs. 74, 75.—Modes of Finishing and Whipping. Fig. 76.—Nippering. Fig. 77.—West Country Whipping. Fig. 78.—Securing a Block to a Rope. Fig. 79.—Catspaw. Fig. 80.—Ditto, Commencement.

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the same end. Instead of a single end, as in the last case, a bight of the seizing stuff is laid along the part to be whipped, and the turns passed over it; when these are completed the end is passed through the bight, as at A. The end B is now hauled upon, which has the effect of bringing the bight and the end of the rope snug under the coils. We have now two loops interlacing at the centre of the work, and which cannot come undone. When the ends A and B are cut off close to the turns, the whole is as fair and smooth as one can wish. This is the method I generally adopt myself in making fishing gear.

"Nippering," or "Racking," is shown in Fig. 76. This is a method of securing two ropes together with cross turns; these are hauled taut, jambing the ropes together, and they are further secured by round turns over all, with a reef knot at the ends.

Fig. 77.—"West Country Whipping." Whether it was invented in the West or not I do not know, but I certainly never heard of it until I came to reside in the "west countrie." It is an excellent method, and deserves to be oftener practised than it is. Bring the middle of the material used under the part to be whipped, raise the ends up and tie an overhand knot, lower the ends and tie another underneath; continue tieing a single knot above and below alternately, finishing with a reef knot—or a round turn or two may be taken and the ends secured, as in Fig. 65; but a reef knot is the most usual way of fastening off this whipping. This is not quite so neat-looking a method as Figs. 74 and 75, but it is very strong and trustworthy, and is an excellent way of fastening large hooks, such as those used for cod or conger, on to a line.

Fig. 78 shows the way a block is often secured to a rope with a selvage strop. The middle of the selvage is placed against the rope, and cross turns taken until the bights come together, when the loop of the block is put through them.

A "Catspaw" (Fig. 79) is used for attaching a rope to the hook of a tackle. Fig. 80 gives the manner of commencing it. A loop is first made, and laid over the standing part so as to form two bights; these are rolled over two or three times from you, and the hook inserted in them. When the standing part is hauled upon, the hooks take the form shown in Fig. 69, and will not slip.

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.*

56.—The "Electrician" Primers.

The "Electrician" Primers are published by the "Electrician" Printing and Publishing Company, Limited, Salisbury Court, Fleet Street, E.C. They are a series of tracts, if I may be permitted to use the word in reference to them, or helpful papers on electrical subjects for the use of students and general readers, and they are comprised in two volumes, each in a paper wrapper, and sold, each, at 2s., or 2s. 2d. post free. Of the two volumes, Vol. I. deals with theory, and Vol. II. with practice; but before proceeding further, I may add that the volumes may also be had in strong cloth bindings at 2s. 6d., or 2s. 9d. post free, and single primers at 3d. each, or 3½d. post free. It is not possible for me to give a list of the primers in detail, as it would take up too much space; but lists of the subjects treated may be easily obtained on application to the Company, whose address is given above. In Vol. I. there are twenty primers devoted to a digest of such subjects as Ohm's Law, Electrolysis, Influence Machines, Thermopyles, etc., and various electrical instruments, as the Galvanometer, the Wheatstone Bridge, etc., the methods and modes of making some of which have been described in these pages. In Vol. II. there are eighteen primers relating to the management, principles, and uses of various machines, including Submarine Cables, the Telephone, Dynamos, Motors, Transformers, Lamps, Meters, etc., and the action of the electric current in deposition, welding, etc. The object of these primers, which are clearly written and all that can be desired in the form of enunciation and explanation, are, to quote from the preface to each volume, "to briefly describe in simple and correct language, the present state of electrical knowledge. Each primer is short and complete in itself, and is devoted to the elucidation of some special point or the description of some special application. Theoretical discussion is, as far as possible, avoided, the principal facts being stated and made clear by reference to the uses to which they have been put. Both volumes are suited to readers having little previous acquaintance with the subject. The matter is brought up to date, and the illustrations refer to instruments and machinery in actual use at the present time."

57.—The Silico and Club Black Enamels.

Some useful specialities, possessed of more than ordinary value to the amateur, have been recently produced and sent into the market by the Silico Enamel Company, 97, Hampstead Road, London, N.W., the most important, perhaps, being the Silico Enamel itself, from which the Company takes its name. This is a thin, liquid enamel, which is easily applied to any polished surface and bright metals of all kinds, and when applied in the proper manner, according to the instructions given and under the conditions named, forms a smooth and transparent film on the surface of the metal which not only protects it from rust or tarnish, but makes its original brilliant appearance to be preserved and maintained unchanged under any circumstances. All cyclists possessing good machines, of which parts are nickel-plated, know how difficult it is to preserve the lustre which these parts present to view when the machine is first sent out from the works or the depôt for sale, and they will accordingly welcome this preparation, which will save them an infinity of labour in rubbing up the bright parts and keeping them in a presentable condition. Further, it is useful for all metal articles or ornaments—be they what they may—that are exposed to the action of the weather. Equally good and desirable for cyclists is the Club Black Enamel, which is suitable for application to all metal surfaces requiring japaning, whose enamel has become chipped or injured in any way, and which it is needful to renovate. The Club Black Enamel is hard, bright, and durable, dries quickly—that is to say, in an hour or thereabouts—without the intervention of heat, as in the case of enamel, which requires to be stoved, and presents not only a hard but a brilliant surface. In fact, it is a "special hard drying" preparation, and this is pointed out and emphasised on the label of the jar, on which the words, in inverted commas, are printed in red. Both of these articles seem to be making their way in public favour very rapidly. Samples of either, with full directions for use and brush for application of the enamel, may be had, in bottles or stone jars at 1s., from the wholesale agents, Messrs. W. B. Fordham & Sons, Limited, York Road, London, N., and at all cycle depôts, ironmongers, stores, etc. In putting on the enamel care must be taken to move the brush in one direction only, and not backwards and forwards.

The Editor.

SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Artificial Stucco-Work.—A new idea, which will be welcomed by amateurs anxious to decorate their ceilings without calling in the aid of the builder or plasterer, has been suggested in a trade journal by Mr. L. Bridger, of Old Manor House, Walton-on-Thames. In place of real stucco, he uses ordinary wood mouldings, about 1¼ in. deep, costing about ½d. per foot, which are mitred together at the joints, and pinned in place with French nails driven into the joists. Plaster-of-Paris is then rubbed into the joints and interstices, and painted white, the whole being then whitewashed. A very rich effect is thus produced if a sufficiency of moulding be used. The *Paper Record* points out that the use of a substance resembling papier maché, which permits of being moulded so as to form circular or curved designs, was not unknown in the reign of Queen Elizabeth, being finished off much in the same way as the wooden mouldings above described.

Spontaneous Combustion on Board Vessels.—Ingenious minds have a promising field in the way of providing against spontaneous combustion on board ship. The recent serious fire at sea on board an Allan Line steamer, which was not extinguished until the vessel had been taken into dock at Liverpool, shows that, despite every reasonable care, certain cargoes, such as cotton, are dangerous. That this material—rags, wool, etc.—will spontaneously ignite under certain circumstances is well-known, but in what way this can be prevented is still uncertain. Even the means now adopted to extinguish such fires are unsatisfactory. On board the steamer in question, which was well provided with steam jets in the hold, the steam was found only to check the progress of the fire. There are thus two points for consideration—how to prevent, and how to absolutely extinguish such fires in cargo. Some apparatus which would utilise carbonic acid gas under pressure would probably meet the necessities of the case as regards putting fires out; but any one who can devise a means of preventing any such necessity from arising will earn the gratitude of, and, it may be hoped, something more substantial from underwriters and ship-owners.

Fire Extinction on Board Ship.—The comparative failure of steam jets to extinguish the fire in the hold of the s.s. *City of Richmond* has drawn public attention to the necessity of devising some effective means of dealing with the spontaneous combustion of cargoes. Various propositions have been laid before shipowners—notably one by Professor Lewis, in which the release of carbonic acid gas stored in breakable vessels is the principal feature. The whole matter, however, requires the exercise of much thought and ingenuity. The heat generated by combustion is relied on by Professor Lewis to set the carbonic acid gas in action, but captains of vessels do not seem to think this sufficiently sure. A simple apparatus, worked from the deck, which would at once discharge the gas if needed seems to be wanted.

New Games, etc.—Two things are remarkable in connection with new inventions in this line—the great difficulty in getting one to "catch on" with the public, and its immense success, financially, when that desirable end has been obtained. A similar remark applies to toys, large fortunes having been made by penny articles of this class sold in the streets. Both new games and new toys are just now in demand—cheapness of production being essential.

Perpetual Electric Clocks.—A Leeds scientist states that electric clocks can be constructed without the aid of batteries—as generally defined—by simply burying the plates in the earth, which would otherwise be excited by an acid solution in an ordinary battery, these, of course, being connected to the driving mechanism in the ordinary way adopted in electric clocks. The idea is very fascinating, and many will feel inclined to experiment in the same direction. As the statement has appeared in technical journals of repute, it is probably based on fact; but we have not ourselves had an opportunity of testing the apparatus described.

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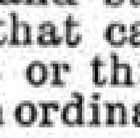
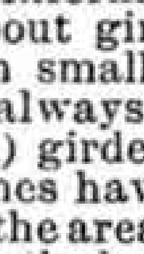
SHOP:

A Corner for Those who Want to Talk It.

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

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

Constructive Strength in Metal Work.—An Engineer writes:—"I have been considerably amused in reading an article in Work of May 30th, on "Constructive Strength in Metal Work," by Mr. Harland (p. 162), and it has set me wondering where he has got his information from, as much is contrary to all ordinary practice. Perhaps you or he could inform me in the column 'Shop.' In speaking about girders, he says: 'Sometimes a second though smaller flange is made at the bottom.' I have always found that wrought iron and steel (rolled) girders have equal flanges, and that cast-iron ones have the flange in tension two or three times the area of the one in compression; in ordinary girders the bottom flange is the largest, thus  not  He also mentions that sometimes in bridges the top flange is straight and the bottom arched, while the web is pierced. If he were to look at any such, he would find that the so-called girder was merely an ornamental casting to give a finish, that there were C.I. or W.I. girders (most likely arches) to take the weight, and this was bolted to the face of the outside one, and the bottom flange was merely to stiffen the web or spandrel. Later on, he talks about a girder being more weakened by holes in the web than the flange. So far as I have ever heard and done, the calculations for girders are taken on the basis that all shearing is borne by the web, and all bending by the flanges. The webs are always far stronger than necessary, *according to calculations for shearing*, for constructive reasons; so a hole does not make any difference, excepting a very large one, or, perhaps, at the ends or under a concentrated load where the shearing force is greatest and the excess of area the least. The bending place or moment in a girder can be resolved into a tension in one flange, and a compression in the other; and usually these are calculated closely; so any hole reduces the area and puts more stress on the rest, and thus diminishes the strength of the flange. Further on he says: 'The broader the base, the lower the centre of gravity will fall.' Will Mr. Harland kindly explain how the method of support affects the centre of gravity? I have always understood it was the point in which the whole weight may be supposed to act, irrespective of the means of support. In speaking of the A support for lathes, etc., he says that alterations of length, due to change of temperature, are alike on both sides; are these so much as to affect *anything* besides a sum in expansion by heat for some schoolboy? I know that bridges of 40 ft. to 50 ft. span, designed by first-class engineers, have often no allowance made for it. I should like to hear what Mr. Harland has to say, as, if he is right, I shall have to alter my methods."

Cycloidal Curves.—An Old Edisonian writes:—"I cannot endorse the statement of C. E. in his reply to C. C. (*New Cross*), pages 237-8 of Work, Vol. III. The speed of any point on the surface of a revolving disc is proportional to its distance from the centre, and to say that the lower part of any wheel travels more slowly than the upper when rolling in contact with a plane surface, is an error of judgment. The fact that the path of any point on the periphery of a rolling wheel takes the form of a cycloidal curve, proves nothing beyond the simple fact that, although the wheel revolves on its axle it does not do so in a circle. Now let a wheel or disc be rotated upon its axle, and at the same time moved along a plane surface, but without actually being in contact with it, and at a speed corresponding to that at which it would move if it were rolling thereon, what becomes of C. C.'s contention? Cycloidal curves would be formed from any point of its periphery in precisely the same way, but the under edge of the wheel must move at the same speed as the upper, no matter what that speed might be." [The fact of your not being able to endorse the accuracy of C. E.'s reply does not affect its soundness. Will you demonstrate, as clearly as C. E. does, the argument you adduce to controvert the conclusion he arrives at?—Ed.]

II.—Questions Answered by Editor and Staff.

Model Electric Lights. — J. H. (*Wolverhampton*).—The carbon plates for the small box battery described in Work, November, 1890, should cost about 4d. or 5d. each. Try J. Steen & Co., or Mr. A. J. Hartill, 53, Worcester Street, in your own town. If you fail these, you can have them sent by post from Mr. Bottone direct, or from any other dealer in electric sundries.—G. E. B.

Electric Coil.—J. E. W. (*Burslem*).—A series of articles on Coils is now in the Editor's hands. The last of the series will deal with medical coils, and you will learn from it how to construct a coil with several powers. For six powers you will require five separate lengths of wire in the construction of the secondary coil, the finish and commencing end of each length being brought out to a separate stud on the base of the coil. Or you may use one length and one size of secondary wire if you bring out a loop of the wire at the end of each fifth layer; twist the wire into a cord, and fasten each bared loop to a separate stud. Then, one wire from the primary to represent the first power, and one each from the five sections of the secondary, will form the six powers. I do not know of a book dealing with electric coils generally. The articles I have written for Work will give you much information on the subject.—G. E. B.

Span Roof Greenhouse.—T. N. (*Dalston*).—I give sketches of front elevation, Fig. 1; side elevation, Fig. 2; general view of framework, Fig. 3, and detail of joint at angles A, A of above. This makes rather a short doorway, but that can easily be altered in the making. I should make the sills of 2½ in. by 4½ in. oak, the four corner posts of 3 in. by 3 in. yellow, and the rest of 3 in. by 2 in. yellow. Either of the sashes along the sides can be hung for the purposes of inlet ventilation. And the space over door at one end, and the gable end of the other for outlet ventilation. Do not attempt to open the sashes at the top, for this not only entails a great deal more work, but it is a constant source of annoyance, unless it is done very nicely, and by putting the tie bolt through the top rails of frame-work, as shown at B, Fig. 3, you do away

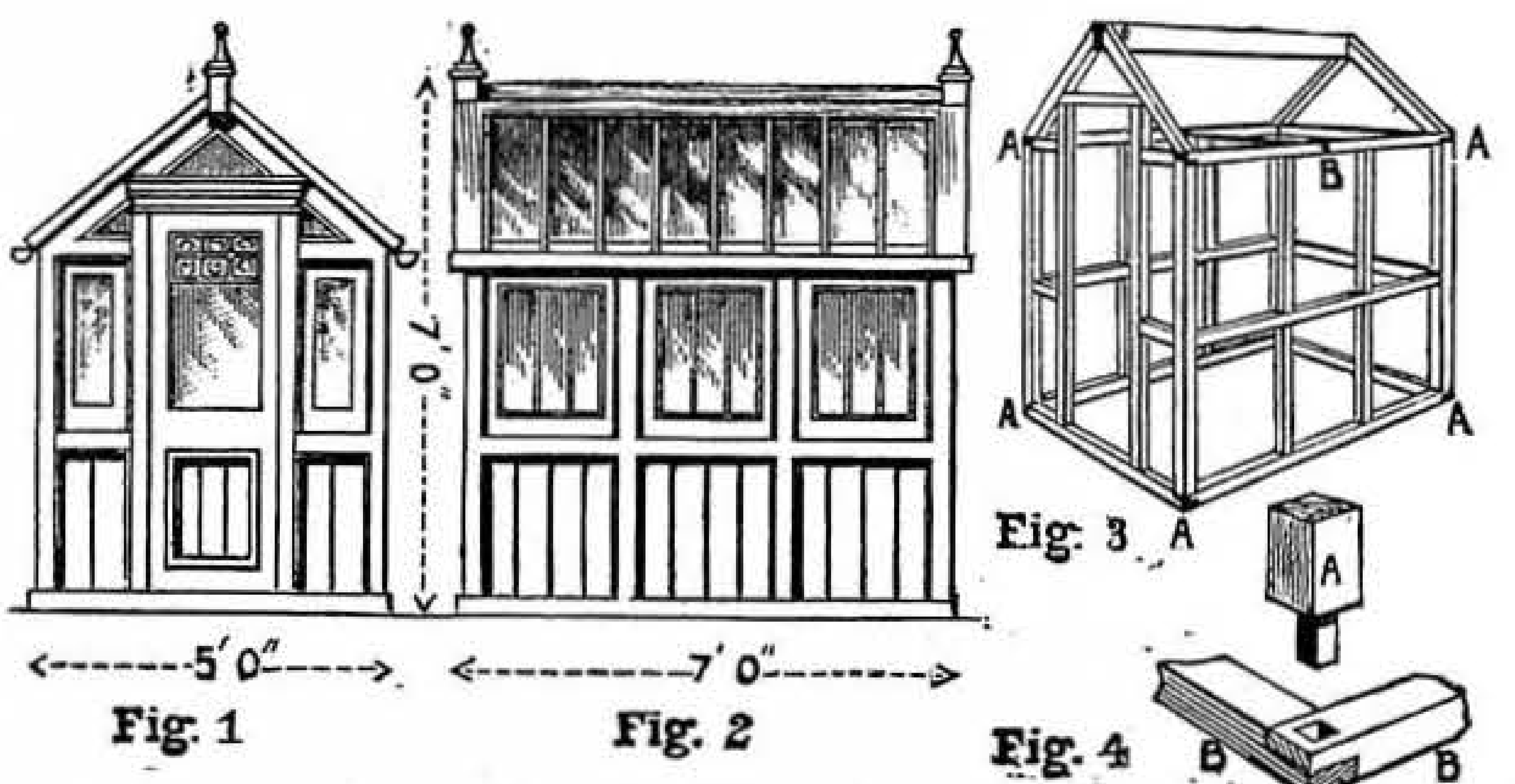


Fig. 1 Fig. 2 Fig. 4

Span Roof Greenhouse.

with the necessity of any intermediate rafters. The sashes need only be beaded on the outside, but do not put any beads at the bottom of sashes or match-lining in the front, but simply weather the rails to allow the water to run off; the match-lining being thinner than the sashes will allow of your beading them on both sides. The top rails of top sashes are mitred together, and a piece of ridge roll bird's-mouthed over them. The space in "Shop" is wholly inadequate for a thorough description of a greenhouse, but you will find the matter exhaustively treated in Nos. 12, 14 and 15, Vol. I., under the heading of "The Tenant's Greenhouse."—E. D.

Watch Springs. — Clips.—(1) Try the effect of cooling between two plates of iron smeared with oil; if after this they go wavy, your only course is to set them true by careful hammering. (2) It depends on size partly, but generally they are heated in a charcoal fire, and hardened in oil and blazed off. You can get spring steel of Pfiel, St. John's Street, Clerkenwell.—J.

Whitening Stains. — Anxious. — When old stained plaster work or woodwork is coated with whitening-wash, the stains invariably work through, no matter if you give it a dozen coats. The why and wherefore is a lengthy matter, and no practical advantage would accrue to you to discuss it here. To remedy the trouble, remove all old whiting, and coat the stains with oil paint, or try a wash of plaster-of-Paris and water—the latter *may* answer, the former is *sure* to. Have you tried Alabastine? —F. P.

General House Repairs.—A. F. S. (*Hackney*). —There is a very useful waistcoat-pocket price book, published by Spon (London), which I think would suit you, but I should advise you to call and see them, or else write for catalogue.—E. D.

Aquarium.—A New Subscriber.—An article on the construction of an Aquarium appeared in Part 31, Vol. I. of Work. Should this be too elaborate for your purpose, you could leave out such details as you did not desire. The instruction for any part of the design will hold good.—C. M. W.

Sewer Gas.—E. T. (*Burntcliffe*).—It is impossible for me to give you a test for sewer gas unless I have a rough plan and a slight description of your system of drainage, as there are so many ways by which sewer gas can find its way into a house. The ways it can do so are, for instance—1. Through defective joints, either caused by bad workmanship, settlement, or general decay. 2. Through any overflow, waste pipe from sinks, baths, gutters, etc., which, although so-called trapped, are in direct communication with sewer. 3. If there is no proper interceptor trap cutting off the house drainage from the main sewer. 4. If the house drain and soil pipes are not subject to a constant current of fresh air by means of inlet and outlet ventilators. 5. If all traps that are in the least way subject to syphonage are not relieved by an air pipe, etc. etc. I could continue for some time giving examples of how it can get into the house; but how to test when and where it gets there is useless to speculate upon without being more fully informed as to the state of things at present. There are several ways of testing if a drain leaks; by putting some nauseous or strongly smelling chemical down the drain by means of the w.c., and seeing if it can be detected anywhere about the house. I have heard of a plan by which a chemical strongly resembling the smell of cats' urine is put into the drain, and it is then left to the delicate (or otherwise) sense of smell of the domestic feline to trace the point of escape. But all these means are purely theoretical, and give nothing else but dissatisfaction, and I should certainly not think of recommending them. The remarks I have made above as to the ways the gas can enter a house may appear to you too technical, but they are not so; for if you find them difficult to understand, I feel convinced that you would not be able to give me a sufficiently clear description to enable me to be of any service to you. If this is so your only way is to call in an *expert* in sanitary matters, and let him make an examination, and give you a specification of what is necessary to be done to put your premises in thorough sanitary order, for which he should not charge you more than £2 2s. If, on the other hand, you feel confident you can give me a clear description, I shall have much pleasure in telling you how to go about finding any defects there might be, and the cheapest way to remedy them when found. But I must say this, that the appliances necessary to make a thorough examination and test are, in many cases, more costly than paying an expert to examine the drains and remedying the defects afterwards. I should have liked to have given a description as to testing a drain as it would interest so many readers; but, in order to do so, I should have to lay down a purely imaginary system of drainage for example, and perhaps this description would be a very long way from meeting your case.—E. D.

Carpentering.—T. G. W. (*Clapham*). —I am not aware of any book suitable for an amateur that is in any way superior to the various articles in Work. Of course, magazine articles vary; some are suitable for well-advanced students, and some for young beginners. It is beyond my province to encourage T. G. W. to hope for a weekly column—if it ever be done it must be graduated better than T. G. W. suggests. I can only advise that you watch the advertisements in local papers. My classes are at the N.W. end of the town.—B. A. B.

Draughtsman.—G. B. (*Poplar*) wishes to know the qualifications of a draughtsman, and asks for advice as to books and classes. One qualification of a draughtsman is undoubtedly the ability to make a drawing, more or less finished and elaborate in style according to the class of work he has to deal with; another, and in most cases a much more important qualification, is that he shall understand what he has to draw. For the draughtsman is generally called upon to invent what he draws; if he be an architectural draughtsman called upon to design, say, such a comparatively simple thing as a sash-window, most likely the only data given him to work from will be the height and width of the window; it is for him to decide on the sizes, shapes, and construction of the window-frames, window-sashes, architraves, thickness of glass, and all other details necessary to make the working drawing complete. If he be a mechanical draughtsman called upon to design an iron roof, probably all the requirements that will be put before him are that it shall cover so much ground, and shall be covered with corrugated iron or slates, as the case may be. It is then the draughtsman's duty to say what style of roof-principal shall be adopted, the size and material of every member—rafters, struts, tension-rods, tie-bars, purlins—with sizes and shapes of all joints and connections, as well as the sizes and strengths of the supporting columns. So that G. B. will see that draughtsmanship, or the art of drawing, is only one of the minor qualifications of what is generally known as a "draughtsman." Before commencing to make mechanical drawings (I assume from G. B.'s letter that he is a mechanical engineer), I would strongly recommend him to work through some small book of plane geometry —there are plenty published at 6d. which are suitable—and familiarise himself with the bisection of lines, drawing parallel lines, erection of right angles under various conditions, finding centres of circles, and other simple problems. A knowledge of these will save him much future trouble.

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After this, let him make copies of simple mechanical drawings, so as to get accustomed to the methods of using the instruments and the uses of sections, plans, and elevations, conventional colours for different materials, etc. After a little of this work, he should make freehand sketches of some simple piece of machinery or joinery, measure it up, and figure the dimensions on his sketches, and from these dimensions try to make a proper working drawing. He will most likely find that the dimensions are not sufficient for his purpose; that although he has taken twice as many measurements as are necessary, he is still short of some that are absolutely needed to make an accurate drawing. Only practice can cure this, though the knowledge of the geometry above recommended will assist him in deciding which are the right dimensions to take. The first drawings should all be big and bold—not "finicky"—to full size or as big a scale as possible. Draw with strong lines, but, on the other hand, let the colouring be rather pale, except in such parts as are in section. Good lettering, or "printing," and general artistic finish to a drawing are very desirable, and in some drawing offices a necessity; but there are thousands of working drawings sent into the shops with the dimensions and particulars merely written on them in ordinary handwriting. I can recommend no better books than Cassell's Technical Manuals, which are advertised in WORK at the end of "Shop." "Drawing for Machinists," price 4s. 6d., is the one that will probably suit G. B. best. Crosby Lockwood & Co. also publish "Engineering Drawing," price 3s. 6d., one-third of which might be useful. If possible, try and attend a night class under some science and art teacher. —A. B.

Life Buoy.—W. J. C. (*Surrey*).—Write to Messrs. P. B. Cow & Co., Indiarubber manufacturers, Cheapside, London, E.C.

Coal Vase.—BLACK DIAMONDS.—If you purchase No. 36 of WORK, price one penny, you will find, on p. 571, particulars of how to make a cheap coal vase; also, if you refer to the Indexes of Vols. I. and II. of WORK, several other references will be found relating to coal boxes.

Overmantel and Coal Vase.—G. A. H. (*Islington, N.*).—Particulars of a simple, cheap coal vase were given in WORK, No. 36, p. 571. For overmantel designs procure Nos. 5 and 22 of WORK.

Electric Lighting Replies.—AN OLD EDISONIAN.—Thanks for your criticisms. The pages of "Shop," Section I., are open to you, or any reader, to question the accuracy of anything you light upon in WORK, and which may not seem quite clear. G. E. B. will reply to you through "Shop." In the meanwhile, reference has been made to his "copy," and in each instance complained of he wrote *Watts*, not "volts," so that it is a printer's, not an author's, error.

Blunders in Replies.—AN OLD EDISONIAN —The blunders noticed by you in my reply to J. C. H. (*Dublin*), on p. 172, are manifestly either slips of the pen or printer's errors. Of course it is most unfortunate that they should have got into print, but it is evident to all, except a mere tyro, that the word "volts" is a misprint for "Watts." The sentence should, therefore, read: "Your ten lamps, of 8 c.p. each lamp, will take 280 *Watts* of current to light them. Twelve lamps will take 336 *Watts* of current." No one in his right mind would think of running ten 28 volt lamps in series from a set of accumulators, as this would involve the employment of one hundred and forty cells in series at the least. In the next sentence but one of the reply, the mistake is repeated. It should read: "Multiply the *Watts* of current by the number of hours the cells are wanted; divide this by the voltage of the cells to be used, and you will then find the desired capacity of the cells to be employed." For instance, supposing we take twelve 8 c.p. lamps. These will take $3\frac{1}{2}$ Watts of current per candle power; then $3\frac{1}{2} \times 12 \times 10$ will give us 336 Watts of current as being necessary to light the lamps. I think the querist wished to know the least number of cells he could use, and the longest time he could use them. Now, if he wished to use the lamps for a twelve hours' run, and the resistance of his lamp circuit is 18 ohms, the figures will be $336 \times 12 = \frac{4,032}{18} = 224$ ampère hours as the required capacity of the accumulator cells. As the eleven plate E. P. S. cells have only a capacity of 220 ampère hours, I deemed it best to have the fifteen plate size, which has a capacity of 330 ampère hours. The merits of a reply in "Shop" can only be judged by comparing it with the question to be answered. These are sometimes of such a character, as to be calculated capable of puzzling a Transatlantic lawyer.—G. E. B.

Brass Lacquer.—J. K. W. (*Liverpool*).—A good golden-coloured lacquer for brass is described on p. 83, No. 58, Vol. II. of WORK. You will also find recipes for brass lacquers in "Shop" (see p. 28, No. 54, Vol. II. of WORK.) As a rule, it is cheaper to buy brass lacquer ready made by professional makers. A good cold lacquer for brass is sold by Messrs. J. & E. Hartley, 13, St. Paul's Square, Birmingham.—G. E. B.

Insulating Compound.—J. K. W. (*Liverpool*). —I cannot just now place my hand on any recipe for making an insulating compound of gutta-percha with other substances. Gutta-percha can be dissolved in bisulphide of carbon, chloroform, and ether, and the resulting pasty mass be employed as an insulating compound. Perhaps some of our readers can describe an insulating compound of gutta-percha with other substances.—G. E. B.

Dry Battery.—E. W. (*Euston Road*).—Dry batteries have been and are used for working portable medical coils, but I cannot say whether the dry battery described by F. A. (*Portsmouth*), on p. 174, would be suitable or not. The mixture appears as if it would work, but I cannot say anything about the constancy of such a battery. Perhaps F. A. will oblige us with his experience. If you wish to try the mixture, use it in cells made of thick sheet zinc. Canisters 6 in. in length by 3 in. in diameter are a convenient size.—G. E. B.

Electric Bell Battery Repairs.—C. R. (*Mayfield*).—I cannot recognise the battery from your description of it; possibly it is a dry silver chloride battery. If so, the wire coil is a silver wire, and this has been immersed in a paste of silver chloride, separated from the zinc by a canvas or cloth partition. The zinc must be cleaned and the silver chloride renewed. I have not a high opinion of these batteries, so should advise Leclanché or Gassner cells instead.—G. E. B.

Electrotype Copy of Hound's Head.—C. F. (*Sherborne*).—As you have modelled the head in clay, and have taken a copy of this in plaster-of-Paris, your course is quite clear. Get a copy of WORK for August 9th, 1890, and read therein the article on "Electrotype Copies of Busts." This will give you details of the process to be followed in getting an electrotype copy of the hound's head. Of course you have the plaster mould in two or more pieces. Soak them well in linseed oil, and bake them afterwards, to make the plaster insoluble in the electrotype solution. This should be done several times. The insides of the two halves of the mould must then be coated with blacklead, as directed in the article on "Blacklead and Blackleading," in WORK for October 5th, 1889. These must now be treated as directed in the article above mentioned to get an electrotype copy, and the two halves of this copy soldered together. If you meet with any difficulty, please let me know and I will advise you in "Shop." We do not send replies by post.—G. E. B.

Fungus.—E. G. P. (*London*).—The only remedy for the above is the removal of the cause. The causes are generally want of ventilation. Confined air without moisture considerably assists the fungus. Too much moisture will prevent its growth, but if dampness is combined with warmth, and without ventilation, it assists its growth; in fact, all kinds of stoves increase its growth if the parts are in any way damp. Linoleum or oil-cloth is frequently the cause of dry rot, by preventing access of air and retaining the damp. The best way to treat it is to cut out all the diseased timber, and substitute thoroughly seasoned material in place of same; ventilate the cellar, and lastly, but not least, thorougly brush away all signs of the fungus; for one of its peculiarities is that the germs of the fungi are carried in all directions in a building where it shows itself, without necessity for actual contact between the affected and sound wood.—E. D.

Gas Meter Index.—C. C. (*Oxford*).—You will find this question fully answered on page 541, No. 34, Vol. I. of WORK, with the correction that where it says, in brackets, "bear in mind it would have to go right round to be 1·090," "read bear in mind it would have to go right round to be 1·000."—E. D.

Iron Roof.—PLUCK.—There is no doubt that galvanised corrugated iron, of at least No. 20 Birmingham wire guage and properly galvanised, is far preferable to black iron sheets for your purpose, and one great consideration in its favour is, that being corrugated this enormously increases the stiffness and strength of the sheets, consequently there are less intermediate supports required. This, I think, does away with the necessity of answering your other questions.—E. D.

Cement.—GLASIUS.—I think you will be able to succeed with plaster-of-Paris. If it sets too quickly, mix sugar with it; alum water used to mix it with makes it set very hard, or you might use Parian cement, which would not set so quickly. I am trying some experiments, and will let you know the result if you do not succeed, and will write again.—W. E. D., JR.

Glass Silvering.—ANXIOUS B.—You cannot have a cheaper method than that by nitrate of silver; and as you say you have read those described in WORK, you will, of course, have seen there are many things that would account for those in the trade being able to make and sell at a cheaper rate than an amateur can produce. To mention one obvious one, all their materials are bought in quantities, and, therefore, very likely at less than half price; and it is quite right that it should be so. They have to live by their trade. A true amateur does things for the love of making and the knowledge gained, and not to compete with the trade, nor to make a profit on his work; in fact, in that case, he ceases to be an amateur. If, therefore, you want to make one or two cheaper than you could buy them, you will find it cannot be done; but if, as I said, you wish to do it for the love of it, and the knowledge gained, try the recipes given in WORK.—W. E. D., JR.

Bicycle Enamel.—W. L. (*No Address.*)—Get enamel paint, any colour, from an oilman. State what it is for. The enamelled plates used in advertising soaps, etc., are baked in an oven; the process is patented. Stoving enamel for bicycles would stand under water, but you would not get it white. You cannot melt the edges of glass so as to make watertight joints. Join the edges with cement used for glass work; cement of Pompeii will do.—A. S. P.

Stains out of Books.—BOOKWORM.—You ask how to take a water stain out of a book. I am very sorry that I cannot tell you how to do this; a stain halfway up every page is a serious affair. I am afraid your book is hopelessly spoiled. There are a few things you might try, but you would have to take the book to pieces and treat every leaf separately, and, of course, such a procedure entails no small degree of labour, besides the chance of making matters worse through the want of experience in your manipulation. A very weak solution of oxalic acid might be used as a bath, every leaf placed in separately, and allowed to remain for some time, and afterwards placed between sheets of blotting to dry. I would really advise this BOOKWORM not to attempt this. I am sure he will only make matters worse.—G. C.

Engine Valves.—PASSIL.—In No. 110, Vol. III. of WORK, and page 89, you will find a diagram and drawings of a plain slide-valve and its action. The description of the practical method of setting the same would take up too much space of "Shop"; it would also be impossible to mention a book treating of all the different forms of valves as desired, and, as the methods of working the same are as numerous as the valves themselves, it would want an encyclopædia on the subject to afford the information desired, and as the method of setting them would vary for each alteration in gearing, you will see that it would be an impossibility for one book to contain all the information desired. I herewith give a list of a few books relating to engine valves:—(1) "A Treatise on Valve Gear," by Zeuner; published by E. and F. N. Spon. This book deals solely with the theory, and is considered a standard work on the subject of which it treats. (2) "Sink Motion and Expansion Gear," by N. P. Burgh, published likewise by E. and F. N. Spon. This gives a pretty complete account of several kinds of valves, including Corliss motion. (3) "Valve Gears," by Spangler, published by John Wiley & Sons, 53, East Tenth Street, New York. (4) "The Steam Engine," by D. K. Clark, published by Blackie & Son, Limited. This is a costly work, as it contains four volumes; there is some useful information on valves in it. (5) "Steuerungen der Dampfmaschinen," by Emil Blaha, published by Julius Springer, Berlin. I give this as, should you be able to read German, it seems more of the style of book you want. It gives both diagrams and drawings of a great number of valves and motions for same. There may probably be an English translation of same, but I have not seen one. When you ask for the methods used in setting the valves, I suppose you mean the practical way which will most probably vary to a certain extent in each shop you work in. I do not know of any book which treats of the subject. All books on valves give the position of the eccentric, or the method of obtaining it for the various valves treated of.—P. B. H.

Mildewed Glass.—T. W. (*Loughboro'*).—I am afraid you cannot restore your glass. Mildew is a fungus growth, and to destroy it would destroy the silvering. To re-silver, kindly refer to articles in WORK, Vol. II., No. 55, p. 44; No. 75, p. 373; No. 78, p. 422; No. 83, p. 503; and No. 85, p. 536.—W. E. D., JR.

Aphengescope.—G. S. R. (*Tewkesbury*).—The above instrument is not a patent, and you can make either of those which have been described in WORK.—C. A. P.

Silvering Glass.—MIRROR.—The formula you quote is generally, I believe, called "Drayton's Process," and is given correctly, except in one important particular. After you have floated on the glass a few drops of a mixture of oil of cloves and spirits of wine (in the proportion of oil of cloves one, spirits of wine three) should be dropped in different places, or diluted oil of cloves can be added to the solution before it is poured on the glass; the more oil of cloves the quicker the deposit, but do not add too much. To remove the old, if by quicksilver process, use wood naphtha on a rag and rub hard. —W. E. D., JR.

Ferrotype Process.—W. J. H. P. (*Cookstown*). —The ferrotype process is simply the wet collodion process on metal plates—ferrotype plates being thin sheet-iron covered with a dark varnish, usually of a chocolate tint, and may be purchased at the photographic dealers in dozen or gross packets of the sizes generally adopted for dry-plates. They may be trimmed with a pair of scissors to any shape. There is no special way of treatment differing from ordinary collodion positive work, and any collodion and developer that will work well on glass will do the same on ferrotype plates. Their advantages are in comparison with glass, less weight and liability to breakage; and the disadvantage is, not so true a surface, and the image is reversed, which is not of much importance with the class of work usually done on them. Of course, by aid of a mirror or reversing prism, the reversal might be remedied, but it rarely ever is.—D.

Umbrella Materials.—EYRE.—The following are the names and addresses of the firms in Liverpool and Manchester who sell all kinds of umbrella materials:—McKenzie Bros., Bold Street, Liverpool; W. Walmsley, Victoria Buildings, Victoria Street, Manchester; Hughes Young, Deansgate, Manchester.—W.

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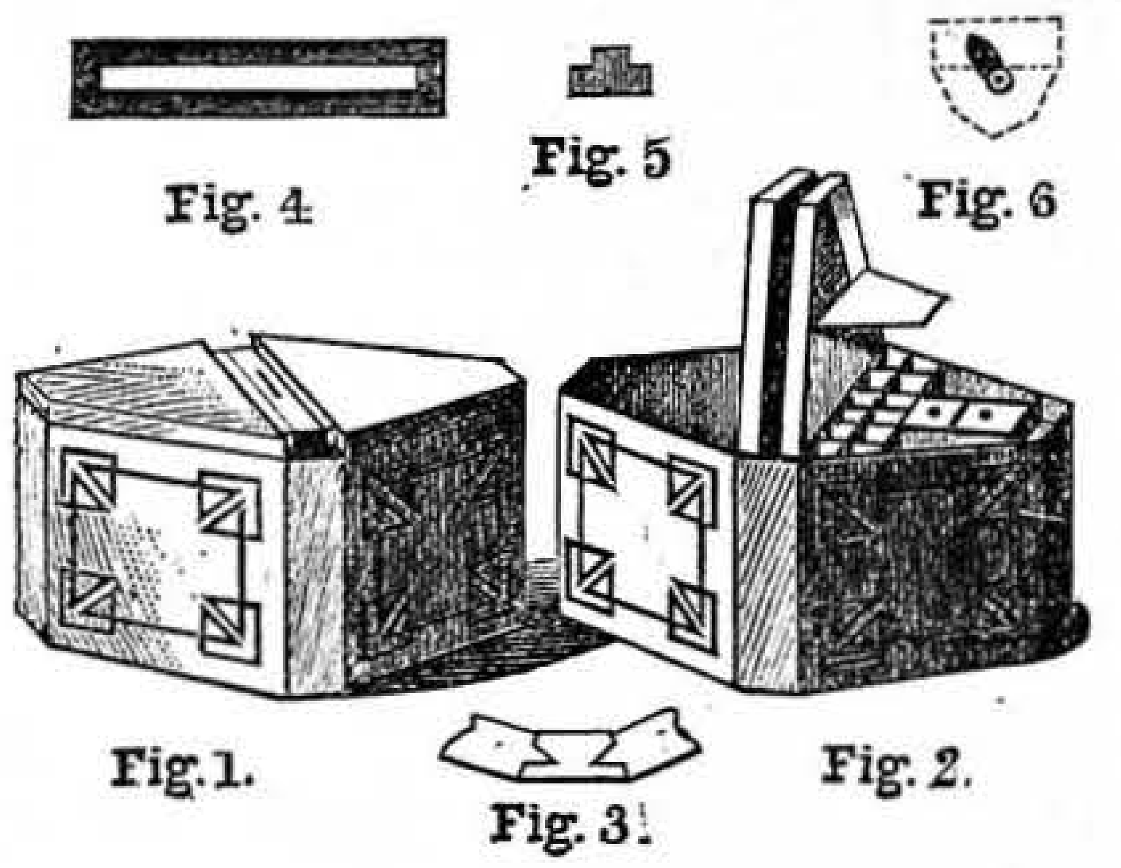
Lady's Work-box.—W. J. (*Portsea*).—Work-boxes offer very little opportunity for originality. As you intend it for a present, I advise you to make it diamond shape. Join each of the four large sides to the narrow sides as in plan (Fig. 3), the grooves, etc., extending from top to bottom. Great strength is not particularly necessary. It might answer if you screwed or dowelled a green-cloth covered bottom board into position. It will be preferable to make the reel and needle boxes bodily removable. Construct a shallow tray, and join three divisions across its width, and a desirable number of partitions between these. For firmness, tongue the ends of each cross-piece into the divisions it meets with. See back numbers for descriptions of these joints. There is a feature about the



Lady's Work Box.—Fig. 1.—Box Closed. Fig. 2.—Box Open. Fig. 3.—Plan of one Corner. Fig. 4.—Plan of fixed Top Board to which are hinged the Lids. Fig. 5.—Section of Removable Top Piece shown between the Lids in Fig. 1.—Fig. 6.—Fastening for the Flaps in Lids.

double lid which will not recommend it to an impatient lady. Mitre and screw four narrow pieces to a whole board. Fill the space of it partly up with a fixed board, and to it hinge a companion flap, the latter with a fastening (Fig. 6) attached. This makes one lid. A rail, in section like Fig. 5, is needed to retain the lids as in Fig. 1—nothing more, unless to provide against dishonesty. Have a fixed slotted rail (Fig. 4) across the top of the box, and screw two narrow pieces to the backs of the lids, as in Fig. 1, to enter the slot, and you will find that, by removing the cross-rail, the lids can be opened as in Fig. 2. In my limited space I cannot show how the ends of the removable cross-piece must be cut, nor the distance apart the lids must be hinged; but a little thought will make it all clear to you. Arrive at best size by cutting and arranging cardboard. Place in our hands another query concerning covering of small lids.—J. S.

Rubber Stamps.—A NEW SUBSCRIBER—Full directions for making rubber stamps are given on pages 594 and 630 of Nos. 38 and 40 of Vol. I. of WORK. Some modification of the process may meet your case, but evidently no suggestions can be given unless the specific purpose be clearly stated.—QUI VIVE.

Imitation of Granite Stone.—J. B. (*Devonport*).—This process is one of the minor and elementary divisions of the Art of Marbling. Space will not permit an exhaustive lesson here, but I give you a few concise directions which will probably serve your present purpose. For a staircase wall, either a pink or grey granite would suit—that is, assuming you require something "everlasting" and sanitary, and not a "modern" decorative treatment. Remember grey walls will give a cold sensation, pink a warm and cheerful effect. For the former, paint the walls with grey paint of a "leaden" hue; then, when dry, with a small piece of honeycomb sponge, apply the spots of pure black and white, and finish with a light varnish. For pink granite, mix your ground with white lead paint and a little Venetian red in oil. Put in the black and white spots as for grey. A skirting of "black and gold" marble beneath this would be best in your case. Banisters would look well and consistent if painted a deep bronze green, then coated with hard-drying varnish. Before this gets set, rub a little gold bronze-powder on the prominent parts with a little piece of unwashed wash-leather.—DECORATOR.

Black Enamel.—J. M. (*Wanstead*).—Slate mantel-pieces and similar goods are enamelled and stoved on the principle of Japanned ware. Hence it is an operation not suitable for a novice to attempt. "Aspinall's" is an enamel, doubtless, equal to the majority of largely used brands; but black enamels of this type, even if one has sufficient ability to make a good job of applying it, cannot be compared for wear to the proper process. Varnish-making firms prepare these enamels especially for stoving. The best result an amateur is likely to obtain on a flat surface of any size, would be by coating the article with one or two thin coats of finely-strained "dead black," made from ivory black ground in turps, a little oil varnish or Japan gold size to bind it, and then thinned to working consistency with turps. Use a flat camel-hair brush, and spread barely and quickly. When hard finish with two or more coats finest copal varnish. Parts near the fire should be coated with Brunswick black.—F. P.

Model Electric Motor.—W. G. C. (*Taunton*).—Your model motor is a very tiny affair indeed, only having an armature ⅜ in. by ⅜ in., and field magnets ⅜ in. square. Fill the armature with No. 32 silk covered copper wire, and wind as much of this wire as you can get in the fields. As you have not given me the full dimensions of the wire space at your command on the magnet cores and the armature, I cannot tell the quantity of wire you can get on the model. The replies are published only in "Shop" for the general benefit of all readers.—G. E. B.

Books on Drawing, etc.—L. G. (*Falmouth*). The following books may help you—"The Principles of Perspective" (Trobridge), 2s. 6d.; "Cassell's Course of Geometry," by E. A. Davidson, price 5s.; "First Book of Experimental Geometry," by Paul Bert, price 1s. 6d.

A Squirrel's Cage.—HUGH.—In making a cage for squirrels, or, in fact, a cage to keep any of the rodents or gnawing animals in, one thing has to be borne in mind, namely, keep the woodwork protected from teeth. The cage illustrated in Fig. 1 is made of ⅝ in. angle bar, zinc bottom and false bottom, the only wooden parts are the round discs for the wheel. These are of ½ in. mahogany, covered on the inside with tin. A small brass tube forms the bearings of the axle. The branch of a tree is not fixed to the bottom, but is suspended from the top,

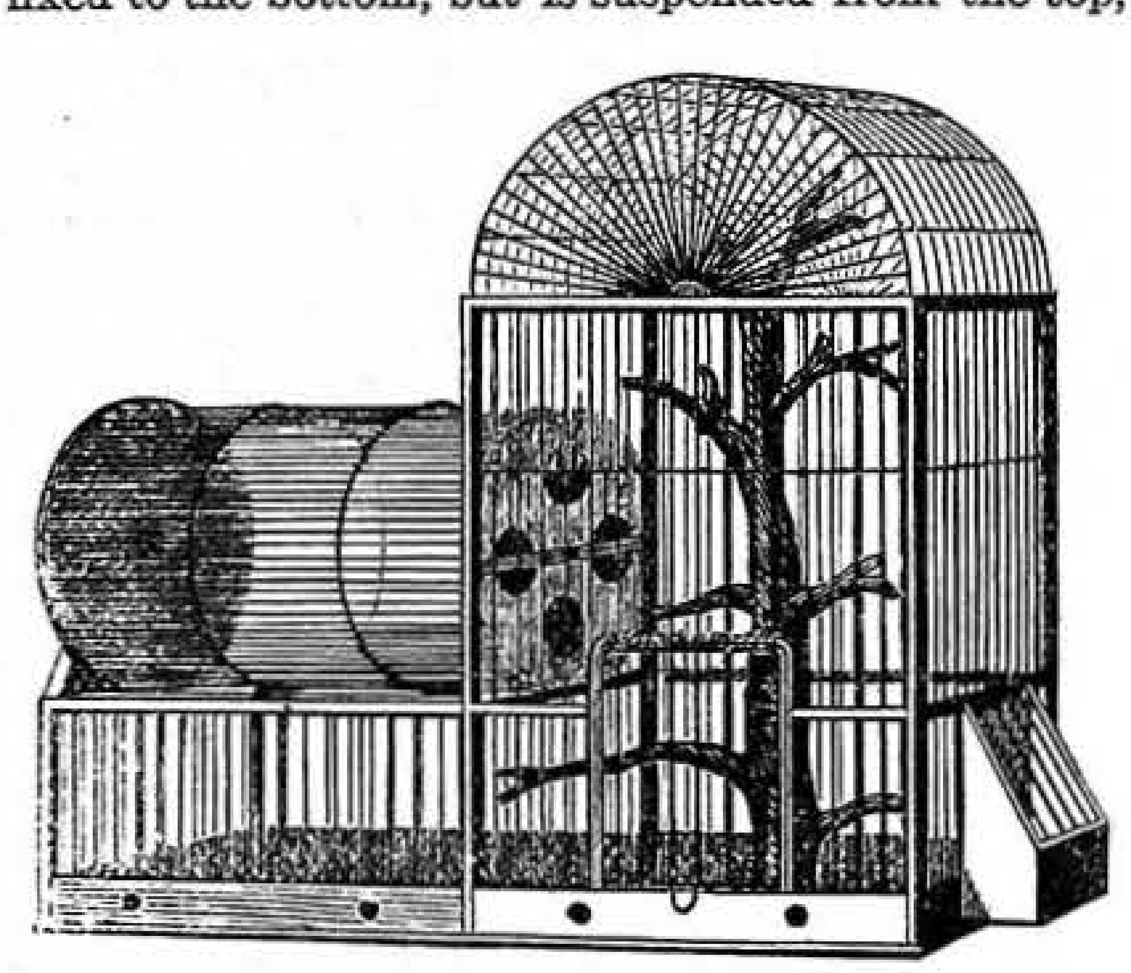


Fig. 1.—A Squirrel's Cage with Branch of Tree and Revolving Wheel.

and can be removed with a little trouble. The trays at the bottom are 1½ in. deep, and draw right out; and the compartment under the wheel can be made dark by a covering. The door opens upwards, and can be closed with a slam, or by its own weight if the fastener (Fig. 3) works easy. The top of the food-box opens and fastens in the same way as the

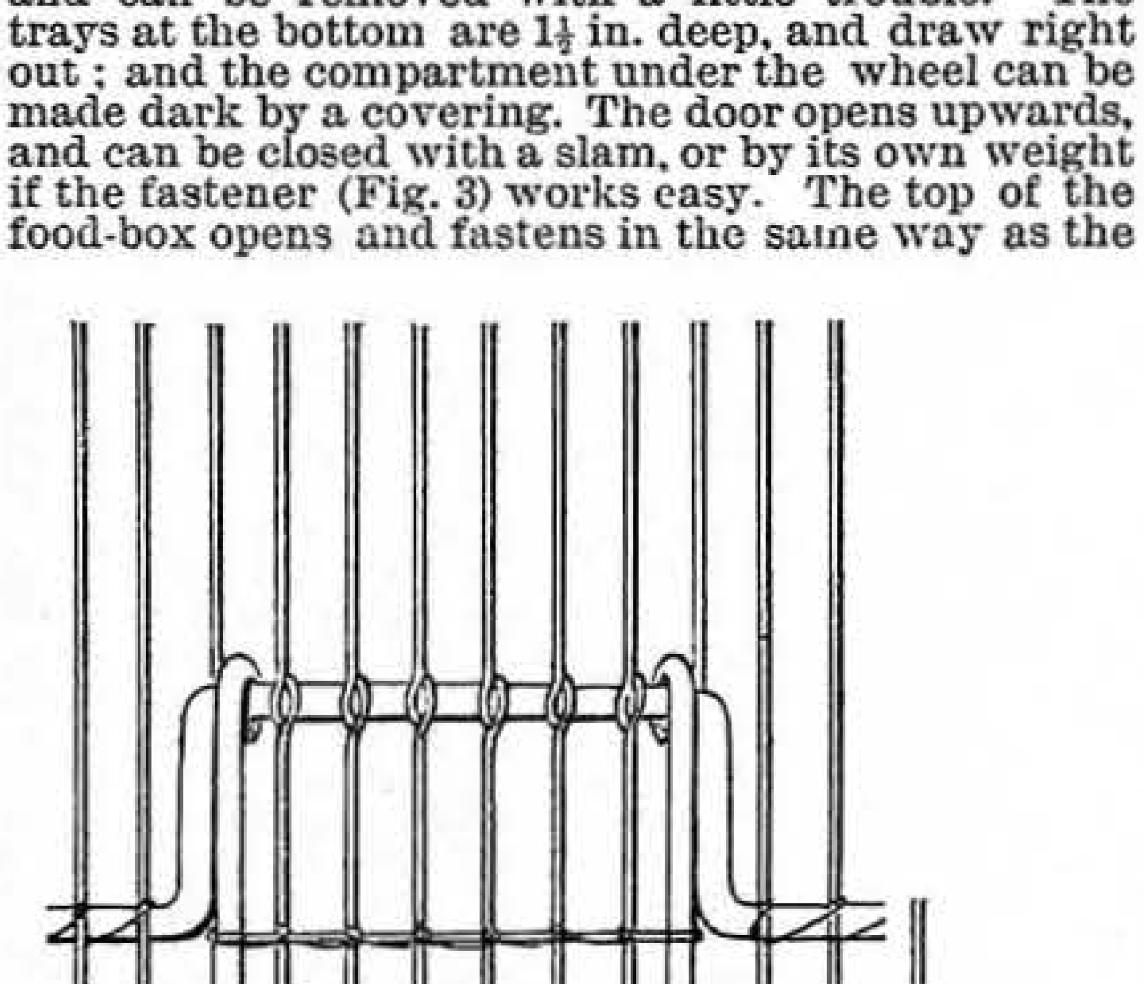
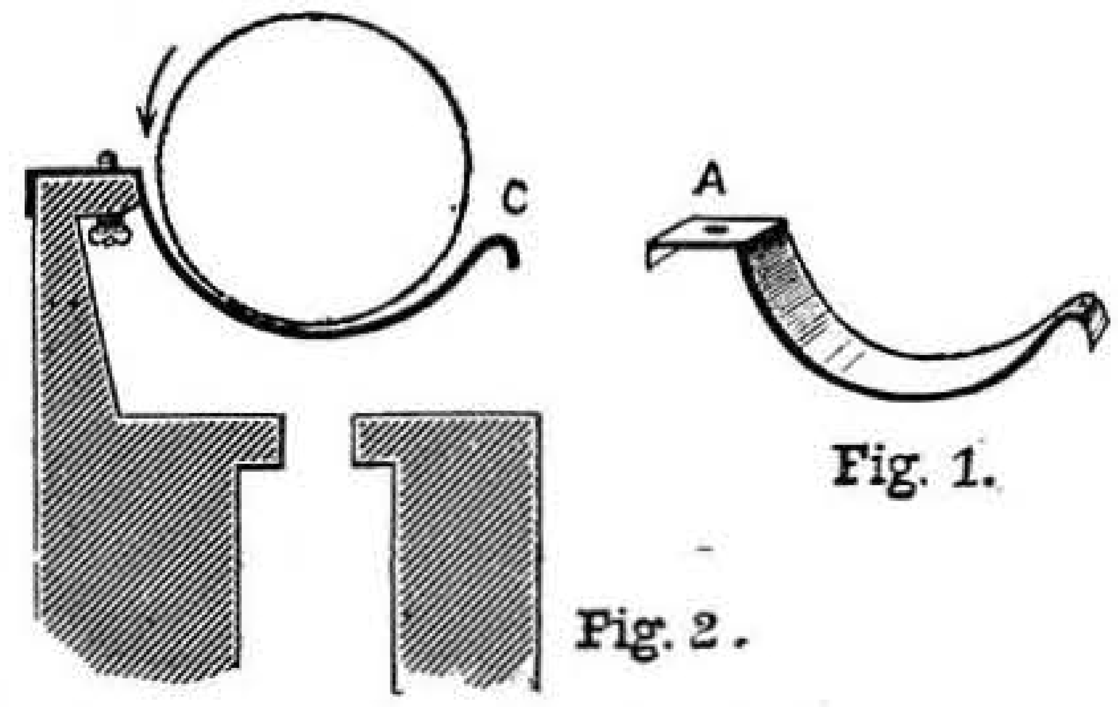


Fig. 2.—Door for Fig. 1. Fig. 3.—Fastening for Door at A, Fig. 2.

door. I need not give full details of construction. I think a glance at the illustrations and the article on "Bird Cages," page 20, Vol. II., No. 54, will be quite sufficient.—F. H.

Aquarium.—F. W. B. (*Sunderland*).—The best book on the Aquarium is published by Upcott Gill, 170, Strand, W.C., price 1s.—C. M. W.

Speculum Grinding.—W. B. (*Bruntcliffe*).—Detailed notes on this subject will eventually appear in the ordinary columns of WORK. Meantime, I sufficiently answer your queries to enable you to go on. The rough edges may be taken off the glass disc either with an ordinary grindstone, using plenty of water, or with a lathe. In the latter case, cement a piece of wood to each face of the glass disc, and mount the whole in the lathe so that it runs true. Get a piece of soft sheet-iron about 18 in. by 3 in. Bend it as in Fig. 1, and clamp it by the part marked A to the tool-rest of the lathe. Bring it under the glass, as in Fig. 2. Feed sand, or coarse emery and water down in the direction of the arrow. The cutting substance will imbed in the soft iron, which will spring to the irregularities of the glass edge, but at the same time cut them away. As the edging approaches completion, the other end (C) of the iron band may be secured, and the disc may



Speculum Grinding.

then be easily cut to a perfect circle. Force nothing—do all easily. The only way to succeed in glass-grinding is to fully grasp the fact that the continuous removal of almost microscopic particles is the speediest and safest method of working. If the discs have been well chipped at the warehouse, and you are without a lathe, you might work your first experimental mirror unedged. For the rough grinding you need nothing but washed sand, or coarse emery and water. The best motion for the rough grinding is a straight stroke, which exposes one-third of the diameter of the lower disc at each stroke. Meantime the operator should walk continuously round the post or bench, and should also revolve the speculum disc under his hand. Let the straight stroke preponderate. Otherwise, an occasional systematic irregularity is an advantage. The time necessary to rough out a speculum will be from three to five hours continuous. Afterwards, the time necessary depends on the character of the work done. When you have roughed the disc out, or if you get into any difficulty, you must come to the editor again.—E. A. F.

Fastening Glass Balls.—F. K. B. (*London*).—There are several good cements in the market that you might use to fasten the glass balls to your looking glass, and the balls being ground flat on one side will greatly facilitate matters. You might use "Coagiline," warming both glass and balls as much as they will safely bear (in fact, making the articles hot enough is the great secret of success with all cements); or I can from experience recommend "Le Page's Liquid Glue," or, if it is likely to stand in a damp place, the following may be tried, as it is said to resist water. Dissolve ten parts of pure dry gelatine in a hundred parts of water, add ten parts of a concentrated solution of bichromate of potash, and keep in the dark. When used the light causes a chemical change to take place, and the film of cement becomes extremely tough and durable.—W. E. D., JNR.

Opal Glass Letters.—J. P. C. (*No Address*).—I do not know of any machine to cut out opal letters. Do you wish them like those sold? If so, they are not cut out; but seeing you wish to utilise the waste, I can only suggest that you make templates, and cut out with a diamond; but perhaps some other subscriber seeing this reply may be able to suggest a better method.—W. E. D., JNR.

Triunial Lantern.—L. J. K. (*Dublin*) wishes to know whether the lid of a piano ½ in. thick would be sufficient substance for the body of the lantern described in WORK. Most certainly yes, as your piece of stuff is sure to be thoroughly well-seasoned. The issues in which the above articles appeared are Nos. 83, 87, 91, 96, and 100. You will also find additional information on lantern matters in the "Shop" columns of the above issues.—C. A. P.

Safety Bicycle.—A NEW SUBSCRIBER.—The numbers of WORK in which the articles on Safety Bicycles appeared are Nos. 107, 111, 115, 119. You can get these numbers of WORK through a newsagent, or of the publishers, Cassell & Co., London, E.C.

Sign Writing and Lettering.—W. S. M. (*Brixton Hill*).—The articles upon this subject will be found in the following numbers of WORK:—Nos. 1, 2, 4, 11, 13, 17, 19, 23, 30, 34, 39, 43, 44, 45, 47, 49, and 51. These and any other of the back numbers, together with the Indexes to Vols. I. and II., are procurable through any bookseller, or of the publishers, Cassell & Co., London, E.C.

Sign Writing.—N. H. (*Longley*).—We do not give the addresses of contributors. Any stamped and sealed communication forwarded here shall have the address completed and posted.

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Skiver Leather.—J. H. B. (*Moseley*).—The term is as I have written it, not *skiva*. You ask for instructions for the preparing the above leather to block in imitation gold, and what varnish to use after. There are many methods by which this is done. Wash the leather over with paste-water, and afterwards give two coats of glaire, allowing the first coat to dry before applying the second. Lay on the gold in the usual manner, block, and wipe off. Another, wash the leather with glue-water, and, when dry, lay on the gold and block. Another, use dry powder, such as resin powdered, gum sandrac powdered, dust over the leather, lift the gold on the block, and block as usual. Afterwards varnish with shellace varnish or Zaehnsdorf's bookbinders' varnish, to be had from the maker—Cambridge Circus, Shaftesbury Avenue, London, W.C. In all of these methods, the press must be hot while blocking. For further information, see many back numbers from the first.—G. C.

Phonograph.—F. W. W. (*Hastings*).—I cannot give instructions in "Shop" for making wax cylinders for this instrument for several reasons, the chief being the want of space. The information would be of little use to you without drawings of moulding apparati. The cylinders are not made entirely of wax, but of a composition in which wax forms a part. In some forms we are informed that "wax is not in it!" There has been no article on the phonograph as yet in WORK.—W. D.

Ash Bar Hole. — T. M. G. (*Hoddesdon*). — Although I do not know the plan adopted by the makers of gymnastic apparatus, yet I may say that the essential conditions are well known, namely, the boring tool must revolve, and the bar must revolve in the contrary direction. This at once indicates a lathe or similar contrivance. Were it not for the fact that the grain of the wood is likely to influence the direction of the bore, you might bore from both ends. I believe that with a Morse twist-bit, as modified by the co. for wood, you could venture to do so. If not, you will have to have lengthening bars made to the boring tool up to 8 ft. long, and such tools are so special that, no doubt, you will have to have them made to order. Unless you expect to have many bars to bore, I should strongly advise obtaining the bar ready, which you may do of the gymnastic apparatus manufacturers.—B. A. B.

Safety Bicycle Rims.—CONSTANT READER.—Rims 30 in. by ¾ in. crescent, 3s. pair; hubs, plated and tapped for spokes, from 11s. to 21s. (The above are prices to the trade.) Price lists of the above, and all other materials and fittings, can be had of Brown Bros., 7, Great Eastern Street, London; also St. George's Cycle Company, Upper Street, Islington; also W. A. Lloyd & Co., Lionel Street, Birmingham.—A. S. P.

Restoring Leather Chair Seats.—ANXIOUS.—To re-dye worn and faded leather seats is, I believe, an operation which upholsterers admit that they have no satisfactory way of doing. When seats reach this stage, the only sound thing to do is, it is said, to give them new coverings. Something may, however, be done in the way of brightening up the faded material. White of egg will do this, or French polish lightly laid on so as not to saturate the leather.—S. W.

Patent.—E. W. G. (*No Address*).—A person who has obtained provisional protection for something, is simply assured thereby that no *later* applicant can obtain the grant of a patent that will give him a prior right. The great danger in putting the invention before the public, prior to the patent being sealed, is that there may be a provisional protection of earlier date for a similar thing, with a similar title, in force, and which may be wide enough to admit of what E. W. G. may show being included in the complete to follow such provisional, in which case E. W. G. would be nowhere, unless he could *prove* that the prior applicant had appropriated his invention, and that his provisional did not fairly comprise it. It is not needed in a provisional to give all the details that are absolutely essential in a complete, but merely such a general description as shall satisfy the examiners of the identity of the invention described in the complete. According to the "popular" idea, any inventor or intending patentee is at once qualified, having made an "invention," to know, understand, and carry out all the proceedings needed to obtain a sound and valid patent, in the right and proper manner required for this purpose. It is needless to assure E. W. G. that this—like most "popular" ideas—is very far from the truth; and we can only pity those who are foolish enough to be led away by such erroneous notions.—C. E.

Repairing Barometer.—MERCURY.—You did not go far wrong in your attempts to clean and refill the tube with mercury. Your difficulties arose more from want of practice and the knack acquired only through this, than from mistakes in the process adopted. It is only when a tube appears to be smeared with mercury, and has a grey, metallic appearance inside, that is is necessary to clean it with dilute nitric acid. The acid should be diluted with distilled water, and the tube rinsed with distilled water. When this has been done, and the water drained out, introduce a little pure alcohol and drain this out; then warm the tube carefully, beginning at the closed end, and drive out all traces of moisture with the last few drops of alcohol. The mercury, when dropped on a clean china plate, should run about in bright round globules without soiling the plate; if the drops drag, and leave a grey trail behind them, the mercury is not pure, nor clean enough for the purpose. There should be no scum on the surface. The mercury should be filtered through fine pin-holes made in chamois leather after it has been cleaned and dried, unless it is pure and freshly distilled. After this, it should be heated in a glass beaker to expel the last trace of moisture before it is introduced into the warm tube. As the mercury has to expel air from the closed end of the tube, it must be introduced to this part drop by drop, so as to allow the air to escape. You did quite right in shaking the mercury in warm. The last traces of air are expelled by heating the closed end of the tube over a spirit lamp, and boiling the mercury, inch by inch, throughout the tube. The process will go on more smoothly as you acquire skill by experience.—G. E. B.

Price of Dynamo Castings. — AMATEUR. — Apply to Mr. S. Bottone, Wallington, Surrey, or to Mr. G. Bowron, 93, Praed Street, London, W., for price of 20 c.p. dynamo castings. You will get them as cheaply from those gentlemen as from any one else in the trade.—G. E. B.

Brass Bearings.—CARDIFF No. 2.—Brass is not used by good engineers, or considered satisfactory for bearings. Gun-metal is the term applied to the compound used for this purpose, and in many cases the "brasses," as they are technically termed, are "bushed" or lined with white metal, such as what is known as "Babbitt's" metal, or other nearly similar compounds, and, if carefully looked after, are found to give very satisfactory results in practice. The production of bearings for machinery of the required hardness is obtained by the materials used for the purpose and the proportions employed of each. Gun-metal may be made of the following materials in or about the following porportions: Bristol brass, 112 lbs.; zinc, 14 lbs.; tin, 7 lbs.; taking care to put in the most fusible of the metals last. Common brass used for casting consists of 20 lbs. copper, 1½ lbs. zinc, 2½ lbs. of tin. Yellow brass is made by melting 30 lbs. zinc with 70 lbs. copper. Hard brass for casting consists of 25 parts copper, 2 parts of zinc, and 4½ of tin. Yellow brass for turning is made of 20 parts of copper, 10 parts of zinc, and 1 to 5 ozs. of lead, which is the best metal put into the pot. Ordinary "pot" metal is made of 3 parts of lead added to 8 of copper. White metal s made by melting 24 lbs. zinc, 4 lbs. copper, 8 lbs. antimony; and, when these proportions are melted add 72 lbs. tin.—C. E.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Chuck.—IGNORAMUS wishes to know the best and cheapest way to go to work to make an oval chuck for wood turning in an 8 in. lathe.

Hair Oil.—X. Y. Z.—Could any reader give me a recipe for making a good cheap hair oil for sale?

Bread Cutter.—JEAN writes:—"Will any of our readers kindly tell me how to make a loaf-slicing machine?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Xylonite.—L. S. M. (*Bishop Auckland*) writes in reply to BEAVERSTOWN (see page 286):—"I have got this in small quantities from C. F. Mearing, 33, Sidmouth Street, Gray's Inn Road, London. If he does not now supply it, you can get it through a chemist."

Glacial Decorations.—M. (*Bishop Auckland*) writes in reply to J. H. (*Salford*) (see page 286):—"I have removed these by sponging with hot water, and scraping them off. They will require a little time to soften."

Camera.—R. M. (*London, S.E.*) writes, in reply to BOY SORTER (see p. 206, No. 117, Vol. III.):—"I would advise BOY SORTER to invest in a Lancaster's 'Merveilleux' camera set, at 21s. This is the best value for the money I know of, the set being well turned out, and consisting of camera, slide, excellent achromatic lens, and stand with brass top. To get anything cheaper than this would be false economy. (2) I can recommend Hepworth's "Photography for Amateurs" (Cassell & Co., Ltd.) and "Burton's Modern Photography" (Piper & Carter). Both books are published at one shilling. For a beginner the former is, perhaps, the better, as, besides being very lucidly written, technical terms are avoided. (3) As to what are the best dry plates, opinions may differ. Personally, I use Ilford's, and am very satisfied with them."

Sealing Wax.—M. (*Bishop Auckland*) writes, in reply to J. C. (*Chelsea*) (see p. 206, No. 117, Vol. III.):—"This is made by melting together four parts of white or bleached shellac, one part of Venice turpentine, and one part (or more, if required) of white lead. Stir well together, and when melted, roll upon a marble slab (heated underneath) with a piece of hard wood till nearly of the right size, and finish by rolling between two marble slabs (cold). To polish the outside, slowly turn the sticks between two charcoal fires till the outside melts. For square or oval shapes, cast the wax in steel moulds."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. L. (*Lincoln*); F. M. (*Portsea*); W. J. E. (*Salford*); A. E. S. (*Wootton Bassett*); C. T. (*Edinburgh*); REARER; T. J. S. (*Durham*); S. T. (*Sevenoaks*); H. F. B. (*Barking*); STENCIL; MICRO; J. M. (*Hebburn-on-Tyne*); C. T. (*Edinburgh*); A. R. (*Scorrier*); J. W. (*York*); J. S. (*Pimlico*); A WOULD-BE DECORATOR; H. H. (*Finsbury, E.C.*); C. C. E. (*Lincoln*); CURVE; YOUNG; F. M. (*Portsmouth*); H. B. (*London, W.*); T. R. B. (*Blaydon-on-Tyne*); C. & M. (*London, N.*); PHOTOGRAPH; E. T. (*Handsworth*); J. T. S. (*Sheffield*); J. A. S. (*Enfield*); J. O. H. (*Wandsworth*).

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TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
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