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Domestic Jobbing

The Repair of Household Articles

WITH NUMEROUS ENGRAVINGS AND DIAGRAMS

EDITED BY

PAUL N. HASLUCK

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PUBLISHERS' NOTE

THIS short treatise on Domestic Jobbing, including Soldering, China Repairing, Chair Caning, Window Glazing, etc., is issued in the confident belief that it is not only thoroughly practical and reliable, but is so simply worded that even inexperienced readers can understand it. Should anyone, however, encounter unexpected difficulty, he has only to address a question to the Editor of THE AMATEUR MECHANIC AND WORK, La Belle Sauvage, London, E.C.4, and his query will be answered in the columns of that journal.

CONTENTS

LIST OF ILLUSTRATIONS

DOMESTIC JOBBING

CHAPTER I.

CUTLERY GRINDING, SHARPENING, AND REPAIRING.

THERE are a number of jobs that occur quite often in the average home that could be successfully undertaken by a member of the household were he given the necessary simple instructions. This handbook is an attempt to provide all the necessary information to enable anyone of ordinary ability to execute with satisfaction such jobs as cutlery grinding and repairing, soldering and brazing of metal ware, glass riveting, chair caning, furniture repairing, window glazing, umbrella making and repairing, lock repairing, key fitting, etc.

This, the first chapter, will show how cutlery of various kinds is ground and repaired.

To repair cutlery properly requires a fair amount of patience and skill, and a suitable set of tools to work with. The following tools, etc., may be regarded as being indispensable: Bench vice, cutler's stiddy (Fig. 1) or scissors-smith's stiddy (Fig. 2), breastplate (Fig. 3), drill stick and cord (Fig. 4), drills (Fig. 5) of various sizes and shapes, setting hammer, flat hammer, wire nippers, and files; also grindstones of various sizes (emery stones are most convenient, if properly used), glazers, buff, and rag dolly or mop. The driving power may be treadle, gas engine, or electric motor—the last is preferable, as it is clean, economical, and easily started and stopped It is unnecessary to have all the different kinds of tools

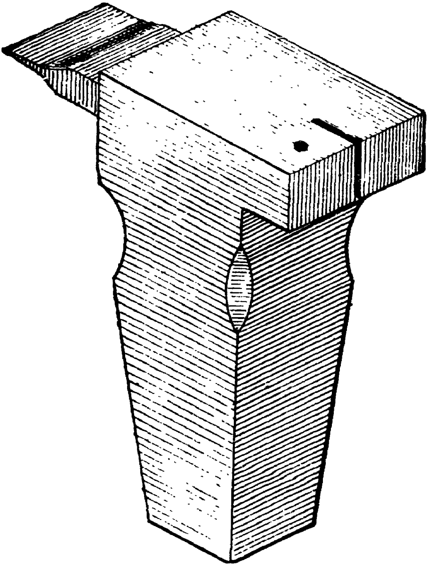


Fig. 1.—Cutler's Stiddy.

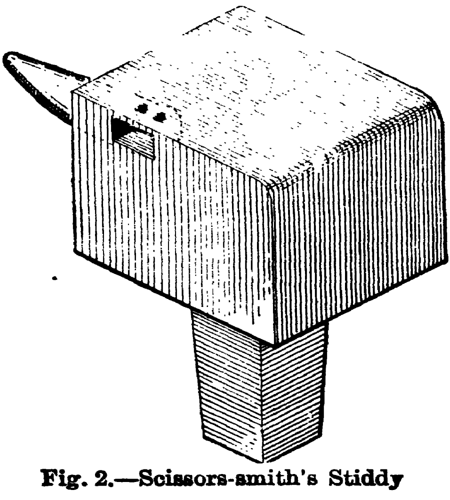


Fig. 2.—Scissors-smith's Stiddy

used in the various branches of the cutlery trade, and those named may be regarded as sufficient for ordinary repairing.

The most useful emery grindstones for a repairer's workshop would be those about 10 in. in diameter by

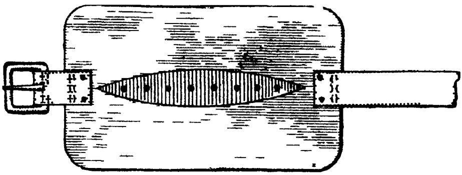


Fig. 3.—Breastplate for Drilling Cutlery.

1 in. thick (for knives and scissors), with a few smaller ones for razors, 4-in. stones being most suitable for the extra hollow-ground razors, with glazers a trifle less to fit the hollows.

Glazers for pocket-knife blades and scissors and the plainer ground razors may be about 10 in. by 1 in. with hard leather heads; but for table-knives, 12-in. or 14-in. glazers, with a softer leather head, are better. When ordering the tools, the repairer should state the purpose for which they are intended, as, for instance, "One 12-in. glazer, suitable for table-knives," or "One 10-in. glazer, for pocket-knife blades." The tool-makers will then know what kind of head is required. These grindstones are smaller than those

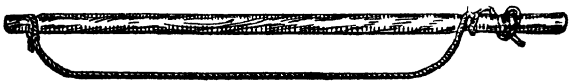


Fig. 4.—Drill Stick or Drill Bow for Cutlery Repairing.

in general use by grinders in the manufacturing trade, which are required larger to grind blades, etc., from the rough. Of course, it is better to use a large grindstone, about 30 in. in diameter, running in water in a suitable trough, for the machine knives, shears, and all large surfaces, if money and workshop accommodation will allow of it. The more tools possessed by the repairer, suitable for the different purposes, the better it will be.

The breastplate (Fig. 3) can be made out of a piece of sheet-iron 6 in. long by 4 in. wide by about $\frac{3}{64}$ in. thick. It should be slightly concave, to fit the breast. The thick plate in the centre should be of steel, 4 in. long by $\frac{5}{8}$ in. wide by $\frac{1}{8}$ in. thick. The hollows for the end of the drill-stock to rest in

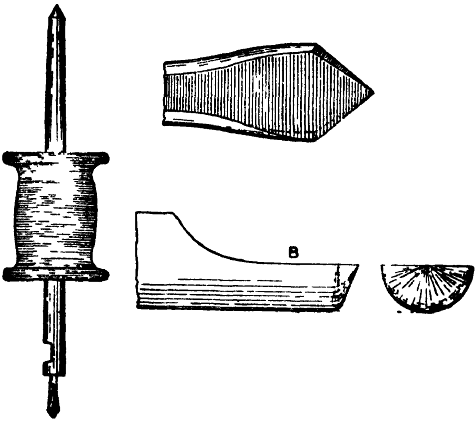


Fig. 5.—Drill Stick and Drills for Cutlery Repairing.

are made with the centre-punch. A hole is drilled through at each end, it is then bent to suit the iron plate, hardened and tempered, and the two are riveted together. The cord of the drilling stick (Fig. 4) is fastened at the top of the stick, then passed through a hole near the lower end, and returned through another hole about an inch lower, and tied. Drill points are made of two shapes: that used for drilling metal is flat and the end is shaped to cut both ways (as at A, Fig. 5), and bevelled at the edge similar to the steel chisels used for iron dressing;

the other kind, used for wood, horn, etc., is half round in section (as at B, Fig. 5), and pointed at the end.

To reblade an ordinary pocket-knife, insert an old blade between the tang and the bolster, cut through the pin by striking with the hammer, and remove the blade. Next place the tang between the cut pin and the bolster, when a smart tap with the hammer will force the pin out at one side. This being removed, punch out the remaining portion of the pin with a steel point. If this method is not effective, the pin must be drilled out. A steel or iron drilling plate (see Fig. 6) should be secured to the edge of the bench. Now select a new knife blade of the proper size and thickness, place the old tang over the new one, so that it covers correctly, and screw in the vice; then mark the new blade through

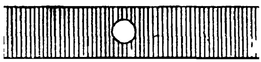


Fig. 6.—Drilling Plate for Cutlery Repairing.

the hole in the old one with the drill. Take them out of the vice, and drill the hole through. Then knock a pin through both tangs, refasten them in the vice, and square the new blade to the old one. When the blade has been made to fit properly, smooth-file and burnish square the front and back, glaze the end and flat side, ream or counter-sink the holes in the bolster slightly, and rivet the blade in position. It is advisable to insert a thin piece of steel, shaped as shown at Fig. 7 (the thin end of an old table-knife blade, with a notch filed in the end, will do), on that side of the blade to which it is required to fall, so that when the piece is removed the blade falls in the proper direction.

Knives with pearl scales—or "pearl-handle" knives, as they are often called—must have the head of the pin reamed off and then punched out very carefully with a thin steel punch or point, or drilled out completely, as pearl scales being very brittle, are liable to break if treated in the same way as bolstered knives. This applies to all knives without bolsters, except those with nickel or other metal scales.

Spring-knives are usually called pocket-knives or pen-knives. A pocket-knife is of stronger make, with the blades at one end only, whilst a pen-knife is a lighter-made knife, with one blade or more at each end.

In repairing two-blade pocket-knives, see that the small blade, when open, stands straight with the large one, and when closed that the nail grooves are clear of each other. In two- and three-blade pen-

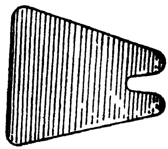


Fig. 7.—Thin Steel Wedge for Guiding Fall of Pocket-knife Blade.

knives it is usual to put in the small blades first, especially when they are fitted with a small brass plate (see B, Fig. 8) at the small-blade end to ensure the large blade clearing the others. If one blade falls to the wrong side, and so fails to clear the other, take it out, and, placing a thin piece of metal under the tang, lay it on the stiddy (Fig. 2), then a smart tap with the flat hammer just in front of or across the hole will probably have the desired effect. If the point of a new blade sticks up, file a little off the kick (indicated at C in Fig. 11). If the point is too low, a few taps with the hammer in the same place will raise it. Of course, all these little alterations should be made when trying the blade in the knife, before riveting. Sometimes the raised point of a blade will not shut down at all. If dirt is not lodged between the tang and the spring, it will invariably be found that the want of oil on the tang end has set up friction and caused a hollow to form in the end of the spring, wearing the end of the tang away, and so causing the point to stick up. In that case, if the hole in the spring is too deep, a new spring must be provided, with the end left a little broader, to correspond with the amount worn off at the end of the tang. If the hollow is not too deep, and the spring end will allow it, file the hole nearly out; then hammer the spring a little broader. This will make it longer and thinner as well, and the blade tang also will require flattening out. If the

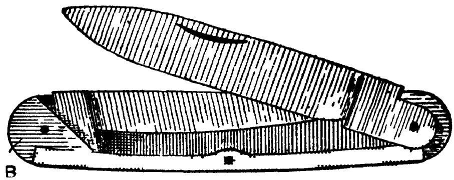


Fig. 8.—Pen-knife with Brass Plate for Separating Blades.

blade, when tried, stands too forward, take it out and file a little off the spring end; this will let back the blade.

To re-blade a knife the old blade of which is missing, try a blade as near the size as can be judged, and if it is a fairly good fit, square the new blade to it. To judge whether a blade fits in the knife properly, see that the spring stands square with the scales when closed and when fully opened, and does not sink under or stand out from the scales.

To put in a new spring, take one in the rough state, as near like the pattern as possible, and mark through the holes in the broken spring; then drill the holes through on the edge of the bench, taking care to make the holes straight. Give the proper amount of bend (see Fig. 9) whilst soft, and file up;

then heat in the fire to cherry red, and plunge in wate or oil. Clean a portion with emery paper so that th temper can be ascertained, and, smearing with tallo or oil, hold it over a clear fire. When the grease burnt off, the spring will usually be found sufficientl

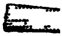


Fig. 9.—Bent Spring.

tempered and of a nice blue colour. Try it with a file, as it is important that it should be of the right temper; it should just show the marks of the file. If it is too hard, it will break; and if too soft, it will be too weak, and the blade will not shut with a click. When properly tempered, brighten the spring, if required; the end where the tang works must always have the blacks taken out, to enable it to work smoothly.

When a new scale or covering is required, take the knife to pieces, and, placing the new scale on the brass lining, see that it covers all over. Place it in the vice, and drill through the holes in the lining, pressing at the back with a piece of wood, to prevent a piece being chipped out of the scale when the drill slips through.

A bolstered knife, such as that shown at Fig. 10, must have the covering matched so as to fit close. If there is a bolster at each end, as shown, the ivory or

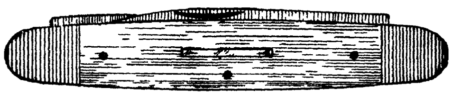


Fig. 10.—Double-bolstered Pen-knife.

other covering must first be filed slightly slanting and hollowed at one end to fit up to the bolster. Then mark the other end; if much too long, saw off the surplus, and file as before, taking care that the scale fits in rather tight. Then proceed to drill the holes.

'earl scales must have holes slightly larger than the ning, for if the wire is tight such scales are liable break. All holes must be reamed a little on the tside, to allow for the pin spreading when riveted. fter putting on the scale and filing to shape, take out ll the file marks with No. 1½ emery-cloth, finishing ith flour emery-cloth, this method being the most onvenient for repairers; then rub on some oil, and lip in powdered pumice-stone or fine sand, and buff or dolly off until a bright surface is obtained.

When a blade requires grinding, if worn or snipped much, first set the blade in at the shoulder, as shown in Fig. 11, with a triangular saw-file; then straighten the edge on the grindstone before grinding the flat sides of the blade. When grinding to a thin edge, keep dipping the blade in water, if using an

Fig. 11.—Worn Blade Set in at the Shoulder for Grinding.

emery wheel, to prevent softening of the blade. Next rough-glaze, then finish on a fine glazer, putting on a good colour by rubbing a smooth pebble across the glazer.

To make a good fine glazer, use a rough (or newly dressed) glazer that has been worn down a bit, and rub some tallow or mutton suet well into the surface, then some emery cake, or compo, which can be bought ready-made. This compo can be made by putting 2 parts of mutton suet and 1 part of beeswax in an old iron saucepan; when melted, stir into it as much flour emery as it will absorb, then pour on a board previously covered with flour emery to prevent the mixture sticking to the board. When nearly cold, mark across in squares, which will easily break when quite cold. To preserve the fine glazer in good condition, keep charging with mutton suet, emery cake, and beeswax as required. To whet the blade, first dip the point of the blade in sweet or olive oil, then draw the edge across the whetstone (holding it to the edge at an angle of about 45°) in sharp successive strokes from pinch to point, first one side and then the other, until the edge bites when tried with the thumb.

Sometimes a new piece is required to be fitted to a broken pearl or ivory scale. To do this, saw the end of the broken scale straight, drill one or two small holes, about $\frac{1}{8}$ in. or $\frac{3}{16}$ in. (according to the size of the knife) from the edge, through both the covering and the brass scale, and pin them together; then fit on the new piece and pin in the same way (see Fig 12). Drill the hole for the blade pin last (if there is no bolster), as the piece may move if not held properly, and thus break when the blade is pinned in, as the hole will not be true.

The grinding and repairing of table-knives, carvers, etc., will now be considered. If worn very much and thin at the point, cut the thinnest part away and proceed to grind the point to its original shape; straighten the edge, and then grind evenly, by a slightly rolling motion, to a thin edge. The glazer or buff for polishing the blades after grinding has a leather head or covering made of softer leather than that used for glazers for spring-knife blades, which are flat or slightly hollow, and have to be glazed on much harder surfaces. The table-knife blade, on the contrary, is rolled from the back to the edge as a rule, and requires a softer leather. The blades are whetted in much the same way as spring-knife blades, except that the whetstone (usually a long piece of bluestone) is dry; or they may be whetted by drawing lightly across a fine-grained emery stone.

When straightening the edges of the blades, it is much the better plan to keep the edge away from the body in the direction the stone is running (especially razors), and change from one hand to the other as required.

To remove handles from table-knives, immerse the handles in boiling-water until the resin is melted (if pinned, first knock the pin out), and then pull the handles off. This applies more to ivory, bone, and stag handles, as some of the xylonite handles have serrated tangs and will not come off, while most xylonite and self-tip handles will warp when subjected to heat.

The best way to separate handles from broken blades would be to hold the broken blade in a gas jet or fire and let the heat gradually run up the blade until the resin melts sufficiently to allow the handle to be taken off. Xylonite handles must not be held close to the flame, as they are highly inflammable. But

Fig. 12.—Fitting Piece to Broken Scale.

when a new xylonite handle is required, usually the old one is burnt off, while a bone or ivory handle can easily be split off by a stroke with the hammer.

In refixing an old handle which has become loose, or in fastening on a new one, first fit the handle to see if it is straight; if not, remove the blade and bend the tang in the required direction. See that the handle fits properly before finally fixing.

If it is required that the handles of table cutlery should be pinned on, the following method must be adopted. Have a drill long enough to go quite through, and gripping the handle in the vice, with the blade upwards, proceed to drill through, holding the blade in position with the left hand. Or mark the thin end of the tang where the hole should be, then drill it and see that the hole corresponds with the hole in the old handle (this applies chiefly to reblading old ivory-handle knives) by passing a piece of wire through them. Pour melted resin into the hole in the handle, and having at the same time heated the tang, insert it and press it in position, holding it there until the resin sets. Now make a piece of wire red-hot and pass it through the pin-hole to clear it, and then secure the tang in the handle with a bit of brass or German silver wire. New handles can be procured from the manufacturers already finished for fixing on the blades, and new blades only require the tangs to be ground or filed to fit the handles if too large for the hole.

Figs. 13 and 14 show two ways of fitting new tangs on old blades. To replace the broken tang of a table-knife, as in Fig. 13, proceed as follows: If there is

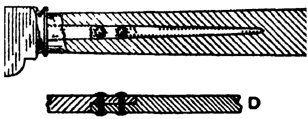


Fig. 13.—Method of Fitting New Tang to Old Blade.

sufficient of the old tang left, hammer the end flat, and about ½ in. from the end set in a shoulder with the file and file level; then procure a piece of thick iron wire, or cut off an old tang from a broken blade, and file in the same way to fit. Drill two holes through the tang. Place it and the wire in the vice, and drill one hole through. Rivet them together before drilling the second hole through. When both holes are riveted file the edges level, and fit in the handle. A section of this joint is shown at D (Fig. 13). If the tang is broken off too close to the bolster for the above method to be adopted, the repair must be effected as shown in Fig. 14. File the end level, centre it with a punch, and drill a hole as deep and large as the bolster and tang will allow. To make a firm job, tap the hole; then, having cut a corresponding thread on the end of the new tang, screw in tight, and fit the handle on in the usual way.

To put a new guard and spring in a carving fork, first punch out the old pin and clear the old spring and rust, etc., out of the slot in the shank. Fit a new spring, and, placing the guard in the slot, screw up in the vice so that the holes in the shank and guard correspond. Knock in a new pin; but before riveting up, see that the guard and spring fit and work properly. If the fork is to be cleaned, this should be done before the guard is fixed in; thus only the heads of the rivet will require glazing afterwards. Guards and springs can be bought ready for fixing at prices varying according to pattern and quality.

The cutting edges of scissors are quite different from knife edges, being on the same principle as wood

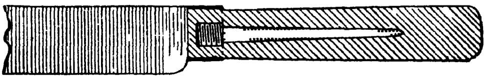


Fig. 14.—Another Method of Fitting New Tang to Old Blade.

chisels, plane irons, etc.—that is, the edge is bevelled on one side, leaving the other side square; and the two square sides, working against each other, if set properly, cut the material without allowing it to slip between the blades. Moreover, the edge of a knife is straight, bur the edge of a scissor-blade is curved more or less sidewise from shoulder to point. A good deal depends on the amount of this curve or set. If too much is given, the edges cut into each other, especially if one blade is softer than the other; while, if too little, they will not cut, and the material slips between the blades. It is advisable to look down the edges of the blades before taking out the screw or rivet, to see if the blades have an equal amount of curvature or cut. If off the cut, they can be set "on" by a few strokes of the setting hammer on the thick or back edge of the blade at the part where it is off. If the blade is too much on the cut, set off the inner side of the blade—on the back edge, of course. Remember that it is outside of the blade to set on the cut, and inside to set off. In each case, care must be taken to have the blade solid on the

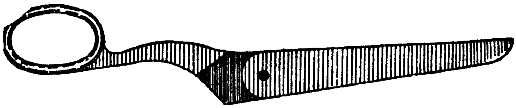


Fig. 15.—Scissors Blade, showing Position of Ride.

stiddy, the blade being drawn towards the operator as it is being set, with the point inclined to the right when setting on. Use the right edge of the stiddy, which, being rounded off, fits the hollow of the inside of the blade. The two blades work together on a bearing, called the ride, at the back of the hole, formed by filing away the part immediately behind where the ride is intended to be, in most cases forming a half-circle from $\frac{1}{8}$ in. to $\frac{1}{2}$ in.—according to the size, etc., of the blade—from the hole (see Fig. 15). Buttonhole scissors, for instance, invariably have the ride near the hole, to allow the corners of the blades to pass without cutting into each other, on account of the notch in the blades (see Fig. 16).

In a pair of practically new scissors which only require setting of the edges, it is best not to interfere

Fig. 16.—Notched Blade of Buttonhole Scissors.

with the ride unless they will not cut in the pinch or shoulder. In such a case, carry the ride a little farther back, clearing it well away at the foreside, as shown at Fig. 17; this will generally throw the edges on the cut at the pinch. When found to be rubbing right up in the joint, form a new ride. If "off" across the hole, set them "on" by tapping with the setting hammer (Fig. 18) on the outside of the rivet-hole. If inclined to be soft, a stroke or two with the flat hammer across the hole on the inside will have the desired effect.

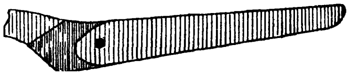


Fig. 17.—Scissors Blade with Ride Carried Back.

Many scissors are spoiled through being ground on the inside of the blade while the screw or rivet is in, this producing a hollow in the pinch; in such a case, grind evenly from the back of the hole to the point, till the inside of the blade is clear and the edge is brought up square. When setting the edges—that is, bevelling the edges—hold at a sufficient angle, and draw across the grindstone from pinch to point until the burr formed shows that the edge is sharp, always removing the burr on the whetstone (pre-

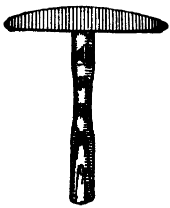


Fig. 18.—Setting Hammer.

viously oiled) before putting the blades together, and putting a drop of oil on the screw and on the ride before riveting up. Then try the scissors; if they will cut a piece of cloth or rag without holding unduly on the cut, they will do.

Great care must be taken with hard scissors—

that is, scissors which are hardened throughout the bows, shanks, blades, and screws. Fortunately for the repairer, they are not very numerous. They may generally be distinguished by the superior finish and style, and are usually of an ornamental pattern, but not always. The best way to test for hardness is to try the back of the shank with a sawfile. Ordinary plain scissors are only hardened to the hole. If a hardened screw breaks in the scissors, and it cannot be got out, hold in a gas jet to soften the screw, taking care not to soften the blade, and then proceed to drill it out. If the blade should get softened too much, harden in oil. Another point to bear in mind, in repairing scissors, is whether the scissors are cast or made from forged steel. Many of the cheaper German and American scissors are made from cast metal, and being very brittle will easily break; others are so soft that it is impossible to get them to hold a cutting edge. Most of the American tailors' shears are lined blades—that is, the inside of the blade is of steel, and the outside and back of iron. These usually will allow of hammering on the cut, if off, the back being very soft. The lining mark is easily discernible on examination.

To punch out a rivet or to rivet a pair of scissors together the blades should be open, not closed; if turning a screw out or in, the blades may be closed. Paperhangers' and barbers' scissors should be left rather loose, as they are required for quick cutting. When the points of scissors stand open and the bows fail to touch, they should be let through—that is, filed on the heel end in an inward slanting direction. See also that the joints are clear. If there is plenty of clearance and the points stand open, pull the shanks in the vice or a brake, with the edge of the blade towards the body; if the points are through too much, pull with the edge away from the body. The brake used for this purpose is shown at Fig. 19. It is made of ⅜-in. steel, being about 6 in. on the longest side, and ½ in. less (to enable the bow of the scissors blade not being pulled to clear it) on the other. It is fixed in the bench with the thin edge towards the body and the longest side farthest away. The shanks of large scissors are pulled in the larger fork, and the small scissors, and those with short shanks, in the smaller fork. The shank is placed in the fork, and the thumb pressed against the front of the brake for leverage ; it is then pulled sufficiently to bring the points of the scissors blades into the proper position—that is, just covering. The brake can be placed in a hole cut in the bench, and taken out when not in use.

Great care must be taken with the large American shears, and all tailors' shears, to have just the proper

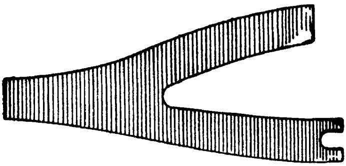


Fig. 19.—Brake for Pulling Shanks.

amount of cut on the blades ; for, if there is too much, they will take pieces out of the edges.

Garden and sheep shears are rather awkward to hold when grinding, especially garden shears. When the rivet cannot be removed, a good plan is to knock the handles off. The burr must be rubbed off the edges cleanly, as they are usually soft, and will cut into each other if this is not done. If a proper scissors stiddy, with holes in it for putting-together purposes, is not available, place a small iron nut on something solid and punch the rivets out of the scissors through that ; or open the jaws of the vice wide enough for the head to pass through, and punch out in that way. A cutler's stiddy, with the right edge ground off, is very useful for setting scissors blades

An assortment of rivets of various sizes should be purchased and kept in stock; they are very cheap, and make a much better job than old nails when a new rivet is required.

The grinding and setting of razors is about the

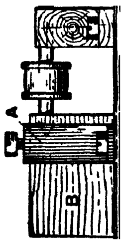


Fig.

most unsatisfactory job the repairer has to do, especially old razors that have been ground time after time until they are quite soft and useless. No matter how much care is spent in grinding and setting them, they cannot be got to hold a shaving edge, as the least touch when wiping them takes it off again. Some of the new razors are no better than the old ones in this respect.

The greatest care must be taken, when grinding a razor, not to soften the edge, which must be laid on very lightly indeed, especially when the razor is extra hollow-ground. If grindstones are not run in water, a pan of water must be kept close to the emery stone and the blade plunged in constantly, so that it can be kept cool. Grind evenly up to a thin edge without getting the edge through in places. Never grind a razor if it does not really need it; it will be found that many of the hollow-ground razors only require setting. If the edges are snipped, lightly draw across the stone in an oblique direction, first

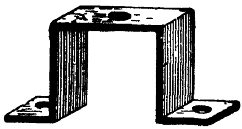


Fig. 21.—Spindle Fitting.

one side then the other, keeping the edge away from the body.

A useful size of stone for the plain or common hollow is from 8 in to 10 in. in diameter, and from 4 in. to 6 in. for the extra hollow, as it is only the edge that needs grinding thin, when too thick to set.

Small leather bobs or glazers, 1½ in., 2 in., and upwards, will be required for cleaning the hollows when tarnished or rusty. An easily made spindle for small bobs is shown at Fig. 20; this can be fixed on a small bench or anywhere convenient, and run off the shafting. To make the metal bridges, A, take two pieces of iron about 1 ft. by 1½ in. by ⅜ in., and bend to the shape shown in Fig. 21. Drill a hole in each end to take screws for securing them to the bench, and a hole in the centre of the top for a ¼-in. set screw, which holds the wooden blocks B; these blocks are of hardwood, and are cut to about 6 in. by 3 in. by 3 in. The spindle block C is also made of hardwood, about 6 in. long by 1½ in. thick, with a hollow in the centre for the spindle to rest on, and reduced to 3 in. across

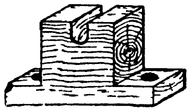


Fig. 22.—Spindle Fitting.

the top by cutting 1½ in. from each side, leaving enough at the base to take a screw at each end for securing it to the bench (see Fig. 22). For the spindle, procure a piece of round mild steel 1 ft. 8 in. long by ½ in. in diameter; have one end turned and screwed about 8 in. or 9 in. to take a ⅜-in. nut, and both ends tapered to a point to run in the holes in the wooden blocks B. Put a ⅜-in. washer on the screwed end up to the shoulder, then the small leather bob or glazer, then another washer, closing them up together with the nut. When a different size bob is required, it is thus easily changed. At the other end fix a wooden pulley about 2 in. in diameter. If the spindle is fixed on the bench, a hole will have to be cut through it

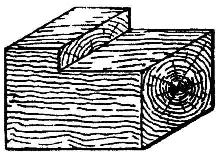


Fig. 23.—Spindle Fitting.

large enough for the driving belt to run clear. Fig. 23 shows an alternative shape for the wooden blocks B, the height being 4 in. in front for a distance of 2 n., and the remainder 3 in. The height of the spindle block C should, of course, correspond. In a block of this shape the set screw is out of the way of the razor scales when a razor is being glazed. It should be noted that the iron clamps must be set farther apart to allow of the blocks being removed.

Before setting the razor, wipe all dirt and grease off the and see that there is no grit on the whetstone or hone. Dip the point of the razor blade in the oil, and transfer some to the whetstone; then place the blade flat on the stone, and with a succession of firm but light strokes on each side alternately, from right to left, turn over, then from left to right, working from heel to point in each case, until the edge is turned up in a fine burr. Then, holding the blade at an angle, lightly skim each side of the edge across the stone to take off the burr, and after-

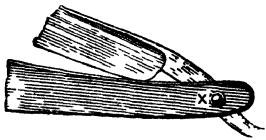


Fig. 24.—Razor with Side Fall, showing where Rivet should be Tapped

wards draw the edge lightly across a piece of old horn razor scale. A few more light strokes from heel to point, keeping the blade flat on the stone (which must be kept clean and well oiled), will bring it to a fine edge.

Examine the blade very closely, to see if the edge is turned or rough; if so, lightly skim it off again and work up the edge until clear. A few strokes on a good strop will put a fine shaving edge on the blade Take great care in wiping the blade, or it will have to go on the stone again.

A good and simple dressing for a razor strop is to rub some tallow well into the strop, keeping the surface free from grit.

When a razor blade catches on the edge of the scale, a few light taps should be given with a small riveting hammer on the side of the rivet head nearest to where the point of the blade falls to the side (see Fig. 24, where the point of the rivet to be tapped is indicated by a cross); then, turning over, give a few taps on

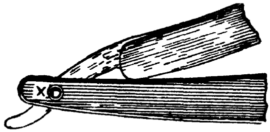


Fig. 25.—Razor with Side Fall, showing where Rivet should be Tapped.

the side of the rivet farthest from that point, as indicated in Fig. 25, at the same time keeping the blade partly open and pressing it slightly to the opposite side. This treatment will in most cases cause the blade to close in the centre. It will be best to practise on an old razor first, until the blade can be made to fall as required. If the scales are of horn, slightly heating them by holding in front of a fire, or dipping in hot water, will soften them, when they can be twisted just enough to allow the blade to fall in the centre; they must be held in that position till cold.

Most of the black razor scales now used are made of a composition, and are very brittle. If a razor requires a new scale of this description it is better to put the blade in a pair of new scales, which can be

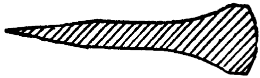


Fig. 26.—Section of Razor, Properly Set.

bought from the manufacturers ready for the blades, together with wire and small brass washers. The same applies to bone scales. If a new ivory scale is required, the method is similar to putting new scales on spring-knives; but there are no brass liners, and the holes must be exactly true with the other side. If scales in the rough are not to hand, it would be better to send the job to Sheffield to be done, or to obtain a pair of finished ivory scales

When a new razor is properly set the section will

Fig. 27 —Section of Razor, much worn

appear as shown in Fig. 26, the edge being acute, and, for a considerable time, if no accidents occur, stropping before it is used will be sufficient to keep it in order After a time, as the cutting edge wears away, the angle becomes more obtuse, as shown by Fig. 27, and the leather of the strop will not remove sufficient metal to bring the edge to the proper angle It is therefore necessary to use an oilstone, or if in bad condition or badly notched, a grindstone first and then the oilstone. A Turkey stone is the best for the purpose, as it cuts quickly and leaves a good edge, but if one of these is not available a Washita or some other coarse cutting stone may be used first, and the edge finished on a hard stone such as a Charnley Forest The use of the stone is to remove the portion blacked, A (Fig. 27), and to do this the blade

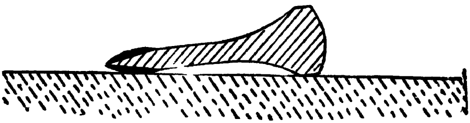


Fig 28.—Section showing Correct Position of Razor on Oilstone.

is placed on the stone with the back and edge resting on it as shown in Fig. 28, and rubbed up and down lengthways of the stone, both sides of the blade being rubbed alternately until the waste metal A (Fig. 27) is removed The sharpening on the oilstone should be discontinued, unless the edge is notched, just before the acute edge is reached, or a wire edge will be the result; that is, a thin edge of metal that will bend backwards and forwards when the blade is turned over, will be formed. The oilstone should be

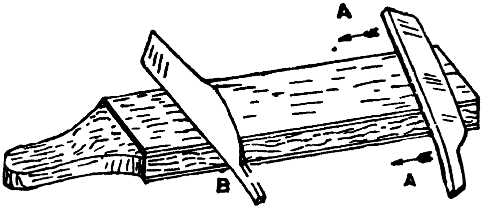


Fig. 29.—Position of Razor on Strop.

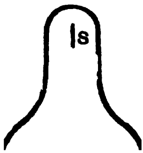


Fig. 30.—Razor Strop.

thoroughly clean, and lard or sweet oil mixed with about a quarter of its bulk of petroleum should be used. The razor is now ready for stropping, and a strap of buff leather, such as an old army belt, is one of the best things that can be used for this purpose. As a substitute, a piece of fairly hard leather may be

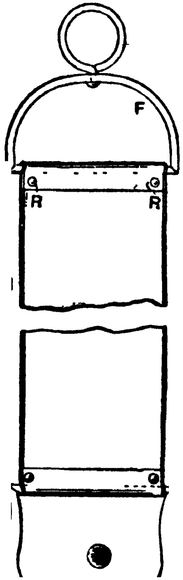


Fig. 31.—Razor Strop with Fittings.

glued on to one side of a piece of wood, the face of the leather being dressed with a little rottenstone and oil, and a piece of soft buff leather may be mounted on the other side of the wood. In using the strop the dressed surface is used first. The blade should be drawn back first along the leather as shown by the arrows A (Fig. 29). then turned over with the back of the blade on the strop as at B (Fig. 29), and not edge downwards, for the return stroke. A few rubs should be sufficient on the soft leather only, the dressed side being used when the razor is in bad condition. Two or three razors should be in use at a time, as it is often found that if given a rest for a week or two a blade that has apparently got out of order will then work better than ever. The strop should be used after shaving as well as before, so as to put away the razor in a good condition.

Razor strops are of two sorts, cushion and hanging. The hanging strop is very apt to put on an edge at too great an angle to the plane of the blade. The cushion strop can be kept moist with a little oil, or with a little lather from the shaving-brush applied immediately before use.

Strops can be made very easily and cheaply by attending to the following instructions. A simple strop is represented by Fig. 30; this is merely a piece of leather cut as shown, and having a slit S, to hook on a nail when stropping the razor. To mark out the leather, a straightedge should be placed on it, and the back edge of a knife run down to make the marks. The line marked M may be worked round with a straightedge and the back edge of the knife, about $\frac{1}{16}$ in. from the edge; in wholesale work, however, these lines are made with a tool called a "marker," which leaves a bright, glossy mark after it.

Razor strops are made wholesale with different kinds of fittings. Fig. 31 is an example of one. The fittings F are nickel plated, and the leather is riveted or eyeletted to the fittings; R represents rivets, of which there are two at each end. Some strops are made with a strip of cloth fixed on the back by means of small rivets.

Hair-clipping machines are constructed of two plates of cutting teeth that work over and across each other, and these plates must be kept in good order so that they may work true and flat, and the two screws must be kept tight so that the plates work closely and smoothly The sharpening should be done by whetting on a flat bluestone, care being taken to keep the steel plates flat as they are rubbed up and down on the face of the stone The plates should be finished off on Turkey stone in a similar manner The essential point that must be observed is to make the steel plates work together true and flat.

Notes on repairing and grinding lawn-mower blades will now be given Before grinding a lawn-mower, turn the revolving blades backwards to see whether they touch all along the bottom blade If the screws that secure this blade are so firmly fixed that a large screwdriver will not move them, they can probably be jarred from position by a few blows with a hammer, and if this does not loosen them, place a blunt chisel against the side of the screw, knock it round a little, and then use the turnscrew. If the screw-head is broken off, when the plate is removed there will be a short stump that can be gripped in a small hand vice and turned. Or file two sides of the broken screw and use the pincers or pliers. If all fails, drill a hole through the screw, drive in a squared plug, and turn out the remains

A "Green" mower has the revolving blades fixed (or stubbed in) with copper, so that if one is out of truth, pick out the copper, re-set, and re-stub. But unless the blades are much worn, or shifted out of place, the grinding will set them right.

Next examine the bearings. If they are worn oval and new brasses cannot be procured file a little off the parts that meet at A (Fig. 32); then, with a suitable file, round the inside at B. Each half must be filed to a little less than a semicircle. The clearance between the two halves is needed for adjustment as the bearings again become worn. When taking out the bearings, mark them so that they may be replaced in the same positions.

Triggers that actuate the chain gear and cutters should miss in drawing back, thus preventing the cutters reversing. These triggers become worn at the point and want renewing, but may sometimes be filed up. The end of the tongue that engages with the ratchet inside the roller should be similar in section to the point of a cross-cut chisel. The dotted line i lustrated in Fig. 33 shows how to correct the rounding.

If the spindles of the revolving cutters shake, before grinding put on a washer or two, which should also be replaced when finally putting together. Next, take off the front rollers, which are merely to keep the cutters at a proper height from the ground. Then, to the large cogwheel on the back roller spindle

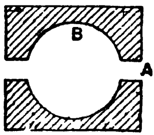


Fig. 32.—Bearing Brasses of Lawn Mower.

fit a temporary handle with which to turn the cutters when grinding. If the wheel is not already tapped for this purpose, either drill and tap a hole, or twist up a piece of ⅜-in. round iron to engage the wheel, and turn with this.

Take off the plate cutter, which is screwed on to the bottom under the spiral cutters, marking each screw as it is taken out. Then the front edge of the cutter should be ground, as at A (Fig. 34). Fix it in place and turn the spiral cutters backwards. If on revolving the cutters they miss all round at a certain part of the plate, the latter will be at fault; therefore, pack it at that spot, using common cartridge or note paper. If the cutters, with the exception of one or two, miss all round, it may be possible to take down the full parts with a file.

If the revolving blades are very uneven it will be useless to alter the bottom plate just now, unless the way is clear for refixing the faulty blade.

It is best to send the mower to the maker if the blade is broken, though with a forge one can be made as follows :—Take two thin strips of blister or spring steel and one of iron, and weld together, with the iron between the steel. Work them nearly to the size wanted, file the edges square and even, then get a red heat all over, and hammer quickly from one end to the other, so that the plate will curl as the work proceeds; then dip into water and cool out. For the exact curve the plate can be sprung into place in fixing, when it can be stubbed with copper.

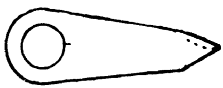


Fig. 33.—Trigger of Lawn Mower. Fig. 34.—Section of Plate Cutter.

When the cutters are adjusted as nearly as possible, begin grinding. Mix some emery and oil in a shallow tray and place this under the blades, and, when turning backwards, feed on the emery with a piece of hoop iron, or anything convenient. Keep it spread along the blade as much as possible. As the grinding proceeds the emery becomes finer, and when finishing, flour emery should be added. During the process, both the set-screws must be gradually tightened until enough has been ground off, which will be known by the knives touching all along the bottom blades. The mower should then be taken to pieces, each part being marked and thoroughly cleaned of all grit and emery.

The chain should be soaked in paraffin oil and thoroughly cleansed, or it may be dipped in paraffin and held over the forge to burn off the old oil and dirt. Wipe all painted parts with turps and apply a hard drying paint. Then, in putting together, screw up the set-screws very gradually, taking opposite ones alternately and trying the effect, always turning the cutters backward until they are known to be even on the under plate. Then turn forward very slowly to see that the first part of each cutter does not catch against the plate, but just passes on its face. The rest of the blade should follow in the same way, or a very little tighter. Wherever there is a hollow, pack as before directed; and where the blade binds take out the packing. Screw up tight again before trying. Next place a piece of paper between the cutters, and if everything is satisfactory the blade should cut like scissors on every part of the edge. If any part misses or tears, pack under that part. Then take the mower to a patch of grass and set the small rollers according to the length of the grass to be cut.

CHAPTER II.

SIMPLE SOLDERING AND BRAZING.

To solder is to unite two portions of an article by means of another metal or alloy, which must necessarily melt at a lower temperature than the metals being operated on. Soldering may therefore be divided into two distinct kinds: hard-soldering or brazing, in which the heat of a Bunsen burner or brazing hearth is necessary to fuse the solder; and soft-soldering, in which the solder may be applied readily at the ordinary heat of a tinman's soldering bit. To make good, sound joints in any metal, it is first necessary to understand properly the principles which underlie the composition of the various solders used, as well as the materials to which the solders are applied.

Hard-soldering is used to a very great extent in making brass and copper tubes, in brazing brass vases, chandelier work, and fittings, and in brazing the ends of tubes into sockets in the manufacture of cycles and motor cars. Although several mechanical joints have been tried in cycle manufacture, the greatest number of joints are made by means of brazing solder. A joint made in this manner is almost as strong as a weld, and the steel tube itself will often break under a strain and the brazed joint remain intact. Copper and brass tubes, when well brazed, will stand a pressure of 40 lb. and upwards to the square inch.

Hard brazing solder is somewhat difficult to make. The copper and spelter used have to be melted in a crucible and cast at a proper heat, and while in a certain condition they are pounded or punned in a mortar. This pulverises the material and forms crystals of various sizes, some being as coarse as wheat grains, varying in fineness down to that known as 0.0, which is a very fine dust indeed, and used only on very small work, such as tubing $\frac{1}{8}$ in. or $\frac{3}{16}$ in. in diameter. The quantity of 0·0 got from 1 cwt. of solder is very small, the corresponding quantity of coarse grains being very much larger; and, unless a large quantity is required, it is cheaper to buy than to make. It is necessary to employ the purest materials in solder-making, also when purchasing solder it is advisable to state the purposes for which it is to be used.

As a general rule, a solder should melt at a heat just under the melting point of the metals being united. With ironwork, or with the steel used in cycle work, this is impossible, for the melting points of these two metals are too high to be attained by the Bunsen blowpipe or brazing hearth; but to join two metals in which the melting point approximates very closely to that of the solder requires great care in order that the metals may not be fused and the joint spoiled.

The reason why the melting-point of solder should be about the same as that of the metals being joined is apparent when it is remembered that heat and cold, vibration and concussion, tension and compression, have very considerable effect upon metals, and that if the expansion and contraction of these under working conditions is not nearly alike disruption or opening of the joint will follow.

Hard solders are mainly composed of copper and zinc, the quality most extensively used consisting of equal parts of copper and zinc. As the quantity of copper in the solder is increased, so the fusing or melting point is raised. Ordinary copper melts at about 2,000° F., and zinc at about 840° F., and a solder composed of equal parts of each metal melts at a point above 500° F. A very hard solder, though restricted in use owing to its initial cost, consists of silver 2 parts and copper 2 parts.

A solder for use in brazing German silver consists of copper 47 parts, zinc 41 parts, and nickel 11 parts. This is pounded in a similar manner to brass solder. For copper and brass work, alloys of copper and zinc are also used, the copper varying from 50 to 60 per cent. and the zinc from 40 to 50 per cent. Occasionally a little tin is introduced, but as a rule this does not exceed 2 per cent.

In using the ordinary brass solders, the solder is first well washed to free it from dirt, and then mixed with calcined borax—that is, ordinary borax crystals, in which the water of crystallisation has been removed by heating in an oven or furnace till it is completely pulverised. The mixture should be well rubbed through the hands, and afterwards worked up with water to the consistency of cream, when it may be applied to the work. When the joint has been brazed, the scaling and all excrescences are removed while hot by scratch-brushing and when cold by the aid of files.

Soft solders, as the name implies, are those that melt at a very low heat. As a rule, they are used for making joints in tinplate, lead, zinc, and some classes of brass. The usual quality is that of plumber's soft solder, consisting of tin 1 part and lead 1 part. A solder consisting of tin 2 parts and lead 1 part melts at a heat of 338° F., though tin melts at 440° F. and lead at 620° F.

Soft solders do not usually contain more than 60 per cent. of tin. Solder containing a number of elements, or containing a small quantity of bismuth or cadmium, will fuse at a very low temperature. A solder consisting of tin and lead, 1 part each, and bismuth 2 parts, known as Rose's alloy, used by pewterers, will fuse at 203° F. Soft solders are termed common, medium, or best, according to the percentage of tin contained, those having the most lead being the cheapest. Fine or best is used for Britannia metal, best tinplate, brass, and other metal articles; commoner qualities are used for ordinary work.

The quality of a solder may be fairly judged by its outward appearance; with excess of lead, the surface will have a greyish-white colour; with excess of tin, the surface will be bright with greyish-white spots. Ordinary soft solders are used with a flux of powdered resin or with spirits of salts; the latter is made by dissolving metallic zinc in muriatic or hydrochloric acid till it is saturated or will dissolve no more. For electrical work resin is invariably used, because the acid has a tendency to cause trouble under the passage of the electric current.

A few other solders used in various trades may also be given.

A solder for jewellers is made of fine silver 19 parts, copper 1 part, and brass 10 parts; a silver solder for plating is composed of brass 10 dwts. and silver 1 oz.

The following are two good solders: pure gold 12 parts, pure silver 2 parts, copper 4 parts, melted together. A solder to flow at a dull red heat, suitable for gold brooches, guards, and such work: 3 parts gold, 2 parts silver, and 1½ parts copper, with an addition of ½ part zinc.

An excellent hard-silver solder contains silver 4 parts and copper 1 part, but this is difficult to fuse; ordinary silver solder is silver 2 parts and good brass (such as pinwire) 1 part, but this may only be melted once.

The best soft solder for cast Britannia ware is tin 8 parts and lead 5 parts; white solder for silver, 1 oz each of tin and silver; solder for pewter, tin 10 parts, lead 5 parts, and bismuth 1 to 3 parts; black solder, copper 2 lb., zinc 3 lb., and tin 2 oz.

Solder for wiped joints usually consists of lead 3 parts and tin 1 part; while the usual composition for plumber's compo pipe is lead 2 parts and tin 1 part.

Before any soldering can be done the soldering bit must be tinned. (The ordinary bit is shown by Fig. 35.) To do this, heat it in the fire to blood-red, grip it in a vice, and quickly file the four faces quite bright; dip the end of the copper bit in killed spirits, rub it on a piece of sal-ammoniac, hold a stick of solder to the point of the bit, and melt a little on the lump of sal-ammoniac, rubbing and turning the bit at the same time. If it is hot enough, the solder will flow and coat the face of the copper. Dip it again in the spirits, and the operation is complete. Another method of tinning a bit is with a piece of clean tin-plate, about 4 in. square, nailed to a piece of wood

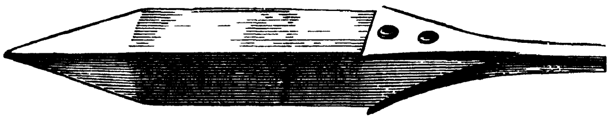


Fig. 35.—Soldering Bit.

Heat and file the bit as before, dip the end in killed spirits, and then put a pinch of resin on the tin-plate, melt a little solder on it, and rub the bit briskly on the tin-plate. The solder will quickly flow on the clean part of the soldering bit. Do not make the copper bit red-hot after tinning, or the whole process of filing and tinning will have to be repeated.

It should be the aim of the workman to so use the copper bits that they remain tinned, re-tinning involving loss of time and the filing quickly wearing away the copper. Care should be taken that bits are not burnt in the stove.

A few simple soldering exercises will now be given and though these are directly connected with repairs, yet it must be remembered that the process of soldering in both new work and repairs is the same. The only difference between the two is that it is necessary to spend more time in preparing the surfaces of old work.

The repair of a vessel—say a teapot—having a pinhole in the bottom, is a typical elementary soldering job. With a knife, scrape round the pinhole a clean patch about the size of a sixpence. An old saw-file driven into a handle makes a very good scraper, though, for some purposes, a more pointed one is required. Have the bit, solder, spirits, and spirit brush handy heat the bit, hold the teapot in the left hand, dip the spirit brush in the spirits, press it against the sides of the jar to remove superfluous liquid, and apply a little to the place to be soldered. Dip the bit in the spirits to clean it, apply it to the solder, and try to pick up a little with it. This may be found a little difficult at first, the solder running all over the bench instead of clinging to the bit. Hold the bit in a nearly horizontal position, do not dig its point into the solder, but lay the side of the bit on it lightly near the point and draw inwards; then, keeping the bit as near horizontal as possible, bring the point of it with the solder it has picked up to the hole in the bottom of the teapot. As it touches the leaky place lift the handle of the soldering bit, and the solder will flow off at the point; move the bit just round the hole and the solder will run all over it Remove the bit, and allow the metal to cool (blowing on it will accelerate the cooling), and the job is done Try with water, to make sure that the repair is sound.

When a large hole in a tin-plate utensil has to be repaired, cut a patch of sheet tin plate to cover it, allowing a good margin. Trim off the sharp corners, and bend the patch to fit the body, then place it in position and mark round it, and carefully clean about ¼ in. beyond the mark, this will allow the solder to flow well under the patch. Brush some spirits on the under side and edges of the patch, hold it firmly in position, and solder Solder is not much wanted on the outside of the patch, as it will be made quite sound by the solder flowing underneath.

When the spout of a tin tea-kettle leaks it should be treated as follows: Dry it thoroughly, scrape it well a little farther each way than the leak extends, hold it in the most suitable position for soldering, which will be on its side, apply the spirits, and solder it, laying the angle of the bit in the angle formed by the spout and body.

To put a knob on a coffee-pot lid, merely place it in the hole (after scraping, of course), and with the bit melt a little solder and the end of the knob together inside, the knob resting on the bench whilst soldering, and taking care not to keep the bit on it too long or the knob will melt away. A little disc is usually punched out and soldered inside over the place where the knob is fixed, to give a neat appearance.

To patch a tin saucepan that leaks, proceed as follows: Cut a piece of tin about 1 in. square, snip off the corners, lay it on the bottom of the saucepan just over the hole, mark round it with a point, scrape clean all inside the square thus marked, and ¼ in. all round the outside of it; or, in other words, if the patch is 1 in. square, scrape a clean place 1½ in. square. If the saucepan is in good condition and scrapes bright and clean, it will be ready to solder; but when the bottom is eaten by fire and rust it is difficult to get clean, and after scraping and cleaning it as well as can be done, it must be "tinned" to make sure of the solder flowing under the patch. To do this, simply rub the hot soldering bit over it with a little solder, applying spirits to make it tin easily. Then lay on the patch and solder it, drawing the bit first round the edges and then all over it, meanwhile holding the patch down to prevent its shifting; the solder flows underneath, and the patch is what is called "sweated" on. This description of putting on a patch applies also to tea kettles, coffee-pots, fish-kettles, etc., with the exception that a large patch need not be sweated all over, but simply soldered all round the edge, letting the bit rest mainly on the patch, so as to draw the solder underneath.

Saucepans and similar tin utens ls often become leaky at the junction of the bottom and the body, and a leak in this position is best repaired from the inside. Thoroughly clean the bruise or crack, and solder as before described, but allow a fair proportion to remain, so that the hole is well covered. Hold the article on its edge, and see that the solder is firmly set before moving. When the bottom is rusty inside, and cannot be reached to clean properly, the

Fig. 36.—"Capped-on" Bottom of Can.

repair may be done on the outside. When very rusty, brush on a little raw spirit after cleaning; allow it to remain for a short time, then wipe off with a wet rag. The solder will then adhere much more easily. A cracked bottom edge can be made sound with solder; first thoroughly clean the edges of the crack then with the point of the bit draw the solder along the bright part, commencing at one end. With repairs of this kind the solder is liable to melt off in use when brought in direct contact with the fire or hot plate.

When a new bottom is required, it may be "capped on," "pened on," or "knocked up"; the first two are usually soldered outside, the last inside. A vessel that needs no great strength, or that is not brought into direct contact with flame, such as an ordinary cheap oil-can, frequently has the bottom "capped on," as in Fig. 36. To re-bottom such a vessel, first scrape the body bright, about ½ in. from the bottom all round, and thoroughly clean the seam. Then hold the can on the edge of the bench, and with a sharp chisel cut off the old bottom carefully, so that the body is not bruised. If drawn out of shape, the body may be rounded again with a mallet on an iron bar or mandrel. The bottom edge, if not true, must be trimmed with the shears. Cut a circle of tin, ¼ in. larger in diameter than the body, and turn up the edge ⅛ in. all round at right angles to the bottom. When completed, this piece should fit exactly on the body, and may then be fixed by

Fig. 37.—"Pened-on" Bottom of Coffee-pot.

the solder being drawn neatly round the joint with the point of the copper bit.

To replace the bottom of a coffee-pot, which is usually "pened on," clean thoroughly, cut off the old bottom, take out the bruises, and trim the edge as in the last case. Then carefully turn the bottom edge of the body outwards, ⅛ in. all round at right angles to the body, making it perfectly level. Cut out a circle of tin for the bottom, allowing ¼ in. for the edge. Turn up the edge of the bottom as before, fit it in position, and rap the edge inwards all round with a small hammer. Then with a pene hammer on a level surface fold the edge of the bottom over the bottom edge of the coffee-pot, and hammer it down close and tight, as in Fig. 37. Solder it carefully on the outside; the job is then complete.

To replace the "knocked-up" bottom of, say, a saucepan, the old bottom should be cut off and the body trimmed and edged as before described. As the soldering is done from the inside, it must be scraped thoroughly, using the file if necessary, and cleaning a depth of about ¼ in. Cut out, edge, and pene on the bottom. Place the saucepan on a mandrel, and with a mallet gradually fold the pened edge over square with the body, going round several times if necessary, until the joint is close, as in Fig. 38. The point of the mandrel must be kept well up in the lag, otherwise it may bruise the body,

Fig. 38.—"Knocked-up" Bottom of Saucepan.

and the bottom will not be true when completed. Dress the bottom smooth with a square-faced hammer, then solder up inside, and the job is completed.

For copper or brass the bit has to be hotter than for tin-plate. See that the part to be soldered is well cleaned as before. Use killed spirits as a flux. Any fancy brass or copper work should be filed off quite smooth when finished. A small piece of sulphate of copper crushed very fine, and mixed with cold water to the consistency of paint, should then be rubbed on the part of the work which has been soldered, it should be wiped off again with a dry rag. This makes the solder look like copper, and if it is done well it is hardly noticeable on copper work.

To re-solder a spout on a copper kettle, first with a piece of emery cloth, thoroughly clean the copper where the spout is to be inserted, and also clean the spout around its large end. Then tin the copper inside the kettle where the spout is to be soldered, and also the spout, using killed spirits as a flux. Pass the small end of the spout through the hole from the inside of the kettle, and press it up so that the small flange on the large end of the spout butts against the inside of the kettle; then solder round the spout inside of the kettle, and leave a thin body of solder floated smoothly round where the join occurs, the same flux being used as for the tinning.

A copper kettle that is cracked along the edge of the bottom for about 1¼ in. can be repaired by putting a patch on the bottom and turning it up on the side. Scrape clean a place on the bottom 1 in. wide, and extending beyond each side of the crack, scrape up the side ½ in. in the same manner, and then tin the places. Now take a piece of thin copper 1½ in. by 1 in.; clean both sides, and tin one side with the soldering bit. Such a job as this should be fixed by the handle in the vice, to leave the hands free, and place the piece of copper, tinned side down, on the bottom of the kettle, leaving about ⅜ in. overlapping to turn up on the side. Solder the piece on to the bottom, cut the overlapping piece to the same sweep as the sides, and with a light hammer tap it up close to the side, and then solder round that part; with a file or scraper clean off any superfluous metal that may have run over the patch, and if necessary, colour the solder with a little solution of sulphate of copper.

Soldering soft alloys will require some skill and practice to master, and it would be advisable for learners to practise on an old soft metal teapot before attempting more serious work. The metal must be scraped bright, because a mere clean appearance is no criterion that it is clean enough to solder properly; a light soldering bit should be used, as the bit cannot rest on the work as can be done in soldering tinware. The weight of the bit being all on the wrist, it would be impossible to hold a heavy bit steady. The bit must be just the right deg ee of heat: if it is too hot, it may make a hole in the metal; if not hot enough it makes the work botchy.

If a soft metal teapot leaks all around the spout, and has been recently used. the first thing to do is to dry it out thoroughly, or on applying the bit the solder will splutter and bubble up instead of flowing nicely. Having dried it well, the next thing will be to scrape it, for which purpose the large blade of a penknife answers very well. Take some very fine running solder, and have ready some resin and oil for a flux; apply it round the spout with a little brush, heat the bit, apply a little solder to the teapot spout, and gently draw it round with the bit, scarcely letting it touch the metal of the teapot. The heat of the solder will melt the metal as it is drawn round; if the bit is fairly hot, do not try to make the solder run round very far, but keep picking more up, and reheat when it hangs. Supposing that the spout has been rounded successfully, the next thing is to clean off the job so that the repairs can hardly be detected. With a half-round file about 6 in. long, work round the job lightly, taking care not to file the side and spout of the teapot more than can be helped, and when it has been got fairly level and smooth go round it with an emery cloth or a round-ended scraper. After this use a steel or agate burnisher.

Vessels of pewter, Britannia metal, etc., are repaired by soldering with pewterers' solder, composed of 2 parts of bismuth, 1 part of lead, and 1 part of tin. When making the solder, melt the lead first then add the tin and bismuth; sprinkle a little resin on the surface of the molten alloy to prevent oxidation, well stir it, and then pour the solder into an iron mould. When using the alloy, first well clean the article where it is to be soldered by scraping with a sharp knife, then rub a little tallow over the cleansed part. Melt a small globule of solder from the stick; place the globule on the part to be soldered, and, with a fine jet from blowpipe, blow gently upon the solder until it flows over the part to be repaired and adheres to the pewter, smooth the edges of the patch of solder with a smooth file, and finish off with a burnisher.

A rather difficult kind of work is the repairing of the rims and covers of china teapots and hot-water jugs These are extremely thin, and made of a very soft and fusible metal. The parts to be soldered must be scraped carefully; no streaks of uncleaned metal should be seen, very little flux should be used, and a very steady hand is required. Good solder which melts at a low temperature should

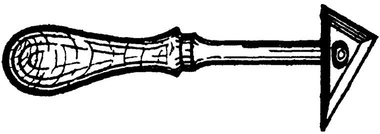


Fig 39.—Plumber's Shavehook

be used. If these directions are attended to, there is little fear of failure or spoiling the work.

Zinc is a difficult metal to solder smoothly and well, even when new and clean The strong or raw spirits of salt must be used and the worker must try to keep the spirit on the part to be soldered, and not let it run over the work; and after the seam joint, or whatever it may be, is soldered, the spirits should be wiped off when the work is cold, as the spirits have a very corrosive action. Soldering zinc is unpleasant, because of the fumes caused by applying the acid to the zinc. It will be found that the solder does not flow very well on zinc, this is because some of the zinc mingles with the solder and deteriorates it, and it will cling to and get hard on the soldering bit like a mass of dross The bit must be cleaned at intervals if much zinc is being soldered; a light touch up with a file all round, and a rub on the sal-ammoniac with a little solder, puts it all right again. Old zinc has to be got fair'y clean w th a ‹craper or file before attempting to solder, and the spirits should be used on it freely. Zinc is not a soft metal like pewter, but it will melt under the bit if thin and if the bit is very hot; practice will soon show the right degree of heat to work with. Smooth the soldering where rough with file and scraper. The plumber's shavehook (Fig. 39) is a good tool for cleaning off zinc after soldering, especially on long s ams.

The treatment of galvanised iron is very similar to that of zinc, strong spirits being used as the flux. An article in zinc or galvanised iron that is to contain any liquid should be very carefully tried before being passed as finished, as though it may appear sound, actually it may be leaky. Galvanised iron is really steel coated with zinc.

The best way of repairing sheets of galvanised corrugated iron in which there are several large holes is to cover the holes with sound pieces of the same material. The pieces should be fitted to the holes, and then soldered in position. The iron must be well cleaned by scraping, or by other suitable means, where the soldering is to be done, and raw spirit (hydrochloric acid) used as a flux; the iron can then be soldered with ordinary tinman's solder and a copper bit in the usual way.

The leaky spout of an iron kettle is repaired in the following way. Most wrought-iron kettles are tinned outside as well as inside before being japanned. If on scraping off the black this proves to be the case, and it has not been in use very long, the scraping knife will be all that is required to clean it for soldering; but if old and rusty round the spout, say, through having been put by when the leak was discovered, instead of being sent to be repaired at once, then the file will be required; a 10-in. half-round is about the most useful size for these operations.

Carefully clean all round the spout till there is no dirty place or rust spot. Then the successive steps are—apply the spirits, heat the copper bit to a good heat, apply the solder by holding a strip of it in one hand and melting a little on with the bit held in the other. Holding the kettle, draw the bit round the spout and the solder will follow. Let the bit rest on the work, as it must be made hot before the solder will unite to it properly . a strong job cannot be made unless the parts to be united are as hot as the solder that is to unite them. For example, supposing a kettle is coated with fur to the depth of ½ in. all over the inside, the solder cannot be made to flow freely, on account of the wet fur taking the heat from the bit, and although it might be possible to get a little solder round the spout a good sound job cannot be produced ; but if the fur is cleaned out, there in no difficulty.

Steel is not a suitable metal for soft soldering, but still the following method answers fairly well. The work must be scraped perfectly clean, and the parts brushed over with killed spirits. Heat the work to drive off the moisture, taking care not to smoke it, or in any way to make the surfaces dirty ; while the work is hot, try to make the solder adhere ; if it will not, add a little Venice turpentine, and use the copper bit. The proper application of heat, and cleanliness, are the essentials. When the surfaces are tinned, tie the parts together ; using a little Venice turpentine or solution as flux, apply the hot bit, and add solder if necessary. Generally, merely brushing the surfaces with killed spirit, and drying them before tying together, answers if the hands and tools are clean and free from grease.

Brazing, as already explained, is another name for hard soldering, and differs from soft soldering in the fact that the uniting metal or solder has a higher melting point and so cannot be applied with an ordinary bit ; instead, a forge or a powerful blowpipe must be employed to make the hard solder—known as spelter—flow into the joint. Brazing is used where greater strength is required than can be given by soft solder, or when an article has to stand a degree of heat when in use that would cause soft solder to run.

There are three or four usual sources of heat for brazing—the blowpipe, the coke or coal forge fire, the benzoline or paraffin brazing lamp, and the gas brazing hearth, this being an arrangement of blowpipes.

Brazing with spelter—that is, with hard solder—necessitates a far greater heat than soft soldering, and when a lamp is used to supply the heat, it must be a powerful one. The fuel may be benzoline or paraffin, according to the special construction of the lamp, and there is generally a hand-pump fitted for putting the fuel under air pressure. One of the most powerful lamps made is the Invicta No. 1, which gives a flame 18 in. long, and in parts 1½ in. in diameter, this being capable of melting a ½-in. copper rod in three minutes. Four pints of benzoline will give a full flame for an hour and a quarter, but by regulating the flame, such a quantity will last for several hours. A still more powerful lamp gives a 21-in. flame, 2 in. thick, and holds 6 pints of benzoline. A typical paraffin brazing lamp can give a 12-in. flame; under a pressure of 4 atmospheres 1 quart of paraffin lasts about 40 minutes, and under 2 atmospheres about 80 minutes. A larger size holds 3 quarts, gives a 20-in. flame, and its fuel lasts for 60 to 100 minutes, according to whether the pressure is 4 or 2 atmospheres.

A suitable solder for use in brazing small steel articles may be made in the proportions of silver 18, brass wire 2, copper 1. Melt in a crucible; when cold, hammer into a thin sheet, or granulate while molten by pouring into water. For small articles, a solder that will flow at a lower temperature than brass wire should be used For brass, copper, or iron, equal parts of silver and brass are sometimes used, though for iron, copper, or very infusible brass, coin silver is the best solder; it should be rolled thin, which may be done by any silversmith or dentist This makes decidedly the toughest of all joints, and as a little silver goes a long way it is not expensive. A commoner spelter for small articles of brass consists of 5 parts copper, 3 parts zinc, and 2 parts silver

To obtain hard solders of uniform composition they may be granulated by pouring them into water through a wet broom. Sometimes they are cast in solid masses and reduced to powder by filing Silver solders for jewellers are generally rolled into thin plates Hard solders are usually reduced to powder, either by granulation or filing, and then spread along the joints after being mixed with borax that has been fused and powdered. It is not necessary that the grains of solder should be placed between the pieces to be joined, as with the aid of the borax they will run into the joint as soon as fusion takes place The same is true of soft solder applied with a soldering fluid. One of the essentials of success, however, is that the surfaces be clean, bright, and free from rust

Borax is a true flux for all hard solders, and it will combine with most of the oxides, which are usually bases It protects the metal from the further action of the air, so that the solder is enabled to come into actual contact with the surfaces which are to be joined Water dissolves only a very small quantity of borax properly. It is, therefore, not possible to mix borax powder and water in anything but a paste in which the borax sinks. This sinking of the borax does no harm as, when hot, it melts and spreads over the work evenly. For small articles requiring only a very little borax, such as spectacle frames, keys, etc , lump borax rubbed down with water on a slate produces a paste of much finer and more even consistency than does borax powder. Generally borax—lump borax, not powdered—is rubbed up on a clean slate with water until it is as thick as cream, or until it stands in ridges. The slate is 4 in. to 6 in. in diameter, and to roughen it, is sometimes scored across with the edge of a file. Make sufficient at one time for the job in hand, and apply it to the work with a borax pencil (camel-hair brush), taking particular care to cover completely all the surfaces over which the solder is to run.

For supplying small work with the hard solder or spelter, small pieces of it (pallions) may be picked up with the borax pencil and laid along the seam. Gentle heating drives off the moisture, and, if the pallions have not shifted, the full heat can then be applied to make the solder run. Another way, after boraxing the soldering seam, is to have a narrow strip of solder, held in long pliers or anything suitable, and apply it to the work when this is hot enough to make it run; and as it runs the hard solder is moved along the seam. Should there be insufficient borax on the work, pass a piece of lump borax along it, and it will hold if the metal is hot enough. This is instead of leaving the work to get cool previous to applying more with the pencil. Borax is sometimes burnt and powdered before mixing with water, but that is only for cases where it is of great importance that the solder does not shift.

If seams in brass are not required to stand much working after brazing, they may be joined edge to edge. When seams are formed in this way, little nicks, about ½ in. apart, should be filed along the edges, so that the solder flowing through the nicks during the soldering operation will render the joint sound. If the seam is to be worked after soldering, a small lap is necessary to ensure adequate strength. To form seams of this type, first thin the edge of the metal along the ends that are to form the seams, about ¼ in. in from the edge, so that when the two edges are lapped over each other their combined thickness at the seams will be the same as the single thickness of the metal at other parts. Cut a smal cramp at the top and bottom of the seam, and fit the opposite edge in these cramps.

After preparing the seams by either of the above methods, fasten binding wire round the articles so as to hold the pieces securely in position. Now powder some borax for use as a flux, and soak it in enough water to form a thick paste; place a little of this along the parts to be soldered, and gently heat the article by some suitable means, such as foot bellows and blowpipe, so that it will expand equally, and not disarrange the seam; increase the temperature until the metal is a dull red, and then take a strip of the hard solder (made of copper, zinc, and silver, as previously explained), dip the end in the borax, and, holding the opposite end with the pliers, rub the solder along the seam until a little melts off. Keep the solder in a molten state, and with a piece of wire flattened at one end gently rub the solder along the seam until every part is joined.

Small articles of iron may be joined in a similar way with equal parts of copper and zinc, but if the iron is to be hammered much after brazing, 2 parts of copper and 1 part of zinc would be more suitable. For use mix together equal parts of the borax paste and grains of spelter, and along the seams place sufficient of the mixture to unite them when melted. Some dry borax should also be kept ready at hand, so that a little may be taken and thrown on the spelter at any point where the material does not appear to be flowing freely.

CHAPTER III.

CHINA RIVETING AND REPAIRING.

In mending china it is questionable whether anything short of rivets should be used, because repairs carried out with the aid of cement are always more or less in danger of falling to pieces with ordinary usage. Of course, china or glass that is rarely handled may sometimes be suitably repaired with a cement, and the appearance of rivets on a prized piece of pottery will then be avoided.

Several good cements can be made at home. The combination of shellac and rectified spirit known as Chinese cement is a very strong medium, and is made by dissolving ¼ lb. of the best pale orange shellac in 3 oz. of strong spirit. The shellac should be pounded up fine and placed in a stoppered or corked bottle with the spirit, in a warm place, and the mixture should not be used until the shellac has become thoroughly dissolved.

The real Chinese cement, however, as made by Chinamen, is produced by pounding glass to a very fine powder, then sieving it through silk, and afterwards mixing and grinding it with albumen. Ornaments repaired with this medium (providing heat is not applied) will not readily separate at the joint.

White-lead will resist boiling water, and make an exceptionally strong repair if it is allowed to set before the article is brought into use; but it will take several weeks to harden properly. It should always be used carefully, as traces of it are difficult to remove when allowed to harden on an exposed part.

Several of the advertised cements are good, but where ornaments only are concerned, probably none is cleaner, stronger, more suitable, or more easily applied than isinglass dissolved in acetic acid. The great drawback of this is that it will not stand hot water. It should be evenly applied to the broken

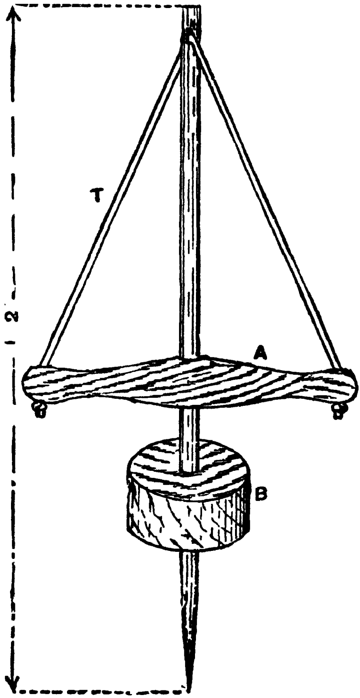


Fig. 40.—Drill for China Repairing.

edges with a camel-hair brush, and sets hard in twelve or fourteen hours.

It is the way in which the cement is used, rather than the kind of cement employed, that is the important element in making a strong joint. Many people are afraid to heat delicate china and glass ornaments sufficiently. The parts should be heated in the oven, as the cement begins to harden immediately it comes in contact with cold materials, and therefore produces

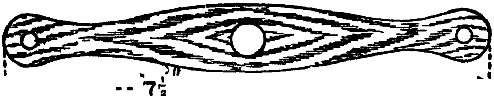


Fig. 41.—Drill Arm.

a "set" layer between the broken parts. If possible, the article joined should be bound tightly with tape until properly set, and should be placed in some cool apartment where it is not likely to be shaken or upset.

Always undertake the repair as soon as possible after the article is broken, as then the edges are not in any way damaged, and a close joint results. Shellac alone makes an extremely strong joint if the broken

Fig. 42.—Diamond Bit

parts are sufficiently heated to fuse it when applied; but, unfortunately, it leaves a very noticeable dark line on white china.

Riveting is the most substantial way of repairing broken articles, but entails a small outlay for the drill, hammer, wire-cutting pliers, file, and material for the rivets. The drill complete is illustrated at Fig. 40. To construct it, a light steel spindle, 14 in. long, pointed at one end, will be required for the stock. A hole must be drilled through the head of this spindle to take the tape T, which is also fastened to the ends of the wooden arm A. This arm is bored (see Fig. 41) so that it can easily pass up and down the spindle. A piece of box or ebony B (Fig. 40) should also be turned 2¼ in. in diameter, by 1 in. thick, and a hole slightly smaller than the steel rod

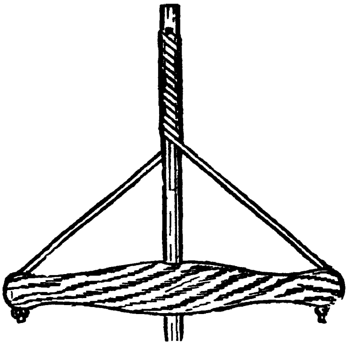


Fig. 43.—Method of Working Drill.

drilled through it, when the block is hammered tightly into position. This hole must be drilled accurately, or the drill will wobble, and for this reason the hole should be drilled halfway through from each side. A still better method is to knock the wood on the spindle, and then true it up in a lathe.

The drill bits (Fig. 42) simply consist of tapering tin tubes with a diamond point cemented or soldered in one end. These tin tubes fit tightly over the cone end of the drill proper, but it is not an easy matter to set the diamond fragments, or "sparks," in the tubes. The mouth of the tube should be not more than $\frac{1}{32}$ in. in diameter, and should not commence to widen out into a cone under $\frac{1}{2}$ in. from the end.

Some measure of success can be obtained with well-tempered steel drills, if fine diamond powder mois

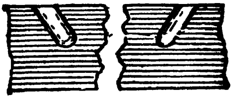


Fig. 44.—Section showing Position of Rivet Holes.

tened with oil is used as an abrasive, but neat holes are rarely produced, and the surrounding glaze is frequently chipped off.

To use the diamond drill, the spindle is twisted so that the tape winds itself round the stem, as illustrated in Fig. 43. When the arm is pressed downwards, the tape unwinds and causes the spindle to revolve; then, if the hand is raised again at the crucial moment, the tape will immediately coil round the stem in the opposite direction, and thus be ready for another downward thrust of the arm. A little practice will soon enable the beginner to get a continuous motion. The operator sits, and always works the apparatus with the right hand only, leaving the left hand free to hold the glass or china rigidly against the thigh of the left leg. Before using the drill, always dip the point in oil, and bore all holes in the articles

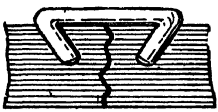


Fig. 45.—Rivet in Position.

about $\frac{1}{4}$ in. from the edge, at an angle so that they incline slightly towards the breakage (see Fig. 44). The positions at which the holes are to be drilled should be very accurately marked, and care should be taken not to bore the holes straight through the material. If the finger is held underneath the part which is being drilled, the warmth will indicate how far the bit is through the china.

The clasps or rivets generally consist of $\frac{1}{16}$-in. brass wire, with one side half filed away, so that a

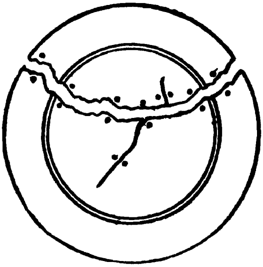


Fig. 46.—Distribution of Rivets on Plate

flat surface meets the article. Of course, the thickness of the wire employed depends on the character

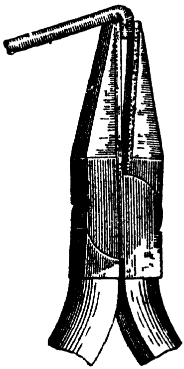


Fig. 47.—Rivet formed with Pliers.

of the article to be repaired. In the case of plates and similar goods, always fix the rivets on the back, as then they cannot be seen. Fig. 45 shows the rivet in position after the repair is accomplished, and Fig.

46 represents the back of a broken plate, and illustrates how the rivets should be distributed.

To make the rivets, first place one end of the filed wire in the mouth of a pair of pliers (see Fig. 47), and, on the nose of the tool, hammer the wire down

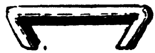


Fig. 48.—Finished Rivet.

a little past a right angle with the flat side. Then carefully measure where the second bend ought to be, cut off the surplus wire, and bend down the second end, as in Fig. 48. Each rivet should fit the hole so tightly as to require gentle knocking into position with a very light hammer, or it will spring into position if given a pull with the pliers. Take care that the ends of the rivet are not too long, as if this is the case it will not lie flat on the broken article. To complete the repair it is then only necessary to fill up the holes and cracks with plaster-of-Paris mixed with water to the consistency of cream, and either

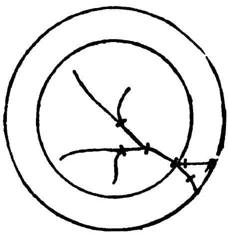


Fig. 49.—Arrangement of Rivets for V-piece Broken out of Plate.

left white or coloured, according to the articles being mended.

Fig. 49 shows the arrangement of rivets for a plate from which a V-piece has been broken out and which is badly cracked as well. Cement would effectively repair a jug broken as shown (see Fig. 50), but if rivets are used distribute them in the manner illustrated. The portion A had best not be tampered with, as it has a very slender hold on the rest of the article, and very little pressure would break it.

A good waterproof cement for glass consists of 3 parts plaster-of-Paris, 3 parts litharge, 3 parts white-lead, and 1 part powdered resin—all by measure. When required for use, mix it into a paste (the proper consistency depends on the purpose for which it is required) with boiled linseed oil. It sets hard in three days. To colour a cement, mix with it colouring matter to be purchased at any oil or colour stores.

Winchell's cement is given as a universal cement. Procure ½ oz. of white sugar, 1½ oz. fine starch, and

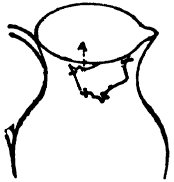


Fig. 50.—Distribution of Rivets for Broken Jug.

2 oz. clear gum arabic. Crush the gum to a powder, then dissolve it in the quantity of water that would be used in laundry work for the quantity of starch mentioned, and afterwards dissolve both the starch and the sugar in the gum solution. Next place this mixture in some suitable receptacle, and place the latter in a saucepan of boiling water, leaving it thus until the starch becomes clear. The cement will then be ready for use, and should be of about the consistency of tar. If it is to be kept for some time, a few drops of oil of cloves or sassafras will prevent it becoming unfit for use.

Illustrations showing jug and vase repairs are presented by Figs. 51 and 52. If jugs are valuable and are used only as ornaments, cement may prove satisfactory for attaching handles, as the disfiguring effect of rivets is then avoided, but if the jugs have to be used (and the breakages allow such a plan to be adopted), fine wire rivets should be employed to

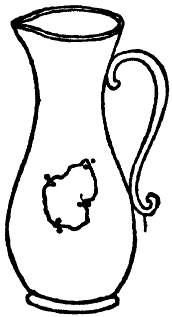


Fig. 51.—Jug Repairs.

strengthen the joints. When a thick handle is broken, china repairers often employ wire (not more than ½ in. long) to strengthen the joint without being visible.

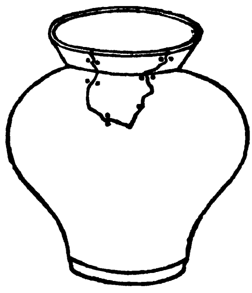


Fig. 52.—Vase Repairs.

As shown in Fig. 53, a hole, somewhat larger in diameter than the wire, is carefully drilled in each piece of the handle, and the wire, after having its ends roughly notched (as shown in Fig. 54) by a file, is fixed in position with a very little plaster-of-Paris, which is placed in the holes before the wire; if too much were used, some of the plaster would be forced out of the holes by the wire, and would prevent a close join being made. The faces of the broken parts are also thinly smeared with suitable cement when the workman is ready to join the pieces.

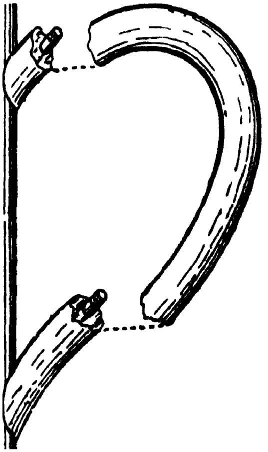


Fig. 53.—Mending Jug Handle with Wire.

Fig. 54.—Wire Rivet with Ends Notched.

When a large Bohemian glass vase is broken in the stem, obtain a ferrule a trifle larger than the raised part of the glass stem; the ferrule may be of brass, or plated metal, or silver. The cement may be made by melting together 5 parts of resin and 1 part of beeswax, and stirring in 1 part of venetian red or yellow ochre. The glass stem should be warmed and coated with the cement; the ferrule should be warmed and coated internally; then the parts should be again warmed and pressed together

CHAPTER IV.

CHAIR CANING.

CHAIR caning may look difficult, but actually is very simple work. If the following instructions are followed, even the first attempt will be equal to, if not better than, the ordinary chair-mender's work.

The split cane is sold at nearly all wickerwork shops at 2s. or 2s. 6d. per pound; 1 lb. will cane

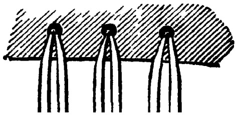


Fig. 55.

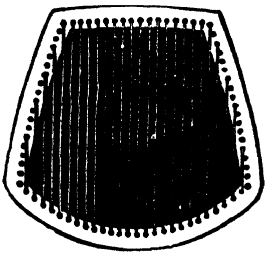


Fig. 56.

Figs. 55 and 56.—Beginning Chair Caning: First Lines of Narrower Cane.

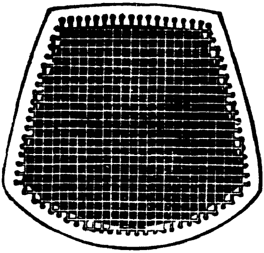


Fig. 57.

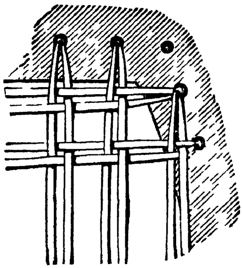


Fig. 58.

Figs. 57 and 58.—Second Operation in Chair Caning: Transverse Lines.

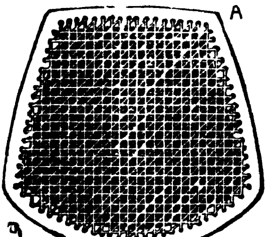


Fig. 59.

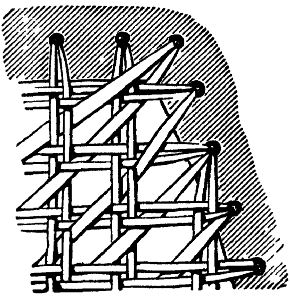


Fig. 60.

Figs. 59 and 60.—Third Operation in Chair Caning: First Diagonal Lines.

about eight chairs. Buy $\frac{1}{4}$ lb. or $\frac{1}{2}$ lb. to begin with The split cane is sold in three or four different widths, but for ordinary chairs the best widths are on of $\frac{1}{8}$ in. and another of $\frac{1}{12}$ in.

Having bought the cane, put it in a tub of cold water and let it soak for twenty-four hours.

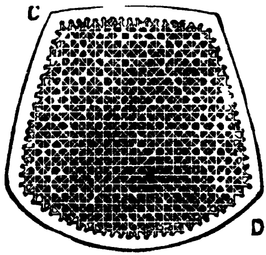


Fig. 61.

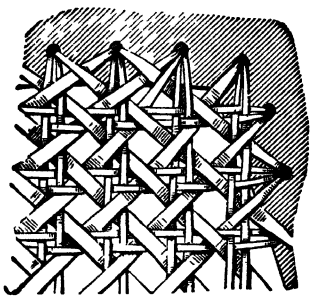


Fig 62.

Figs. 61 and 62.—Fourth Operation in Chair Caning : Second Diagonal Lines

Meanwhile, prepare the chair. Cut out the old canework with a large knife. When this is done, a fringe of cane still remains to be cleared away from the holes. Most of the holes have little wooden pegs in them to keep the cane tight; these must be punched out with a nail or any other suitable tool. Get the holes clear till nothing remains but the bare framework of the chair Now get some sticks of firewood, cut into points to form pegs, to insert temporarily into the holes in order to keep the cane firm till the real permanent pegging has to be done

To begin take two long pieces of the narrower wet cane, and, having tied the ends together into a

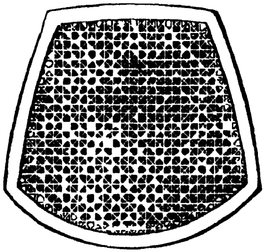


Fig. 63.

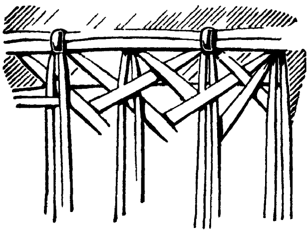


Fig 64

Figs 63 and 64 —Last Operation in Chair Caning: Binding

knot (see Fig 55), follow the illustration (Fig 56), putting in the temporary pegs as the work proceeds, to prevent the cane from slipping Move the pegs at discretion Complete the design shown in Fig 56

Again take two long pieces, and work in and out, as shown in Figs. 57 and 58 Complete this as illustrated by Fig 57

Now from corner to corner, as in Figs 59 and 60, take one long piece of coarse cane, commencing at the corner marked A, taking it over to B in the way illustrated. Complete as shown.

Now start at C (see Figs. 61 and 62), and work over to D, using the coarse cane exactly as in Fig. 59, only working from the opposite corner.

For finishing off, make some more pegs of fire-wood and break them off short—one in every other hole all round the chair seat. Now take two long pieces of coarse cane, and put them into the first hole at C, having first knotted the ends together. Then take a single fine piece of cane, and bring it up across these pieces of cane and return it through the same hole, thus forming a firm binding all round the chair, as is plainly shown by the illustrations (Figs. 63 and 64). Of course, only bind the narrow cane over the coarser at every other hole, where there is no peg.

Great care must be taken throughout to keep the cane well soaked, as otherwise it will not strain. Always pull the cane tight after each hole, though not too tight, or the cane will split, and after each hole put in a temporary peg to keep it firm, otherwise, when the chair is finished, it will present a most unsatisfactory appearance.

For a first attempt choose long pieces of cane, as continual knotting makes the work more awkward; though with a very little practice one may learn how to manage the shorter pieces just as easily. Do not cut off long ends till quite the last, when the work is all well pegged.

CHAPTER V

FURNITURE REPAIRING.

In the repairing of broken furniture, first examine thoroughly the article, and, having decided how it is to be dealt with, get all tools and materials ready before beginning operations If the article s to be glued and screwed, bore the holes and turn the screws into their places before any glue is put on ; if hand screws or clamps are to be used, see that suitable ones are provided, and try them in the places they are intended to occupy ; and, if wedges or bevel blocks are required, have them in readiness Then take the article to pieces, glue up with hot thin glue, and put together again, and the result should be satisfactory. It must not be forgotten that glue will hold best when the wood surfaces are in contact

A well-fitting screw, wherever possible, is the best thing with which to mend broken work But dowels, or nails and screws, are sometimes used When driving in dowels, there is always a tendency to drive the joined surfaces apart, however well they may be secured, and this accident is inevitable if the dowels touch the bottom of the holes , while on the other hand a screw is always pulling the surfaces together Care, however, should be taken to use screws of a size proportionate to the work, and, within reason, the finer the screws are the better ; because the larger the number of threads that are forced into the wood the better will the screw hold

The method of repairing the backs of the old-fashioned dining-room chairs, that have a broad flat back fitted by a dovetail on the top of the sides, is an illustration of the use of unsuitable screws. When these backs work loose, they are usually repaired with glue and with a screw driven through the back of the upright; generally about a ¾-in. No. 9 or No. 10 screw is used. When the backs work loose again and are taken off, it is found that the screw has penetrated the back for about ¼ in. and is holding with only two or three threads; these break out so very easily that they are practically useless. If, however, a No. 5 or No. 6 1-in. screw is used, and is screwed carefully in, coming as near the front as safety will allow, it will be found that there is a ⅝-in. hold instead of ¼-in., with perhaps seven or eight threads instead of two; and a much neater as well as stronger job is the result, the small head of the screw being carefully countersunk and neatly filled up. Again, screw-holes should be bored so as to fit the neck as well as the thread of the screw, for if this is not done the screw will always have a tendency to work loose; the same care should be taken in making holes for nails. For work of this kind small half-twist bits are very useful.

If the article to be mended has any curved framing, such as easy-chair seat frames, etc., care must be taken to get them well up at the joints. Pieces are very frequently found glued in where cramping nicks have been cut when the frame was made; these should be knocked out, and the cramp put in the nicks to draw them well up. Many frames are, however, framed up with a band cramp, no nicks being required. In such cases some frames are nicked when repairing. Strike a line across the joint, and cut two pieces out of the rails in such a position that the pull of the cramp will be directly through the middle of the joint (see Fig. 65). The letter references in this figure are: A A, position of nicks to cramp on back foot B; C, position of nick to cramp front foot to side rail.

In re-framing work of this class, take care that the dowel holes are deep enough, and that the dowels are not too long, for in the cheap goods now common it will frequently be found that the dowels touch the bottom of the holes, and prevent the joint going up close. If after every effort the joint still gapes somewhere (which it frequently will through not being properly cut at first), fit a small wedge and glue it tightly in, so as to prevent any working of the joint, for it is the presence of these little spaces that causes the frames to twist about, leading ultimatel to broken dowels and similar accidents.

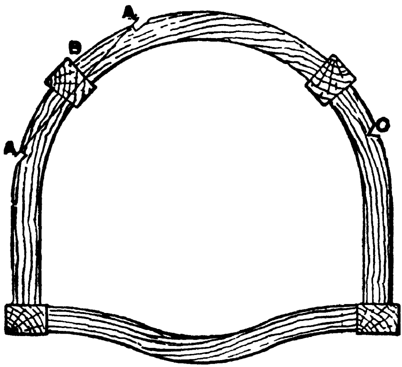


Fig. 65.—Chair Seat Frame.

Occasionally in a very bad case a well-fitting metal plate or square may be necessary in addition to other methods, but the common plan of screwing a plate that does not fit over a joint that does not meet and filling up the spaces with glue is worse than useless. If the fracture is concealed from sight, as in a stuffed frame, a better plan than using a plate is, after gluing and screwing, to well glue the joint, and wrap it round with a piece of strong canvas saturated with hot thin glue, and well rub down with the hand. This will dry nearly as hard as the wood, and will defy almost every effort to get it off again. In splicing, or otherwise fitting pieces, it is an excellent plan, after doing as much as possible with the chisel, etc., to scrape the surfaces the way of the grain with a fine sharp toothing iron. This not only roughens the surface and

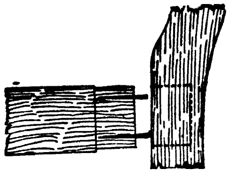


Fig. 66.—Repairing Loose Seat of Chair.

gives the glue a better hold, but if carefully done removes ridges and humps and gives a truer and more even face to the joint, care being taken, of course, not to work it out of truth. For holding pieces on while the glue is drying, handscrews of various sizes are generally used, but for small work a handier tool is a small G-shape thumb-cramp.

The weakest part about the chairs of a dining-room or drawing-room suite is where the side seat rails are joined to the back uprights, this joint often working loose. The best way to remedy this is shown

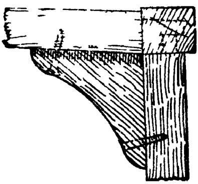


Fig. 67.—Repairing Loose Seat of Chair.

in Fig. 66, which is a side view. The two back wood braces are removed, and the joints knocked apart; then the old glue is cleaned off, and the tenons wedged as shown. Hot glue should then be brushed inside the mortise holes and on the tenons, and the joints brought together quickly and cramped up close.

Special attention must also be given to the braces; if too slight, stronger ones should be made. They need to fit well, and may be fixed with strong screws, as shown in plan at Fig. 67. They are taken off to

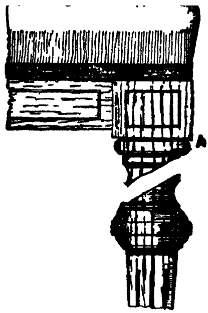


Fig. 68.—Repairing Leg of Chair.

be toothed, and after being well warmed at the fire are put on again, using glue. With chairs having loose seats this can be done quickly; but with spring seats it is more troublesome, as the webbing has to be undone at the back rail and the cover and stuffing removed, in order to detach the back so as to get at the tenons. In this case it is first put together as

Fig. 69.—Repairing Leg of Chair

already described, and when the joints are set, the stuffing, etc., is replaced; but as the detached webbing will have been weakened, a couple of extra pieces should be added.

Another serious-looking break is shown in Fig. 68.

This is sometimes due to the extreme dryness of the wood, and often happens to old walnut chairs, when the wood is rather cross-grain. Owing to the peculiar nature of the break, it is not practicable to dowel it direct, and to substitute a new leg involves too much labour. The best way is to saw the top part of the spindle completely through below the square at A, then warm the break well before the fire, and apply hot glue (not too thick) to both pieces, bringing them together and pressing the joint as close as possible. It must be allowed to set thoroughly, when it may be dowelled as shown in Fig.

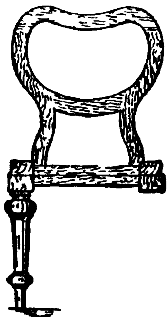


Fig. 70.—Broken Chair Leg Cut Off.

69, using a ⅜-in. hard-wood dowel. Glue must be applied between the joint as well as in the holes. This will make a strong job, and the break should be scarcely visible.

It is a good practice in chair repairing to avoid screws in cases where the ordinary methods of framing are applicable; when they are used, indicate the screw by sinking the head and plugging the hole on the outside, so that whoever repairs the chair again may not run his saw across the screw.

Dovetail chair tops often become loose owing to the back legs being imperfectly seasoned at the time of making; and where the back of the top is not broken away, a piece of veneer glued up one side of the top in the groove, allowed to dry, and the top glued down again, will be all that is required.

When putting in new chair legs the method adopted by most chairmakers is as follows:—Cut away the leg level with the bottom of the seat rail, as shown in Fig. 70; then with mallet and chisel remove the square, but leave the tenons, and if the chair be not stuffed, remove the braces, make the mortises in the required places, fit the tenons, and spring in the foot. Should the chair be stuffed, however, carry the mortise through to the top of the square, driving the foot up from underneath, fill in

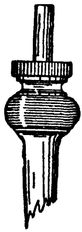


Fig. 71.—Adding New Foot to Chair Leg.

the spaces at the top, put a small dowel through the tenons in the rebate for stuffing, and replace braces. Should the square of the foot be perfectly sound, a new foot is usually turned to the bottom of the square, and put up with a pin, as illustrated in Fig. 71.

Chairs are often found to have the bottom end of the back leg broken, and where the upper half is sound a new lower end is all that is required. To do this, cut away the wood at the side-rail joint, as shown in Fig. 72, leaving the back-rail tenon in the upper half; then splice the lower half, the dowels securing the side rail, also going through the splice (the upper half of a back leg may also be treated in the same way). If the chair is not stuffed, remove the back from the side rails, and reframe in the ordinary way after repairing the back leg. Should the stuffing not be removed, two dowels must be put through from under the seat rail. The lower ends of easy-chair back legs being much shorter, permit of their being dowelled up to the bottom of the seat rail (Fig. 73).

Chair tops of the kind illustrated in Fig. 70 often break off; and, seeing that these tops cut into rather a large piece of wood, it is customary where the breakage is not too bad to joint on a piece of wood, as shown in Fig. 74. When these joints are dry, fit

Fig. 72.—Attaching New Lower End to Chair Leg.

down the top, and dowel on in the same manner as with a new chair.

A common form of damage is where no breakage is sustained, the chair only being in a rickety condition. The best thing to be done in this case is to take the chair apart, and reframe. It should be remembered, however, that if the dowels or tenons are loose, simply gluing them up again and bracing is of no use. If the chairs are dowelled together, a dowel a trifle larger to ensure tightness should be used, the dowels being placed to occupy the old dowel holes. If tenoned together, some pieces of thin wood should be fitted into the mortises, so as to diminish their size: the tenons can then be refitted.

Settees and chairs having socket castors some-

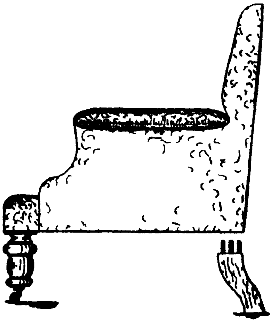


Fig. 73.—Attaching New Lower End to Easy-chair Leg.

times get the castor broken off, and a portion of the leg broken away with it. In this instance have a fresh piece turned to fit the castor. With a pin of suitable length and diameter, as Fig. 75, bore this into the old leg, and refix the castor.

Among the jobs that are often considered difficult are the cutting out and fitting of new cabriole legs to chairs, etc. (see Fig 76). The job is not nearly so difficult as it looks, though much care is required and the details of the operation must be well mastered before any beginning is made, or good stuff may be wasted. The first thing required is a correct

Fig 74.—Repairing Chair Back.

mould. To make this, procure a good clean picture-frame backboard, free from knots and shakes. Lay the chair on its side, or in the most convenient position, and carefully trace on the board the line of the existing leg, testing it by setting up the square against the leg in several places, and seeing that it comes down on to the line of the pattern. Then cut out the pattern with a sharp chisel or knife, and trim up neatly. It is a good plan to glue a piece of fine canvas over one side of the mould and trim it off when dry; this will allow it to be bent into hollows and curves without fear of snapping. A waste strip of blind union will answer the purpose. A front leg, being the simplest, as only one mould is required, may be first taken as an example. Having got out the mould, select a square piece of stuff of the required size, or a piece of plank of the necessary

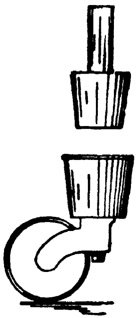


Fig. 75.—Fitting New Castor.

thickness, remembering that one angle of the square will form the front, and the other the back of the leg, and arrange any flaws, etc., accordingly. Then place the mould on one side of the piece, strike it out, and saw out with band-saw or frame-saw. If the latter is used, it is well to square a line over and mark it out again on the bottom side to ensure square sawing. Then place the pattern on the other (cut) side and mark out the other lines, making sure that the same angle is kept for the back; a mistake is very easily made here by taking one of the outside edges. This, when sawn out, will give a leg in the rough. The back angle will now, with perhaps a little planing, fit into the space between the ends of the front and side rails.

The fitting of new legs to chairs has already been mentioned. Opinion is divided as to whether or no it is desirable to cut away the old tenons. In the method described above they are left, but to show how a repair is effected when they are cut away, the following hints are given with regard to the fitting of a new cabriole leg. Cut away the old tenons, fit

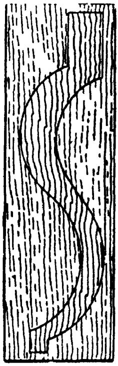


Fig. 76.—Marking out Cabriole Leg.

the leg into the angle, and then dowel in, springing the frame open to allow the dowels to enter. The leg should be carved and shaped and nearly finished before being put in, leaving only a little cleaning off to be done last. A back leg is, of course, more difficult, as two moulds are required, one for each face, and the stay and top must be arranged for; but the principle is the same. The seat rails should be fitted first, then the stay, and the height cut off last. Care must also be taken to get the leg upright, which can be tested by measuring from back foot to front, etc., trying the new one by the old. This remark applies also to the front legs. A method of procedure of putting on a cabriole leg when the chair is well made and properly blocked is as follows : The broken leg and tenons may be cut away, leaving the rails held in position by the block. The leg is then fitted into its place, and two dowels are bored into the end of the front rail, and a dowel hole downward and backward through the lower part of the side rail and out on the under edge of the rail at the curve just behind the leg. The holes in the foot are next bored, and the leg is cramped on to the front rail ; then, with the cramp on from back to front, a dowel is bored at A (Fig. 77) through the stuffing square above the

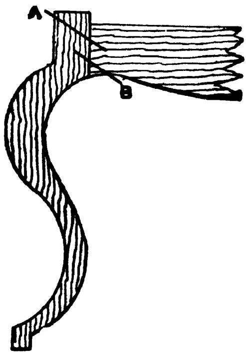


Fig. 77.—Cabriole Leg Dowelled on.

carving into the side rail, the hole in the bottom edge of the rail being continued into the leg with a ratchet brace, and a dowel at B driven through the rai into the leg, making a sound and neat job without any difficulty. If a ratchet brace is not available for jobs of this kind, and an ordinary brace cannot be used, a handy substitute may be made by fitting a hardwood cross-handle on to the top of the twist-bit and converting it into a temporary worm auger, a bit of twine being twisted over the handle and round the neck of the bit to assist in drawiug the bit out.

Up to sometime later than the middle of the seventeenth century it was the rule that chairs should be tied by cross-bars mortised into the legs near the

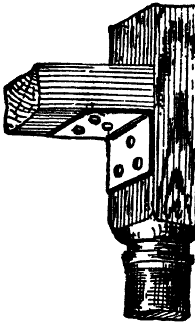


Fig. 78.—Angle-iron and Cross-bar of Chair.

ground; and rough usage and exposure will often cause these mortises to work loose. Provided the wood is sound, the joint may again be made firm by

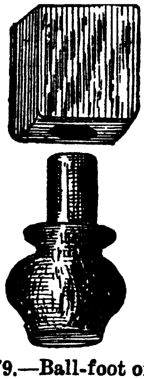


Fig. 79.—Ball-foot of Chair.

driving in one or more thin glued wedges. If moisture has lodged in the joint, and tenon and mortise are both fragile, still drive in wedges to tighten the joint, but in addition screw an angle-iron (Fig. 78) beneath the cross-bar; this, if let into the wood, will scarcely be seen, especially when it is painted to match. Such irons may be used with advantage for strengthening other work, as the upper frames of tables, etc.

The smaller tables, as well as chairs, foot-stools, etc., commonly stand on ball feet, and these may become defective. To substitute new feet is, however, a simple matter. The original pieces are sawn off, as in Fig. 79, and holes are bored as shown, and in

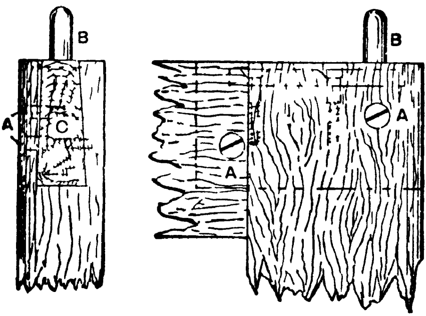


Fig. 80.—Chiffonier Door Stud. Hinge, etc.

them the shanks of new ball feet, turned to match the old, are glued.

Nails are sometimes thoroughly rusted into the wood. Should the nail come out leaving a clean hole, a mere stopping of coloured putty—putty kneaded with vandyke brown or burnt umber—may suffice. When it is difficult to get a grip on these old nails without bruising and disfiguring the surface, it is better to sink a hole round the head with the gouge till a firm hold can be obtained. The hole so made can be readily trimmed to shape, and a fresh piece of wood let in and glued, due care being given to direction of grain, etc. Indeed, when a screw from the front seems desirable to strengthen any crazy piece of old work, it will be found that to countersink deeply, and to hide the head in this manner, is the best thing.

Repairing a chiffonier door where the stud hinges have been broken off, and there is a difficulty in removing the upper part, is a rather awkward job, though it may be accomplished in the following manner: Fit two pieces of well-seasoned English

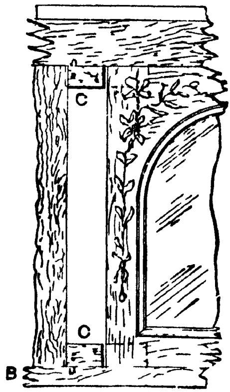


Fig. 81.—Part of Chiffonier Door.

elm at the upper and lower corners of the door; these should be slightly dovetailed as shown in end view at C (Fig. 80). Each piece is secured with two screws A (see Fig. 80) from the inside. The new studs B are then let in and screwed to these pieces, but they must occupy the original position. The screws are next taken out, and the dovetailed pieces withdrawn and slipped in their positions C (Fig. 81) in the chiffonier frame, hot glue being applied to the joining parts, and the door is slid over the dovetails. The screws will then house in well, and this completes the job.

In re-covering a writing-table top, first clean off the old leather covers and well smooth the surface with glasspaper. For roans, moroccos, and leather cloths, make a paste of rye-flour and boiling water, stirring well to keep it free from lumps, and for oil-cloths use hot thin glue. Cut the leather rather larger than the space to be covered, then paste the wood, rubbing well in with a stiff brush and picking out lumps. Next warm the leather before a fire or stove, place it on the table top, and, commencing in the centre, with a cork pad work out the wrinkles and puckers to the ends and side. Continue stroking until the leather lies quite flat, then dress it off with a sharp, thin-bladed knife and lay down the edges

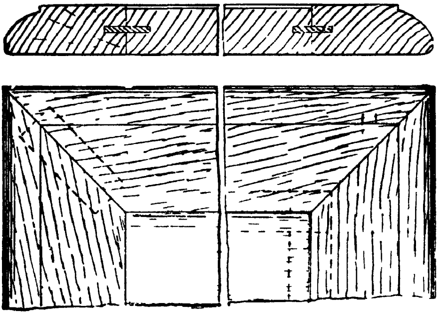


Fig. 82.—Part of Leather-covered Table Top.

For thin leather cloth a rubber-covered squeegee is even better than the cork pad. For oilcloth the process is the same, but hot thin glue is used as the sticking medium. Start smoothing in the centre and keep the hands clean. No advantage will be gained by wetting the cloth, and if paste is used it should be as thick as starch.

Writing-table tops having leather centres are constructed usually as shown in Fig. 82, which presents section and plan respectively, the moulded rim being mitred round the centre and fixed with a ploughed and tongued joint. The rim stands $\frac{1}{16}$ in. bare above the centre, so that when the leather is laid it will lie flush. The rim is cleaned off flush with a small piece of the leather to be used in covering. The best covering is tanned sheepskin (levant is the trade term), but for common work good American oilcloth can be employed, this having a linen back and being capable of folding without cracking; a cracked material could not be tolerated.

To straighten a round table top that is warped across the centre, first remove the top from the pillar, turn it face downwards, and sponge several times with clean water. Then apply heavy weights or pressure at its highest points for several days, frequently damping the underneath part. Water should not be allowed to remain on the polished portion. To prevent the top going back again, glue and screw several strengthening bars across

CHAPTER VI.

GLAZING WINDOWS.

To those of limited experience in glass buying, an inspection of the price lists (or, as they are termed in the trade, "tariffs") of the leading glass merchants is, from the very mass of detail such lists supply, apt to be confusing. The different qualities of the various kinds of glass, the numerous rules governing both the price and the various sizes that can be had, and, where glass is to be bent, the rules with reference to the curves, require close study before they can be clearly understood.

Much of the sheet glass sold is of foreign make, but the best and most reliable sheet glass is of British manufacture, and thus, however, is somewhat higher in price. Of English sheet glass, the quality usually known as A (the better) and B (a somewhat lower quality) are not, as a rule, used for glazing windows, but are picture qualities. The usual glazing quality is of three grades, known respectively as best (suitable for high-class work), seconds (the quality in general use for all-round work), and thirds (suitable for cottage property, etc.). Except for greenhouses, conservatories, frames, and other horticultural work, any quality below thirds would hardly be satisfactory. Foreign sheet glass is extensively used for horticultural work.

Sheet glass is described by the weight in ounces per square foot, and the general thicknesses are 15 oz., 21 oz., 26 oz., and 32 oz.; but it can be had thicker if desired. Except for inferior kinds of work, such as outbuildings, small cottages, greenhouses, etc., it would, in the long run, probably be found more economical in all cases to use not less than 21-oz. glass, for with thinner glass the risk of breakage is very great. For general purposes, 21 oz. is perhaps most commonly used, but 26 oz. is better when the squares are large, or for glazing door panels or other framings exposed to vibration. In the latter case the glass should, in the higher class of work, be bedded in wash-leather, to prevent breakage. For extremely large squares, 32-oz. glass should be used when expense prohibits the use of plate glass. The thickness of 21-oz. sheet glass is generally taken as $\frac{1}{10}$ in.

Sheet glass sold in quantities is usually packed in crates. The quantities per crate, however, are not uniform, but are governed by the thickness and also by the quality of the glass. The crate of English glass varies from about 200 ft. to 400 ft., whilst the crate of foreign glass ranges from 200 ft. to 300 ft. or thereabouts.

Both the home-manufactured and the imported sheet glass can, in the lower qualities, be had cut to standard sizes. One list, consulted at random, enumerates squares from 9 in. by 7 in. up to those containing 11 ft. superficial. The cheap foreign glass for horticultural use is sold in boxes as imported, cut to stock sizes. One size only is in each box, and, as a rule, the boxes are not divided. As regards the carriage of sheet glass, it is usually sent "carriage forward"—that is, the carriage is to be paid by the purchaser on the arrival of the goods. Sometimes merchants pay the carriage in the case of large consignments of plate glass, but, as the practice varies, it is very desirable to arrive at a clear understanding on the point when ordering. Breakages in transit are almost always considered as the buyer's risk; but the breakages are usually not serious.

In cases in which the glass is intended to obstruct the vision, and a rather more ornamental substitute for the common ground sheet glass or rough rolled plate is required, the ornamental figure-rolled glass is very suitable, being comparatively inexpensive and, at the same time, artistic. It has the further

Fig. 83.—Putty Knives.

advantage of being made in a large number of different designs, and is known by such names as small and large Muranese, lustre, figure-rolled, crate, diaper, Moorish, Morocco, kaleidoscope, mediæval, and many others The tinted variety is more expensive than the white, and if it is ordered cut to sizes, an extra charge is made.

In ordering glass, it should be remembered that the extreme length and the extreme limit of width made

Fig. 84 —Notched Putty Knives.

are not combined in one sheet. For 15-oz. sheet glass the extreme length is about 5 ft., while the width is 3 ft. 4 in.; the extreme area being 15 ft. in the square, or thereabouts. For 21-oz., 26-oz., and 32-oz. glass the extreme dimensions (as well as the area) are larger. The fractional parts of inches are usually charged thus: Up to $\frac{1}{4}$ in. as $\frac{1}{4}$ in., over $\frac{1}{4}$ in. and up to $\frac{1}{2}$ in. as $\frac{1}{2}$ in., and so on. When surveyors take the dimensions of glass, they almost invariably

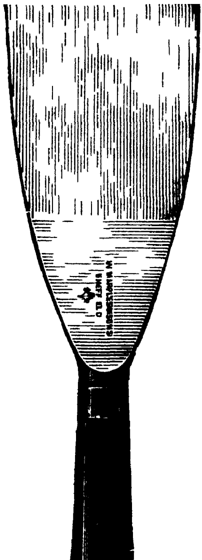


Fig. 85.—Chisel Knife.

reckon any fraction of an inch as a full inch. In irregular shaped squares, the extreme sizes are measured.

The price of polished plate glass is influenced to a considerable extent, particularly in the larger squares, by the number of superficial feet each sheet contains;

consequently, in measuring this glass for the purpose of estimating, etc., care should be taken to keep the totals of the glass separate, according to the different

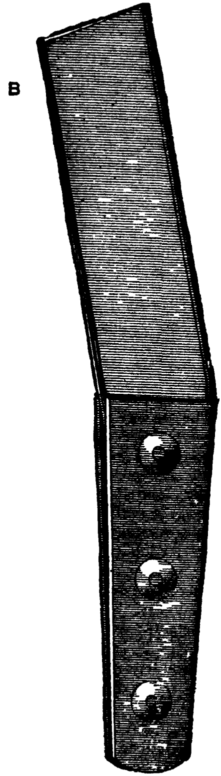


Fig 86.—Hacking Knife and Chipping Knife.

areas of the squares. The qualities are known as ordinary glazing, best glazing, and silvering quality; these descriptions speak for themselves. If plate glass is required, selected either as exactly ¼ in. thick or in any thickness other than the nominal ¼ in., an extra charge is made. Ordinary plate glass is reckoned to weigh about 25½ oz. per superficial foot. Sheet glass, when polished on both sides, is termed patent plate, and patent glass in which wire is embedded is said to be proof against hailstorms, vibration, and changes of temperature.

Leaded lights, if well designed and placed in suitable positions, have a very artistic appearance. They should be rigid when fixed, and perfectly wind-tight and water-tight. When fixed in the panels, etc., of doors where they are liable to sudden vibration from slamming, they should be well secured, at very close intervals, to the iron rods. In ordering leaded lights, it is always advisable to give not only the sizes in the rebates, but also the sight opening, or, as it is sometimes called, the daylight size, and also to make clear which dimension is the width.

Where the amount of light is limited, the comparative interception of various kinds of glass should be considered. Sheet glass may be said to intercept half as much light again as British polished plate.

The glazier's tools include a putty-knife, two examples of which, the spearpoint and the clipped point, are illustrated at A and B (Fig. 83). Putty knives with notches are shown by Fig. 84, A having a boxwood handle and B an ebony handle. The chisel knife (Fig. 85) is a useful tool. Fig. 86 shows at A and B respectively a hacking knife and a chipping knife, both of which are useful in replacing broken panes. A diamond (Fig. 87) is almost essential for cutting glass. A medium quality diamond for crown glass costs about twelve shillings, and for sheet glass about one guinea.

A variety of wheel glass-cutters are obtainable (see Fig. 88). These tools, of course, are not so generally useful as the diamond; but they are much less expensive, and, if used properly, will answer most ordinary requirements.

The following is an inexpensive method of making a wheel glass-cutter, which will wear and cut as well, if not better, than many of those now supplied by manufacturers. First get a pennyworth of french chalk, and cut from it any size of wheel, say $\frac{1}{2}$ in. in diameter by $\frac{1}{8}$ in. thick, as shown in Fig. 89. Make it as smooth as possible, and bore a hole in the centre

Fig. 87.—Crown Diamond.

for the pin. Also obtain a small piece of brass rod, the size of a penholder, about 6 in. long, and cut down one end with a saw to admit the wheel or cutter (see Fig. 89). The wheel having been made quite smooth and fitted to the rod, remove it, and

Fig. 88.—Wheel Glass-cutter.

place it in a crucible, and lute with a mixture of equal parts of fine sand and clay or fire lute. Place the crucible with its contents in a charcoal fire, and gradually raise to white heat, at which it should be kept for three hours; then allow it to cool out. The wheel will afterwards be found to resist the file in any form, so care must be taken to have everything correct before hardening.

Fig. 90 shows how to sharpen glass-cutter steel wheels, the procedure being as follows:—Remove the wheel from the holder by punching out the rivet; then, through the centre of the hole in the wheel A press a fine-tapered straight awl B Having glued a piece of medium-grade emery cloth C to a block of wood D, secure the tang end of the awl in the chuck of an archimedean or similar drill-stock E, and place the wheel over the emery. Work the drill until the point of the awl pierces the wood, bringing the cutter wheel into close contact with the emery; then, lubricating the wheel with turps, continue working the drill. A smart tap with a hammer will separate the awl and the wheel, after which the latter should be reversed, and the operation repeated.

To cut glass without a glazier's diamond, proceed as follows:—File a small notch at the edge of the glass where the cut is to be commenced, and again at the edge where it is intended to finish. Have a piece of fine round paling wire fixed in a wooden handle;

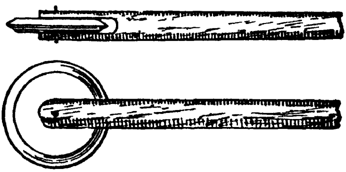


Fig. 89.—Two Views of Home-made Wheel Glass-cutter.

heat the wire to red heat, and run it slowly along the surface of the glass in the direction in which the glass is to be cut, being careful to begin and end exactly at the notches already filed. As the wire is moved along, the glass will be observed cracking in a clean line after it. It is better not to point the wire, as it does not conduct the heat so well as when left plainly cut across.

A handy appliance for nibbling the edges of a piece of glass is the glass pliers shown by Fig. 91.

In putty glazing, care should be taken to see that the work is well-bedded and back-puttied. In old work it is an advantage to paint the rebates; whilst in skylights, etc., if the glass can be obtained in one length the job will be the sounder; and where clips are necessary, those made of copper are best. It is common, when glazing ground glass, to run a coat of size round the edges.

The work of renewing a pane of glass will necessitate a proper hacking-knife and a putty-knife. After knocking out all the pieces of broken glass, carefully hack or cut out the old putty with the hacking-knife and small hammer, taking care that the knife does not cut the wood, or get damaged against that portion of the broken glass behind the putty

If the putty is very hard, it can be softened by holding a red-hot iron against it, taking care not to burn the woodwork or crack the next square. A very good thing for this is an old poker, with the square part bent at a right angle to the handle or stem.

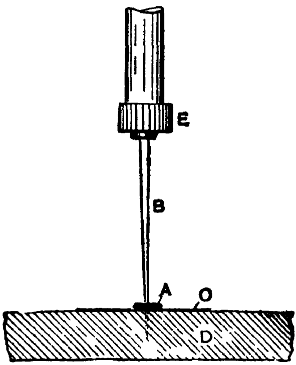


Fig. 90.—Sharpening Wheel Glass-cutters.

Make it red-hot at the junction of the square and round parts before attempting to bend it, and it can be bent back again after using it. Thoroughly clean out all the putty from the rebates. Now measure the size of the pane of glass required, being careful to get it correct to size ; any glass merchant will cut and supply the glass for a few pence per foot super In measuring glass, give the size in inches, not in feet and inches ; also state the weight or thickness that is required.

Glass about	1-15th of an inch thick	is	called	15 oz.
,,	1-10th	,,	,,	,,	21 oz
,,	1-9th	,,	,,	,,	26 oz.

That is to say, it weighs so many ounces to every superficial foot.

Now put a layer of very soft putty all round the inside rebate, and gently press the square of glass into its place, being careful to press it uniformly, and not more in one part than another, or it is apt to crack. Secure it in its place with four small brads, driven in so that they only just clip the glass ; next

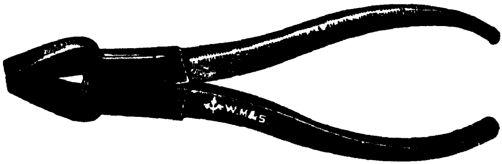


Fig. 91.—Glass Pliers.

proceed to putty the outside all round with the putty-knife ; and then, taking one side at a time, form a nice clean bevel on the putty by decisively drawing the knife along, resting it on the bar and on the glass, keeping the bevel so that it is not seen through the glass from the inside.

Do not attempt to scrape off the fine strips of putty left on the glass, but brush them off with a dusting-brush. Very often a novice makes a clean bevel, and then spoils it in scraping off the superfluous putty. Now clean off the inside putty, carefully stopping-in any little places which the bedding has not filled up.

Sometimes it is found that it is very difficult or impossible to get at a square of glass by sitting on the window-sill, and then it will be necessary to take out the sash. To do this, take out one side sash bead, get hold of the sash cord, and pull the weight right up to the sash pulley, then carefully drive a clout headed nail through the cord into the pulley style just below the pulley, to keep the weight up; treat the other side in the same manner, and then undo the cords from the sash and take it out.

Canada balsam is one of the best waterproof cements for glass. The ordinary Canada balsam should be heated in a shallow tin in the oven till all the volatile matter has been driven off. The resin that is left should then be broken up, placed in a bottle, and just covered with benzol; in a day or two a thick viscid mass will form, which will become nearly fluid on gently heating. To cement the glass, warm the pieces slowly, place on them a little of the softened Canada balsam, press them together, then allow to become cold. Canada balsam in benzol may be bought ready prepared.

Slight scratches on plate glass may be removed by polishing the glass with pumice-powder. The job is a tedious one, and will require much perseverance and patience. The powder is applied on a thick felt pad, measuring about 3 in. by 4 in., which should be nailed on a wood block $\frac{3}{4}$ in. thick. The powder should be used in a slightly damp form at first, the finishing being done with dry powder.

CHAPTER VII.

UMBRELLA MAKING AND REPAIRING.

UMBRELLA makers require a variety of tools to be able to turn out good work, but none of these is very expensive, excepting the lathe, which, though not

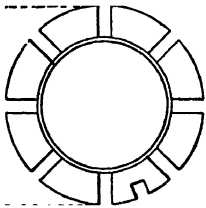


Fig. 92.—Runner for Umbrella

absolutely necessary, would be found a great help for sawing and drilling, and also for grinding small tools, polishing mounts, etc.

The other tools required are as follows :—A pair

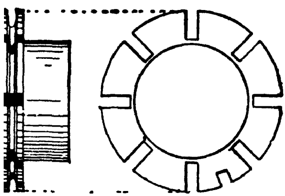
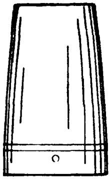


Fig. 93.—Notch.

of really good pliers with narrow nose, about ¼ in. (these may be cutting pliers, and there will then be no need of nippers); a flat file with one cutting edge; a round file; a small dovetail saw; a small steel punch; a couple of fine handled bradawls; a brace for drilling; centre-bits, size $\frac{1}{4}$ in., $\frac{5}{16}$ in., $\frac{3}{8}$ in.,



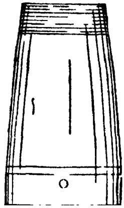


Fig. 94. Fig 95.

Figs 94 and 95.—Umbrella Ferrules.

$\frac{7}{16}$ in., and $\frac{1}{2}$ in.; two Morse twist drills, $\frac{1}{8}$ in. and $\frac{3}{16}$ in., to fit brace; a sculptor; and a parallel vice with $2\frac{1}{2}$-in. or 3-in. jaws. The centre-bits mentioned are not really necessary, but they are sometimes useful in repairing gentlemen's umbrellas. The sculptor is a little tool, costing about 6d., used for cutting the spring slots. If access is had to a lathe, this tool

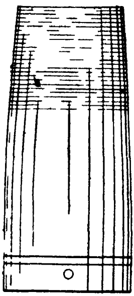


Fig. 96.—Umbrella Ferrule.

is not wanted. A special circular saw for putting on the lathe measures 2 in. in diameter, and costs about 1s. 6d. The drill bits may also be fitted to the lathe.

The materials required for repairing will be found more expensive than the tools. The list given below includes all the most useful materials, but other goods can always be added as needed :—Some beech-shanks or fit-ups. These, which should be bought ready drilled, are made in two sizes, known as ladies' and gentlemen's, and in two qualities—common, which are the same thickness throughout, and best, which are tapered towards the top (or ferrule) end. They can be had in light natural wood colour, yellow, brown, and black ; it is best to get them in assorted colours.

Fig. 97. Fig. 98.

Figs. 97 and 98.—Splicing Tubes.

Copper-plated spring wire, also in two sizes—ladies' 3 in. long, and gentlemen's 3½ in., the latter being of larger gauge than the ladies' ; it is cheapest to buy this wire ready cut to lengths. Some soft iron tying wire, also in two sizes and cut to lengths. Runners (Fig. 92) and notches (Fig. 93). These can be had in brass and zinc, the former being far better. Runners are generally japanned black, but can be had bronzed at a slight extra charge. They are also made in lacquered brass and in nickelled brass for sunshades. Ribs (fluted). Outside caps. Ferrules (Figs. 94, 95, and 96). Nickel swedges. Bronzed brass 2-in. splicing tubes (Fig 97). Nickelled brass 1½ in splicing tubes (Fig 98). All these articles must be obtained in assorted sizes Double pointed screws, 2¼ in and 2½ in Muffles (waterproof are the best for the joints of ribs) and Paragon top tips (Fig 99). It is also advisable to have an assortment of sticks, handles, knobs, etc , to replace broken ones.

The size of an umbrella is determined by the length of its rib The usual sizes are —For ladies', 21 in., 21½ in., 22 in , and 23 in ; gentlemen's 24 in , 24½ in., 25 in., and 26 in. ; for sunshades the lengths

Fig 99.—Top Tip

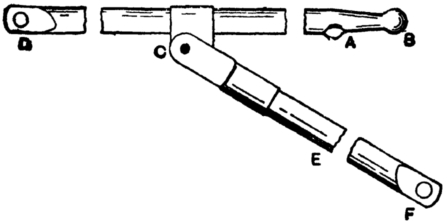


Fig. 100.—Umbrella Rib Complete.

are generally 20 in Gig umbrellas vary from 27 in. to 36 in. The cheapest ribs obtainable are solid ; these are much heavier and not always so strong as the fluted, or Paragon, and are only used on the cheapest class of umbrella. Fluted ribs are made from a steel strip bent to a U-section, the rounded part of which comes next the cover in the finished umbrella. The different parts of the rib are shown in Fig. 100 : A is the bottom eye ; B the ball, globe, or bottom tip ; C, the joint or hinge ; D, top eye ; E, the stretcher or stay ; F, the eye of stretcher. The joint at C is generally made triple to add strength. Ribs may be had in several qualities and kinds. Fox's Paragon are generally considered the best ; they are beautifully finished and stoved, but cheaper qualities are nearly always used for repairing. Lock ribs are those in which the rib folds or locks into the stretcher, which is made of wider stuff to take it. In Fox's patent Laurus rib this is reversed, the stretcher folding into the rib, but in this case a triple joint cannot be used. These are the ribs which are in general use, but other varieties will occasionally be met with.

The method of making up a new umbrella will first be given, and then general repairs will be dealt with.

First decide on the size of the umbrella and select a suitable stick. We will suppose a gentleman's 25-in. umbrella has been chosen. Pick out a runner that slides easily on the stick with as little side play as possible. Next select the notch to fit the stick tightly, or the umbrella will not be sound and strong. If too tight, ease with the round file. This is best done by putting the notch on the jaws of the vice with the "teeth" between the jaws and the tube resting on one of the jaws. Now screw up barely tight, so that the notch can easily be rolled sideways but not moved across the vice. File always on the bottom side, working the notch sideways whilst at the same time it is filed backwards and forwards. This is the quickest way of doing it, and makes the filing equal all round.

Next drill two holes in opposite sides through the flange of the notch, and take off any burr inside with the file. Most umbrellas have eight ribs, but in some instances only seven are employed. Take one of the stoutest tying wires and commence threading on the ribs. Commence on one side of the little nick (called the half tooth or tying slot), which will be noticed amongst the eight deeper nicks or notches, and press each rib well home as it is threaded, the hollow side of the rib being inwards and the boss of the notch away from the ribs. Twist the ends of the tying wire firmly together, and bend the ends downwards in the direction of the ribs. Next wire the runner to the stretcher ends in the same way, but in this case bend the ends of the tying wire upwards. Slip this frame on to the stick until the "balls" of ribs are level with the place where the shank joins the "neck." A glance at any well-made umbrella will make this clear. Hold this frame firmly in position, and make a mark on the stick with the awl *through* the slot of the runner nearest the handle end.

The frame can now be taken off. The mark just made gives the position of bottom spring. Nick it slightly with a file to make it clearer. Measure from this the distance required for the top spring; this, of course, will vary with the size of the umbrella. The following will be found about right distances, though they may vary slightly for different makes of ribs :—

A 20-in. umbrella	takes	springs	13¼ in. apart.
21-in.	,,	,,	14
21½-in.	,,	,,	14¼
22-in.	,,	,,	14½
23-in.	,,	,,	15
24-in.	,,	,,	15½
25-in.	,,	,,	16
26-in.	,,	,,	16½

The springs themselves, when made up, are about 3 in. long for gentlemen's and 2½ in. for ladies'. Mark the stick at the right distance from the former marks (the length of spring), and in each case towards the other spring. The top spring must be one quarter-turn towards the right, round the stick. If the springs were in a line with each other, the top spring would snap into the slot of the runner, making it very awkward to close the umbrella.

Cut the spring slots either with the circular saw or sculptor. Fig. 101 gives a sectional view of these slots with the springs fitted. The shape of the bottom spring is there shown, both ends of the spring being slightly flattened with the hammer. This prevents them from sticking against the sides of the slot. The end G, being flattened, has a firmer grip in the stick. J is the peg that keeps the spring in position, and is known as the spring peg or spring pin. Another method of springing is illustrated in Fig. 102. With a $\frac{1}{8}$-in. Morse drill, bore two holes side by side for the head of the spring. These must be close together, cutting in to each other so as to make one hole of a roughly elliptical shape. Take care that the drill does not go right through the stick. From this hole to the position the heel of spring will occupy is cut a

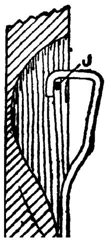


Fig. 101. Fig. 102.

Figs. 101 and 102.—Springs inserted in Solid Sticks.

narrow groove, which is deepest at the part marked K (Fig. 102). The shape of the spring is there shown.

A special kind of flat or ribbon wire can be obtained for these springs It will be noticed in the section shown in Fig. 102 that the bow end of the spring is turned and filed to a tiny hook to engage with the pin J. Fig. 103 shows a patent spring used on hollow reed or cane fit-ups. These only require an opening M N, cut in one side, and the spring inserted and kept in position by peg J. Fig. 104 gives the shape of spring generally used for reeds. This spring is secured by a rivet L put right through the sides of reed and riveted quite smooth, so as not to offer any obstruction to the runner. The ends O (Figs. 103 and 104) give sufficient elasticity to the springs to make them snap well. Fig. 101 gives the shape of the bottom spring, and Fig. 102 of the top spring. When the springs are in position, try them to see that they work properly. If they stick any-

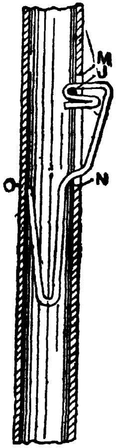


Fig. 103.

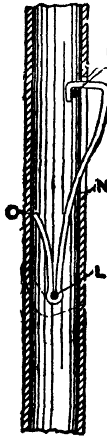


Fig. 104.

Figs. 103 and 104.—Springs inserted in Hollow Sticks.

where, bend them slightly with the pliers. Next put in a short piece of pegging wire through one side of the slot and into the opposite side so as to engage the free end of the spring. A common pin makes good pegs for this purpose.

When the springs are right, put on the frame again with the bottom spring in position, and then put an awl through one of the holes in the notch and into the stick so as to hold it in position. Now open the frame and see whether, when it is again closed, the runner returns properly on to the bottom spring.

If so, put the awl right through the stick and out of the other hole in the notch Secure the notch to the stick by passing a bit of spring wire through this hole and either riveting or bending the ends to prevent it working out. Next open the frame, make a mark just above the runner, bore two bradawl holes on this mark, and insert a tiny staple of spring wire to act as a stop to prevent the umbrella from opening too wide. Nickel-plated stop pins can now be purchased, and make a neater job than the wire staple, besides being easier to put on. The frame is now complete.

The next thing is to muffle the joints of the ribs; without this the friction would soon wear holes in the cover. Any old black material will do, but the water-

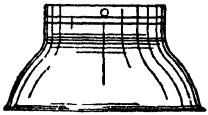


Fig. 105 —Dome Cap.

proof oval muffles are the best. These are put on by stitching round the rib. Another method is to cut two holes or slits near one end of the muffle (several may be cut through at once with a ¼-in. chisel), slip the bottom end of the rib through these slits, and secure by stitching on the other side of the joint; but this method must not be used on Lock or Laurus ribs, as it would interfere with the closing of the umbrella. The waterproof muffles are sold ready cut to size at about 2d. per twelve sets.

The inside caps are sold printed a dozen on a sheet, and require cutting round and a hole to be made in the centre for the stick to be put through. Place one of these on the frame with the printed side next the ribs.

The next thing is the cover. This can be bought ready made or can be made at home according to directions to be given later. When the cover is put on, first stitch it with waxed thread round the hole where the stick comes through and close up to it (in some instances covers are sent out by the manufacturers sewn ready for use ; in such cases they will not of course, require stitching). This stitching is to keep the cover from splitting when the umbrella is opened. Now open the umbrella and place it on the knees, handle upwards, taking care that the cover does not slip off, and sew each seam of the cover in two or three places to each rib in turn. If preferred, the corners can be sewn first, but this makes it more awkward to do the interior stitching. In sewing the corners the cover should be so held that the needle passes through both sides of the cloth and the bottom

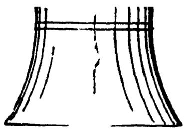


Fig. 106.—Tapered Cap.

eye of the rib at one and the same time. If the cover has a " tape " or bordered edge instead of a hem, it is best to strengthen it by running a stitch about 2 in. long down to the seam. This will take some of the pull off the corners, which are otherwise liable to break away when the umbrella is opened. Should the eye of the umbrella rib be too small to pass the needle, it can be carefully opened with a fine bradawl. Covers purchased ready made are generally sent out fitted with an elastic band.

A rosette is next sewn round the runner to prevent the fingers being hurt when opening the umbrella. Another small rosette should be put on the stick outside the cover for the outside cap to rest upon.

The two shapes of caps in general use are shown in Figs. 105 and 106 ; Fig. 105 is a " dome " cap, and

Fig. 106 is a "tapered" cap. See that the cap is a good fit and pressed well home. If too large, pack it with brown paper wrapped round the stick, and cut off with a sharp knife the surplus that projects outside. A piece of wood with a hole bored through it is useful for pushing on caps that are tight. Secure with a couple of ¼-in. pins. The stick should project about 4 in. above the top notch. Fit the ferrule to a shoulder and secure by pinning.

Ferrules can be had in several qualities, the commonest sort, Fig. 94, being merely a shell of brass and not worth the trouble of putting on. The kind generally used for umbrellas is shown in Fig. 95, and has a ⅛-in. steel end. Fig. 96 is the extra heavy ferrule used chiefly on walking-sticks, and has ½ in. of solid steel at the end. See that the end of the stick goes well to the bottom of the ferrule, or it will buckle when used. If the cover is well made it should not require ironing after putting on. If it is ironed, however, put an old cover between the umbrella and iron, or the latter will leave shiny streaks. The umbrella is now complete.

Some of the more usual repairing jobs will now be described.

A job that very often comes in is the repairing of a broken rib. Sometimes it is not the rib that is broken, but only the stretcher; in this case, if the rib is good, a new stretcher can be put on. When they are in good condition old stretchers taken off broken ribs may be saved for this purpose. To put on a new stretcher, take off the outside cap, and then unwire the runner and turn the umbrella inside out. This is most easily done by standing with the umbrella partly open, the inside of the cover resting against the left side and outside of left arm, and the stick passing between the left arm and the body. Now pull the stick sharply with the right hand. If the cover is very old or has been seamed, it is best to unstitch a couple of the corners from the ribs or the cover may split when turning, or another rib may break. Take care that the broken ends of the rib do not pierce the cover. To put on the new stretcher, file off the head of the rivet that is in the joint and punch it out, holding it meanwhile in the vice by means of the broken bit of stretcher. See that the new stretcher is exactly the same length as the old one by measuring with one of the other stretchers. The new rivet may be made from a bit of spring wire. Fit the stretcher so that the hollow side will be towards the handle when the umbrella is open. When only a new stretcher is wanted, it is not necessary to unwire the notch or to undo the stitches on the rib to which it is connected.

When wiring in a new rib at the notch it is most convenient to hang up the stick by means of a little wire hook suspended by a string to the ceiling. This hook should be about 6 ft. or 7 ft. above the floor, and should be hooked in the bottom spring of the umbrella. In fitting an entire new rib, measure it against one of the old ones, and also measure the stretchers, otherwise this rib will perhaps be "closed" before the rest, or else it will be left projecting; sometimes it will be found that the rib and stretcher are the right length, but the joint is in the wrong place. The entire joint and the stretcher with it may generally be driven along the rib to its new position. Hold the rib in the vice, putting it with the hollow side towards one of the vice jaws, when there will be no fear of crushing it, and drive the joint in the direction required by hammering. When re-wiring a runner, take care that it is in the right position for the bottom spring to snap in the runner sot. If only the eye (F or D, Fig. 100) is broken, use a top tip (Fig. 99); measure first and mark with a file to get the right position, then cut off a small bit of the broken end. Knock the tip on carefully so as not to close its eye.

To put on a new runner, remove the outside cap and take out the rivet in the notch; unwire the old runner and slip the frame off. Take out the stop-pin, exchange the old runner for a new one, and replace stop-pin and frame. It will not be necessary to remove the frame if the handle will unscrew from the fit-up, as is the case with some umbrellas; but in some instances it is difficult to get the bottom spring to fit accurately without altering the top notch.

Splicing the stick should only be attempted when the break is above the top spring (usually against the notch). If it is not broken off too short, cut the stick square across midway between the stop-pin and notch, and on this end fit one of the bronzed splicing tubes; it should be shouldered on, the end of stick coming to about the middle of the tube. In the other end of the tube fit a piece of old stick or fit-up, of a colour that will match the rest of the stick. Secure each end with a rivet right through the tube and sticks. This stick may now be put in the frame and finished off as described in making up an umbrella. If it is broken anywhere below the top spring, the best remedy is a new shank. Cut the old stick off square across at the shoulder (some sticks, especially ladies', are made to unscrew at the joint, in which case it will not, of course, be necessary to cut the stick). Fit a swage over the end of the neck, and drill in it a hole sufficiently deep to take half one of the umbrella screws. It is very difficult to get this hole exactly central unless it is drilled on the lathe with a proper guide. The best plan in doing it by hand is first to make a hole with a bradawl as nearly in the centre of the neck as possible; then hold the neck in the vice, using a piece of leather or felt to keep the jaws from marking it, and drill out with the Morse drill and brace. When drilled sufficiently, insert one of the double-pointed screws, and tightly screw a suitable shank on the other end—so as to make it seemingly one continuous piece. Take care when screwing together not to split either piece. Always fit the shank before springing. The old broken shank may be measured to get the proper distances of the springs apart. Sometimes it is best to bore a hole in the neck of the same diameter as the shank, and insert a couple of inches of the latter, securing by gluing. A nickel or silver splicing tube can be put on if a shank is split during use at the end, unless it is very badly broken, when a new shank will be necessary.

Silver and metal collars and bands are generally bedded on the stick with plaster-of-Paris mixed with weak glue. A pin can be put through and into the neck to make all additionally secure. Caps (or knobs) are put on with a special cap-filling cement, obtainable from any wholesale house at about 4d. per lb. Melt a little of this and pour into the cap (the stick having been previously cut to fit) and at once insert the end of the stick, seeing that the cap is on straight. This cement sets very rapidly. Mind that the cement put into the cap is not excessive, or the stick will not go home properly. Do not, if possible, get any cement on the outside of the cap, as it is difficult to remove from chased or incised work. Glass and stone balls or handles are generally attached to the neck by a screw, but sometimes a projection is left on one side to fit into a corresponding hole bored into the shank.

"Tube" frames or shanks are often used so as to make a closer folding umbrella than is possible with an ordinary stick. These tubes are socketed into the neck, and are bought ready sprung; they can be had in various diameters and qualities, and are generally enamelled a brick-red colour.

In replacing a broken tube, first remove the broken part. Hold the piece of tube in the vice, and drive the neck off with the hammer, placing against the neck a piece of wood to take the blows. If it cannot be removed in this way, try heating it in a gas or spirit flame, and remove whilst hot. Now slip the frame on the new tube, and mark it just above the balls of the ribs. The tube is next cemented into the neck up to this mark. To make a good job of it, pour a little cement into the neck, then heat the end of the tube, drive it in whilst hot, and leave to cool.

The Patent Titania tubes are coated to a depth of about $\frac{1}{16}$ in. with a composition resembling celluloid, and are much higher priced than the common ones. Very often only seven-rib frames are used on these tubes, and they are generally of either the Lock or Laurus variety.

The Habilis self-opening umbrella requires a specially strong variety of rib; no top spring is used, as the strong spiral spring which is fitted inside the patent runner is sufficient to keep the umbrella open. To fit a new rib the two portions of the runner must be firmly tied together when the umbrella is closed, so as to prevent the spring from acting; and upon opening it will be found that the connecting wires that go from the runner to the stretchers can be disconnected, and the new rib inserted.

For umbrella repairing it is best not to fix the bench vice with the jaws parallel with the edge of the bench, but so that if a rod is placed horizontally in it the left-hand end projects over the bench. In this position the bench will form a support, and things put in the vice can be more easily got at with the brace and bits.

The materials used for covering umbrellas have a variety of names, but they may be roughly divided into four classes: alpacas or dagmars, levantines, glorias, and silks. The alpacas are not used so much as formerly, for, although very good wearing materials, they have a rather coarse texture (especially the cheaper qualities), and the modern demand is for an umbrella that will fold as small as possible. Glorias are a mixture of silk and wool, but there are so-called glorias that contain more cotton than anything else; a good gloria is an excellent wearing material. The best material in appearance is, of course, silk; but pure silk covers are more liable to split than those that contain a percentage of wool or cotton.

If only a few covers are wanted, it is cheaper and better to buy them ready made, but the stuff can be had by the yard or piece from any wholesale umbrella dealer; it is generally 22 in. to 24 in. wide, but sometimes may be obtained double width of 44 in. or 48 in. The sections or gores of covers are cut across the material alternately with what will be the hem of the finished cover on the selvedge edges

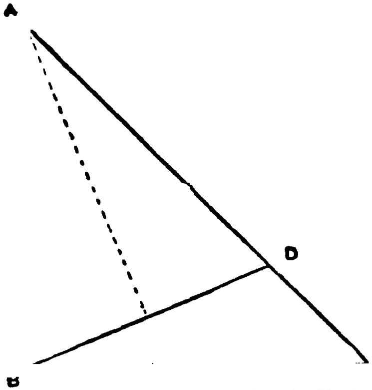


Fig.107.—Pattern for Gore of Eight-rib Umbrella Cover.

of the cloth. If the stuff is of the width shown by the dotted line (Fig. 107) there is no waste of material.

The cover pattern is best cut from sheet zinc, but brown paper will answer the purpose. First cut a square of paper, each edge of which is exactly the length of the frame it is desired to cover, and be sure that it is exactly square; then divide this again diagonally from the upper left-hand corner to the bottom right-hand corner. It will now be like A B C (Fig. 107). Measure along the edge A C a distance equal to A B, and then divide again along the line B D. This part, A B D, is the pattern. The dotted line gives the exact width of material necessary to cut a given size without waste. For a seven-rib cover, the pattern must be one-seventh of the distance B D wider. In cutting out, allow a little for the seams.

The covers are best sewn on a machine, a double hem being used for the seams to within about 1½ in. of the corners, where they run off to a single hem. This is to prevent it being awkward and bulky on the folded umbrella. The method of doing this will best be seen by examining any made-up cover. Hem the edges round after sewing the gores together. The gores should be sewn together in pairs first; then two of these quarter covers so as to form a half, and last the two halves so as to make a complete cover, commencing always at the corners.

In stitching the band to the cover, place a bit of material inside to strengthen it. It is an advantage to iron the covers before putting them on, but if well cut they ought not to want it afterwards.

To repair small holes in a cover, stick small patches inside with strong rubber solution, using only a very little, so as not to spread through the cover. Large cuts will require darning, or perhaps a new gore in place of the one torn. Covers which only show wear at the folds are sometimes hemmed down again inside. This is technically known as "seaming"; but it is never satisfactory, as it generally spoils the shape and appearance of the umbrella. In repairing and doing up umbrellas, black and brown quick drying varnish stains will be found useful. Use methylated spirit for thinning out. Spirit varnish and French polish will also be found useful.

Ribs are most conveniently kept in drawers divided into compartments, and shanks are also best kept horizontal, to prevent warping.

The "top" of an umbrella is the ferrule end.

CHAPTER VIII.

LOCK REPAIRING AND KEY FITTING.

THE only tools absolutely necessary for use in repairing locks and fitting keys are a vice, hammer, screwdriver, and a few warding files and chisels. Some other tools also will be useful, although not essential. Some vices have small square anvils, or heads, attached to them, and these will be found of great service in keyfitting. Warding files can be purchased for threepence or fourpence each, and chisels for about sixpence.

Ordinary back-spring and tumbler locks are more frequently used than any other kinds of locks. The one shown in Fig. 108 is a fairly good specimen of its class, but it will be seen that a skeleton key of the description shown in Fig. 109 will open it as easily as would the original key (Fig. 110). The keys of a tumbler lock rarely, if ever, have wards in the lock corresponding to more than one or two cuts in the key. Skeleton keys are made in a variety of patterns, and will pass almost any warded lock; in fact, warded locks, although still made by thousands, are gradually being superseded by lever locks. If a skeleton key will not pass, the wards can easily be found by first holding the key in the flame of a candle, lamp, or gas until it is blackened, or covering it with a film of wax, then inserting it in the lock, and pressing it against the wards. On removing the key the impression of the wards will be found on it, and when these are cut away the key will pass easily enough. However, if a skeleton will not pass, it is much quicker to use a pick. These are made in various shapes, a few of which are shown in Figs. 111 to 113.

To open the lock shown in Fig. 108 it would be necessary to use two picks like Fig. 111, one to raise the tumbler A and another to throw back the bolt B (Fig. 108).

With the aid of skeleton keys and picks any warded lock can be opened.

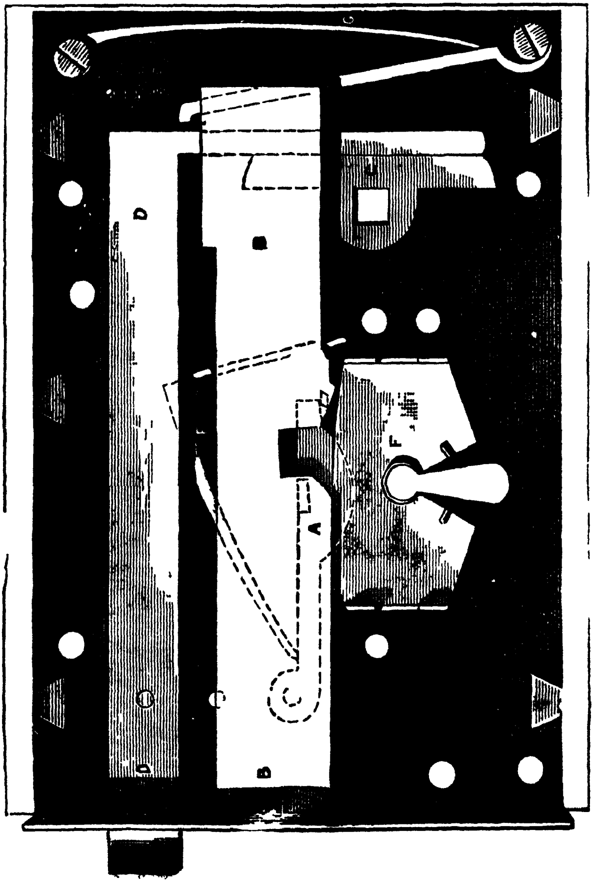


Fig. 108.—Back-spring and Tumbler Lock.

Assume that a new key is required for the lock shown in Fig. 108. This is rather a difficult key to cut, and it will be better, if possible, to get a blank, with the bridge and collar wards also cut, as shown on dotted lines (Fig. 114). However, if unable to get anything better than a plain blank, these wards will have to be cut specially. There are not so many

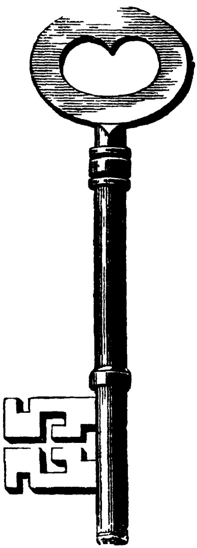


Fig. 110.

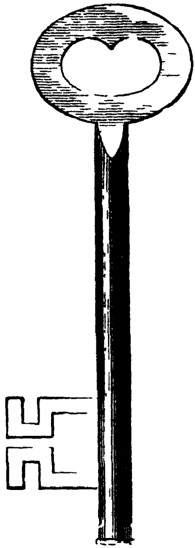


Fig. 109.

Figs. 109 and 110.—Key and Corresponding Skeleton Key.

wards in the lock as one would imagine by looking at the key; in this case, assume that there are as many wards as the key indicates. First drill a hole at A (Fig. 115), and cut the L wards, B B first; if a drill is not available, cut the bridge ward C C first, to do which make a straight cut with a warding file through C C. After cutting the bridge ward, lay the key on the anvil or head of the vice or on a flat-iron held on the knees, and cut the L wards with a key chisel. Great care must be exercised in cutting these wards, or the key is liable to break at D D. The collar ward E must also be cut with a chisel. It is not necessary to cut the entire ward with a chisel, but only sufficient to allow the point of the warding file to

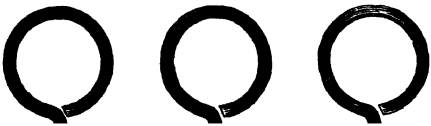


Fig. 111. Fig. 112. Fig. 113.

Figs. 111 to 113.—Lock Picks.

enter. The two wards F F can easily be cut down with a file.

It frequently happens that the spring of a lock breaks. A Scotch spring, as that shown in Fig. 116, can be purchased for about threepence; a feather spring (G, Fig. 108) will not cost more than a penny. The method of fixing these is obvious.

Should a new follower (O, Fig. 108) be required for a back-spring and tumbler lock, it will have to be riveted in. To do this, it is necessary to take out the bolts, etc., and hold the face of the follower on the small head of the vice, or on the face of a hammer held in the vice, and then rivet it on; it must not be riveted on too tight, or it will not work. After riveting, it will probably require cleaning out

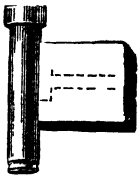


Fig 114 —Blank with Bridge and Collar Wards Cut.

with a small square file, or the knob spindle will not pass through. The price of a follower for a lock like this would be about three-halfpence.

If the lock requires cleaning, all the movable parts must be taken out, and the case washed out with paraffin or benzoline; the bolts, staples, etc., must then be held in the vice and cleaned with emery cloth. Although not necessary, as far as the working of the lock is concerned, it is as well to clean the ledges of the case and the heads of the screws, as it gives a much better appearance to the lock. A drop of oil should be put where there is friction.

Many locks are bushed at the keyhole with a small

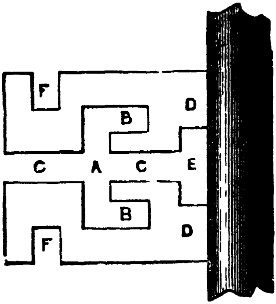


Fig. 115.—Wards in Key.

extra plate to take wear, but the lock already illustrated and a few others are made without a bush, so that occasionally the keyhole is worn away, and the key works loose in the lock. Fig. 117 shows the covering plate of a lock with worn keyhole. If it is only slightly worn, it can be remedied by making a row of marks with a centre punch, as shown in

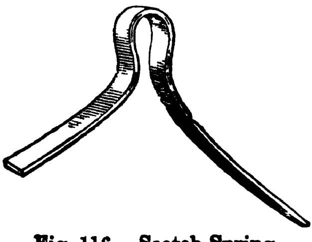


Fig. 116.—Scotch Spring.

Fig. 118; but the keyhole of the lock-case cannot be done in this way without removing the bridge ward, which is rather a troublesome job. The best

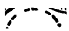


Fig. 117.—Covering Plate with Worn Keyhole

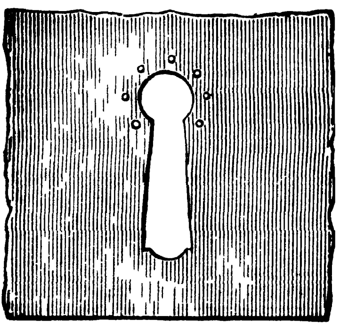


Fig 118.—Repairing Worn Keyhole by Stretching Metal.

way to bush a lock is to cut out a small brass plate with keyhole, and solder or rivet it over the worn keyhole; but as this is rather a difficult matter for a beginner, another plan is described here; it may not look so well, but it will answer the purpose. Every one is familiar with the iron washers used for putting under the heads and nuts of bolts. Buy two of these at an ironmonger's, of a size to fit over the pin of the key—about $\frac{5}{16}$ in. will be required for the key shown by Fig. 110. File one side of the washers bright; now scrape or file the keyholes of the lock

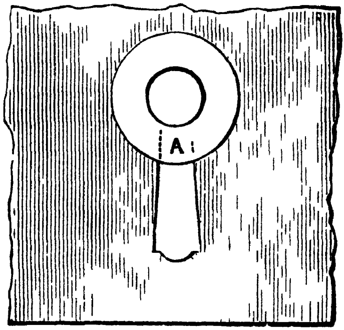


Fig. 119.—Repairing Worn Keyhole with Iron Washer.

bright, and lay the washers on them with the bright parts downwards. Get a pennyworth of spirits of salts (muriatic or hydrochloric acid), pour it in an old cup or gallipot, put some scraps of zinc in it; and when it has done boiling, put a little of the spirits on the washers and keyholes, place a small piece of solder on the top of them, and hold them in the flame of the gas or over a clear fire until the solder melts; then lay them on one side to cool. They will now appear as shown in Fig. 119, and after the part marked A is filed away the repair is completed. The collar of the key will probably require filing back to allow for the extra thickness of the bush.

Fig. 120 shows the interior of a common back-spring lock which is too cheap to pay for repairing; it can be bought new for a few pence The style of key for this lock is shown. The old lock should be

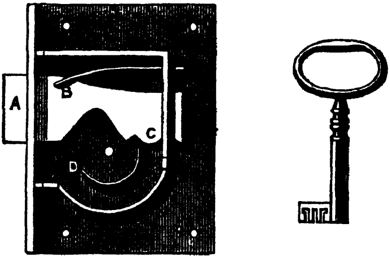


Fig. 120 —Common Back Spring Lock with Key.

taken as a pattern when purchasing a new one, so that the new lock may fit in the same place. It is sometimes difficult to get a new one of the same pattern as the old, and then it becomes a question whether it is better to repair the old one or to cut the woodwork for a new one. If it is decided to repair the old it will probably be found that the spring is broken. This can be easily remedied by cutting

Fig. 121.—Mode of Repairing Pin of Back Spring Lock.

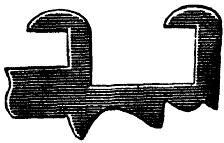


Fig. 122 —Bolt of Drop Lock

off a piece of a stout feather spring and fitting it in the slot of the bolt at B. To get the bolt A out, bend back the rim gently at C, afterwards bending it into position when spring is fixed. If a new pin is required, a piece of wire must be used considerably larger than the pipe of the key, and filed down so as to form a shoulder as shown at A (Fig. 121). The pin must then be held in the vice at C, and the part marked B riveted into the lock.

In small locks, such as used in desks, the bolt is sometimes broken. · This cannot be repaired, as any extra thickness at the place where it is broken would prevent the bolt from working, but it is comparatively easy to make a new one. The broken pieces should be filed bright on one side, and laid on a piece of brass of the same thickness, and soldered on as described in bushing a lock. Now file away the brass plate round the old bolt, hold it in the gas to melt off the old pieces, and the new bolt will be complete (see Fig. 122).

When mortice locks are out of order, either the spring or the follower is wrong, as a rule. To repair or replace this, the lock must be taken off. Although this is a simple matter, it may be as well to describe how it is done. Fig. 123 shows the edge of a door with mortise lock fixed. To take it out remove the knobs and spindle, then take out the screws A and the face plate; under this will be found two other screws. These must be taken out; then if the screw-driver is inserted in the keyhole, and the lock pushed forward, it will come out sufficiently to be grasped by the hand and pulled right out. If the follower is worn out, a new one must be fitted. Followers for mortice locks (see Fig. 124), and indeed for most rim locks, are not riveted in as previously described (see p. 123), but work between the two plates of the lock. The old one should be taken as a pattern in buying a new one, but this will probably require a little alteration before it will fit. The spring will probably be a feather spring, and a new one can be bought for a penny. The screws of the face plate are very short, and liable to be lost; should this happen the plate can be fixed by ordinary screws, long enough to reach the woodwork.

Keys to padlocks must be fitted by examining the wards, as far as possible, through the keyhole, or

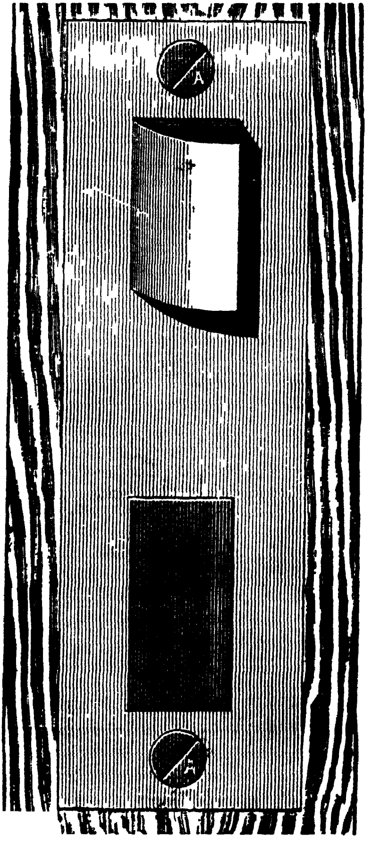


Fig. 123.—Edge of Door with Mortise Lock fixed.

by blacking the blank as previously described. Warded padlocks, however, can easily be picked by holding the lock on one side and raising the tumbler with a pick, when the bolt will drop back by its own weight.

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

For lever locks, keys must be cut from blanks. Ordinary lever locks, though not absolutely unpickable, are sufficiently so for general purposes; and those made by some of the most eminent makers, with patented improvements, may be said to be unpickable.

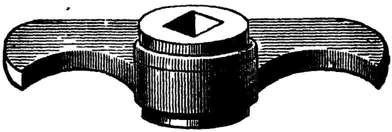


Fig. 124.—Follower in Mortise Lock, showing Form, etc.

Backspring and tumbler, or warded, locks are really no protection at all against force or trickery, and as from the nature of their construction they are capable of very few variations, it follows that there are hundreds of a similar pattern in existence.

The Barron lock, shown with key at Fig. 125, although it can hardly be called a lever lock, may be justly considered the prototype of the modern lever. It was invented in 1778 by Robert Barron, and is still in use. This invention was a great improvement on the ordinary tumbler lock, as it has two tumblers B B (Fig. 125), with two studs C C, which work in slots in the bolts, shown by dotted lines D D. The wards in this lock, too, are more intricate than in most warded locks; but they can, of course, be passed by a skeleton key, and as the bellies of the tumblers are nearly the same pattern as the key, they can easily be lifted to the right height by a skilled lock-smith. To fit a key to this lock, first cut the wards in the blank as previously described, using a much finer chisel and file; then cut the steps F F in the key, so as to raise the tumblers to the right height.

Fig. 126 shows the ordinary lever lock, with key. The best modern locks are made on this principle, with additional protecting contrivances. No wards are used for these locks, except for arranging suites of locks with master-keys; and the single tumbler is replaced by a number of levers. Fig. 127 shows one of these levers with part of bolt. The lock shown

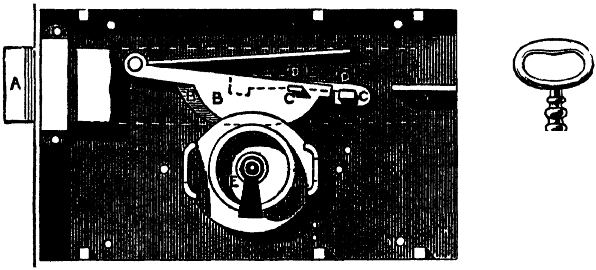


Fig. 125 —Barron Lock and Key.

in Fig. 126 has only two of these levers, but this is a very ordinary kind. Of course, each additional lever adds to its security, and some of the best makes have as many as fifteen. The bolt A (Fig. 127) has a stump B fixed to it at right angles; the lever has a passage cut in it of sufficient size to allow the stump to pass through. In the illustration the lever is shown in the position it stands in when the bolt is locked. In unlocking the lock each lever has to be raised so that the passage comes exactly opposite the stump, and as each lever has the passage cut at a different height, it follows that only the original key will open it. That they are secure against opening with false keys may be judged from the fact that a seven-lever lock is capable of over four thousand (4,000) changes; or, in other words, it would be necessary to try that number of keys in order to get any probability of succeeding in opening it.

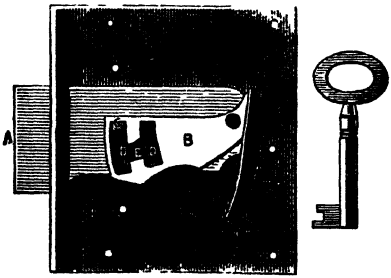


Fig. 126.—Lever Lock and Key.

Mr. Samuel Chatwood, the eminent safe-maker, has stated the manner in which his keys are cut by machinery. A very important requirement in safe locks is that no two should be made alike, in order that there should be no possibility that the key of one safe should open another. The method in use in the Chatwood works renders it absolutely impossible

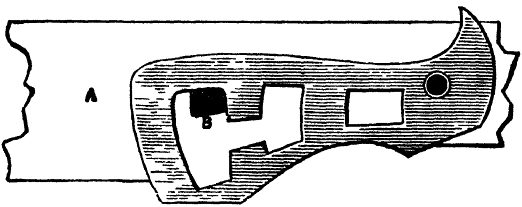


Fig. 127.—Lever and Part of Bolt of Good Type Lever Lock.

for two locks to pass, unless specially made to do so. The key consists of a number of steps corresponding to the number of levers—say, for example, eight. These are of different lengths. They are cut out of the key blank by eight circular saws of different diameters, placed in a pack on a mandrel. The key blank is held in a special vice fixed on a slide rest, and is brought forward against the saws by the screw of the slide rest. The saws thus cut out the steps. Each

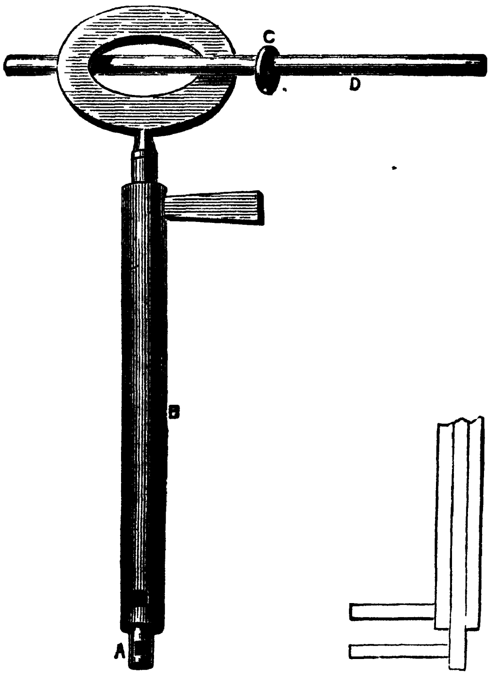


Fig 128. Fig. 129.

Figs. 128 and 129.—Tool for Picking Lever Lock.

of the saws is numbered, and for the first key they are placed in the order 1, 2, 3, 4, 5, 6, 7, 8; for the second in the order 1, 2, 3, 4, 5, 6, 8, 7, and so on. The number of changes—*i.e.*, the number of different keys—which can be cut with a set of eight saws is 40,320, which may be extended almost indefinitely.

To make a second set of 40,320, it is only necessary to alter the diameter of one of the saws, or to vary the depth to which they are allowed to cut into the key blank. Keys are made in this manner and stored. When the locks are finished, with the exception of the cutting of the gatings, the locksmith receives keys from the store, and marks off and cuts out the gatings to correspond with them. The lock is made to the key, therefore, and not the key to the lock.

Though for a long time considered unpickable, it has been found possible to pick lever locks. Fig. 128 shows one description of instrument used for this purpose. A is a solid rod with one step, used for engaging with the bolt, and B is a tube fitting over A, having a step for raising the levers. The weight at the end of A causes the bolt stump to be pressed against the face of the levers, and then by raising each lever in turn with the tubular key B, the position of the passage or gating in the lever is ascertained by the difference in the friction when pressed by the stump, and when in position and no longer pressed by the stump. As each lever is raised the weight C is carried along the lever arm, so as to keep them in their position by the extra pressure, and when all the levers are raised, the bolt slides back. Should the lock have a pin, as it probably will, the pin must be knocked out and a hole drilled in the plate to support the key, or two very thin tubular keys may be used, when it will be unnecessary to remove the pin. (A section of the instrument shown by Fig. 128 when in action is presented by Fig. 129.)

Picking a lever lock is a very tedious operation, and can only be accomplished by a skilled locksmith, so that for general purposes ordinary lever locks afford ample security.

For safes, or where perfect security is required it is necessary to render lever locks unpickable

There are various means in use for attaining this end, most of them protected by patent.

Messrs. Chubb have used levers with notches (or false gatings as they are technically termed) cut in them, as shown in Figs. 130 and 131, so that the bolt stump (Fig. 131) can enter a short distance, and where these are numerous it is almost impossible to tell if the bolt has entered the true or false gating. The makers, however, do not rely entirely on these, for they use a detector, which, briefly described, consists of a trigger so arranged that if any lever is raised too high the bolt is blocked, and it cannot be withdrawn even by its own key. It can, however, be released by turning the key slightly in the other direction

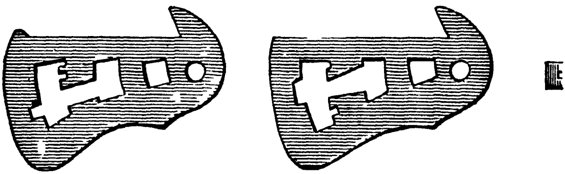


Fig. 130. Fig. 131.

Figs. 130 and 131.—Chubb Levers with Notches or False Gatings.

This detector, besides assisting in rendering the lock unpickable, serves to show if the lock has been tampered with.

Messrs. Hobbs relied on their patent movable stump, shown in Fig. 132, by means of which any pressure, if applied to the bolt before raising the levers, is transferred to a fixed part of the lock, so that the levers are perfectly free. Both these methods render the locks practically unpickable.

One defect in lever locks that has not yet been mentioned is the risk of the bolt step A (Fig. 133) being worn (or, perhaps, wilfully filed or ground down) so that it is not long enough to throw the bolt home, the bolt, remaining in the passage of the levers, can easily be thrown back by an ordinary pick. To obviate this danger, Messrs. Hobbs introduced their patent protector, in which the bolt step or talon is fixed to a revolving nozzle instead of on the key (see Fig. 134). With these improvements their locks may

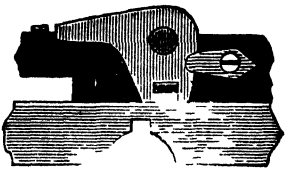


Fig. 132.—Hobbs' Movable Stop.

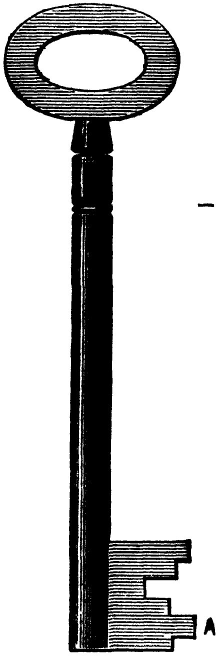


Fig. 133.—Defective Key for Lever Lock.

be said to be perfect. Space will not permit of mention being made of the inventions of Chatwood, Tucker, Parnell, Tann, Price, Fenby, Hart, Cottrell, and Hodgson, all of which have demonstrated the possibility of producing locks capable of defying picking instruments even in the hands of experts.

To cut a key to a lever lock it is necessary to remove all the levers, laying them carefully on one side in the order in which they are taken out. Now cut the first step in the blank so that it will throw

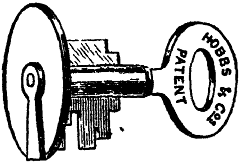


Fig. 134.—Hobbs' Protector for Lever Locks.

the bolt, then replace the first lever and cut the second step so that it raises the lever to the necessary height to allow the stump on the bolt to pass the gating; next replace the second lever and proceed in the same manner, continuing until all the levers are replaced and the corresponding steps cut in the key.

Fig. 133 shows a lever key for a night latch. The first step in this is a sham, as the bolt is thicker than the lever, and takes up the first two steps, so that it follows that the key belongs to a four-lever

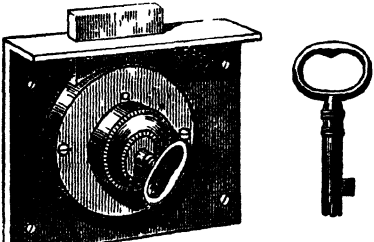


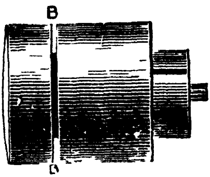
Fig. 135.—Bramah Lock, with Key, for Till.

lock. It will not do, however, in buying a lock, to be guided by the key unless it is by some well-known maker, as a lock with only two levers may have a key like that shown by Fig. 133, the levers being kept in their places by a pin riveted in the covering plate, so that it is as well, in buying a lock, to have the covering plate removed, so as to see that the levers are actually there.

Fig. 135 shows a Bramah lock. This well-known lock is in principle the same as a lever lock, but instead of levers small guards of sheet metal (Fig. 136) are used. These work in a cylinder (Fig. 137), carrying a stud which turns the bolt; a flat steel ring (Fig. 138) projects into a groove in this cylinder, and the ring is notched to correspond with the notches in the guards, as shown at A (Fig. 136). In unlocking, the key presses the guards down until the notches are opposite the corresponding notches in the ring. The cylinder can then be turned round and the bolt thrown back, a small spiral spring at the back of the guards replacing them in position when the key is withdrawn. Those made by Messrs. Needs and Co., the successors to Joseph Bramah, the patentee, are very secure, but common Bramah locks are seldom perfect, and can be opened in many different ways.

To cut a key to a Bramah lock it is necessary to fit the blank to pass the outside cylinder, then to take off the cylinder, when it will appear as shown in Fig. 137, with the ring, Fig. 138 (which is in two pieces), in position in the groove B B; now file down the end of the blank until the stud on the key nearly enters the cylinder, then blacken the end and press it in the cylinder. It will then show the impression of the guards on the end, and these should be cut down equally in the blank for a short distance, say, ⅛ in. The cylinder should now be held in the hand with the key pressing it, so as to see the distance necessary to cut the notches in the key, which may be ascertained by holding the cylinder to the light and looking at the groove B B. The notches in the key should be cut down one at a time, until the gatings in the guards are opposite the grooves in the cylinder, when if the lock is put together the key will fit.

These locks are now seldom used for safes, but they are frequently used for purposes where a small key is preferred, such as night latches, jewel cases, etc. For night latches, however, they cannot be recommended, as, like all drawback locks, however good the works may be, they can easily be opened by boring a hole under the latch through the door, and turning back the handle with a piece of bent wire. For this reason, Chubb's combination night latch is preferred ; in this the levers themselves form the bolt, and the latch is opened from the inside by turning a handle, and not by drawing it back. Direction need not be



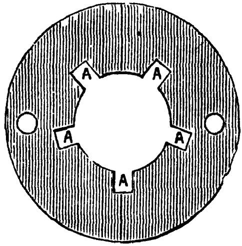


Fig. 136. Fig. 137. Fig. 138.

Fig. 136.—Guard with Notches. Figs. 137 and 138.— Cylinder and Ring of Branch Night Latch.

given for cutting keys to this kind of lock, as all lever keys are cut in the manner described above.

In brazing together the broken parts of a key stem, first it is necessary to file the fractured ends quite true ; this may entail the shortening of the key by ¼ in. or ½ in., and as another ¼ in. will be lost in making the joint, it may be advisable to use another key bow having a longer piece of stem than the one which was broken off. With a warding file cut a dovetail on each of the ends to be joined. The pin of the dovetail may be on either part of the key, as is explained by Figs. 139 and 140. A small, half-round file will assist in making the edges true and square. The pieces must interlock perfectly, and when this is the case, very lightly hammer the joint, around which then wind seven or eight turns of brass wire to act as spelter. Wet the joint, sprinkle powdered borax on it (this is to serve as the flux), and, holding the key in a pair of tongs, place it in a clear part of a forge fire made with charcoal, small coke, or coal cinders, and commence to blow steadily the forge bellows

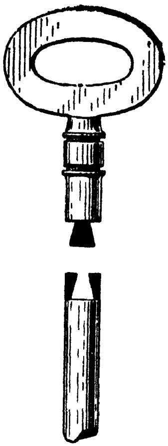


Fig. 139.—Dovetailing New Bow to Key Stem.

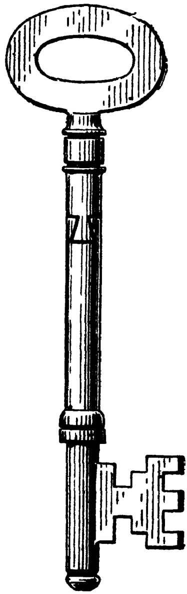


Fig. 140.—New Bow Brazed to Key Stem.

or blower. Failing a forge fire, use a blowpipe, the key being placed on a piece of charcoal or pumice-stone whilst the heat is being applied. A blowpipe for brazing requires a greater pressure of air than can be given by the mouth, so the blowpipe must be connected to a blower. The air pressure regulates the temperature of the flame, and to get a sharp, concentrated heat, an air pressure of from 1 lb. to 1½ lb. on the square inch is required. Such a pressure is obtained easily from a foot blower. If the forge fire is used it is as well to support the key on a guard of thick iron plate having a hole in its centre, over which is the joint to be brazed By this means the necessary local heating is obtained, and much labour in cleaning the key afterwards is avoided. On being heated, the borax swells and boils up, and should be pressed down with a spatula, previously dipped in cold water to prevent the hot borax adhering to it; a suitable spatula is made by flattening one end of a 1-ft. length of a ¼-in. round rod, having at its other end an eye by which it may be hung when not in use. With this spatula, also, powdered spelter may be added to the joint if required. When the brass wire commences to run, assist the flow by adding powdered borax, and when all the brass has run into the joint, rub off superfluous molten metal from underneath and allow the joint to cool gradually. When cold, file up and clean the stem of the key until only a thin bright line of brass can be seen. Fig. 140 shows the finished key.

CHAPTER IX.

TRAVELLING CUTLERS' GRINDING MACHINES AND BARROWS.

The travelling cutler and repairer undertakes many or all of the jobs which have been described in this handbook; and so to render this book a complete guide to his trade it is thought desirable to let the concluding chapter take the form of simple practical descriptions of how a travelling cutler's grinding machine or barrow is made.

The first type of barrow to be described will be that which is drawn by a pony. In order that it may be of service generally, the barrow is so constructed that the front wheel and iron stays may be taken away and wood handles fixed by the same bolt-holes; otherwise, were it to be used solely for a pony, the third wheel should be at the other end.

Figs. 141 to 143 show the barrow. Fig. 141 represents a side elevation of the barrow, which has double panels at the bottom part and open framework at the top, where turned spindles, as Fig. 144, may be put in if so desired. The upper portion of the wheel is omitted from the illustration in order to give a clearer view of the body generally. The figure also shows the position of the driving- and grinding-wheels, front seat, etc. Fig. 142 is a back view, giving the widths of body, etc., the position of the springs, axle, driving-wheel, crank, and pedals, with connecting-rods. Fig. 143 represents the barrow as seen from above.

The whole of the framework should be of good dry ash. The bottom sides A are 3 ft. 9½ in. long by 2¼ in. wide by 2 in. deep; the two cross-bars B, 1 ft. 10 in. long by 2½ in. wide by 2 in. deep; the four corner pillars C, 2 ft. long by 1¾ in. wide by 1½ in. thick; the two middle rails D, 3 ft. 6½ in. long by 3 in. wide

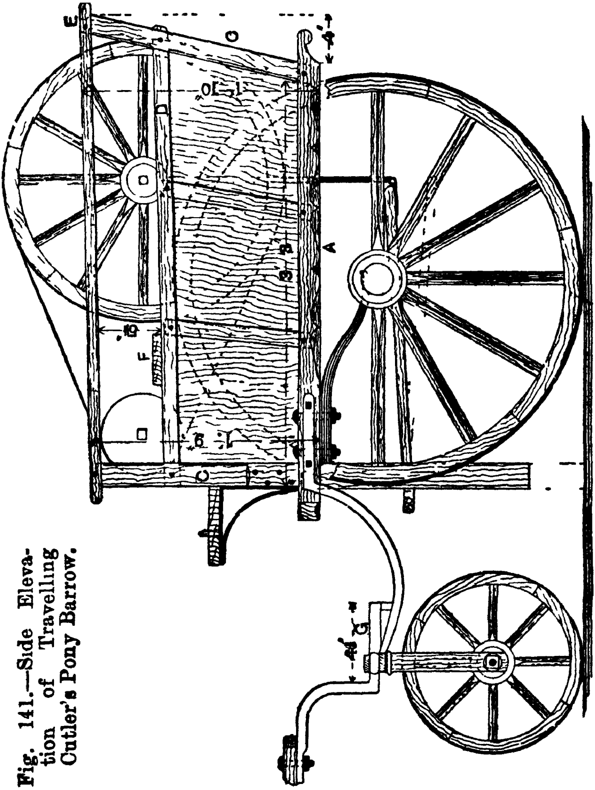


Fig. 141.—Side Elevation of Travelling Cutler's Pony Barrow.

by 1½ in. deep; the two top rails E, 3 ft. 10 in. long by 1½ in. wide by 1¼ in. deep.

The outer edges of the bottom sides and middle rails are bevelled to oversail as shown by Fig. 142. The inner edges are square, whilst the top rail is bevelled on both edges. The crossbars are square all ways. In framing in the cross-bars, which are stump-tenoned into the bottom sides 1½ in., the outer edge of the hind one is kept 2½ in. in from the outside of the back pillar, and the front one should measure 2 ft. 3 in. to its front edge from this point. The corner pillars

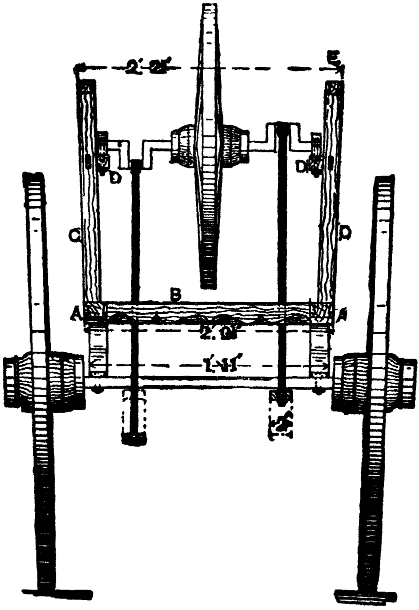


Fig. 142.—Rear Elevation of Cutler's Pony Barrow.

are framed in in a similar manner, being haunched at the top end to give a little more strength to the stubb ends on the top rails. The middle rails are kept flush with the pillars on the outside, the part inside which overhangs forming a fixing for the crank and spindle bearings. The battens between the panels in the lower part of the body are 1¼ in. wide by ½ in. thick, framed in their full width and thickness 1 in. deep both top and bottom.

Having put the barrow together, to see that all the joints fit properly and that it is true and square,

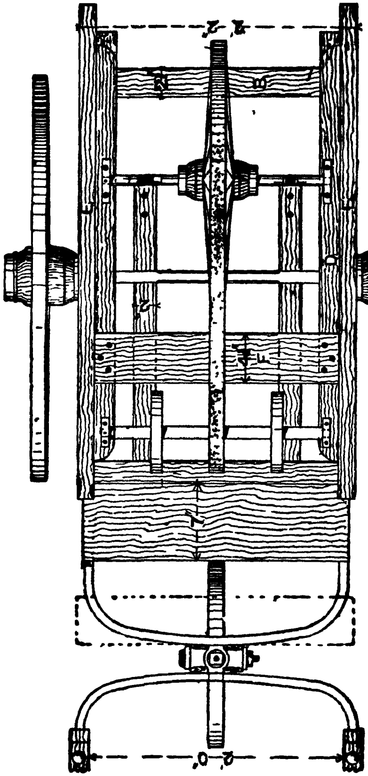


Fig. 143.—Plan of Cutler's Barrow

mark off all the bearings, and prick the tenons through the holes in the mortices, which, when bored, should be a trifle nearer the shoulder than the mark; this will draw the shoulder tight home in its place. If it is decided to have turned pins in the top part measure out the distance equally for them; they should be about 3 in. apart. Then take the barrow apart, and box out the pillars to receive the panels and lining boards. Shave it up as shown, and fix the cross-bars in for good, not forgetting to give all the mortices and tenons a coat of good white lead mixed with raw linseed oil only. Put the corner pillars in tem-

Fig 144.—Turned Spindle.

porarily, and fit the outside panels, taking care that they fit in the grooves of the pillars quite tightly. These, which should be of yellow pine, fully $\frac{3}{8}$ in. thick, should be cleaned up nicely before being fixed in for good, which can now be done, using lancewood pins, tapered and made slightly oval to hold the framing together. To keep it firm and rigid at the top, a piece of birch, $4\frac{1}{2}$ in. wide by $\frac{7}{8}$ in. thick, is screwed on top of the middle rail at F. At the back end the name-board answers the same purpose. It is left out of the drawing, as it would hide the working parts.

The legs at the front part are 2 in. wide by 1½ in. thick, lapped on to the front pillar, and fixed by

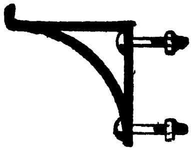


Fig. 145.—Iron Bracket Seat Stay.

screws, also by a light iron stay fixed on the inside of the leg and bottom side. At a point 8 in. below the bottom side, a piece of birch, 4 in. wide by ⅞ in. thick, is framed in to hinge the treadles to, supported underneath by two iron corner-plates. The seat, which is carried by the iron brackets shown in Figs. 141 and 145, is 7 in. wide by 1 in. thick, of red deal, and is rounded off at the near inner corner to allow of it turning against the pillar, when it is swung open for the worker to take his seat. In order that this seat

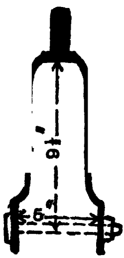


Fig. 146.—Forked Stay and Bolt.

Fig. 147.—End Section of Box for Front Wheel.

may also be used for driving from, a small board to rest the feet upon is fitted on top of the iron stay at a.

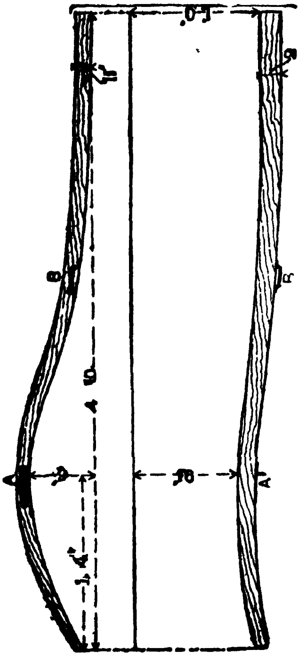
For mounting it, coster-barrow springs are used, 1 ft. 7½ in. long, with a depth of 5½ in. over all. The four plates used, 1½ in. wide, are fixed to the underneath of the bottom side with two ⅜-in. bolts, and bolted to the axle as shown in Fig. 142.

The axle is a common grease one, the arms being ⅞ in. in diameter, with nuts at the front end. The boxes are 6½ in. long, and should measure 2 ft. between the collars. When shut together ready for fixing, the axle should have a ⅜-in. hole punched through, 1½ in. from each collar, to fix the springs to. By punching these holes a better bearing is obtained for the spring, as the axle swells out, and the grain is not severed, as would be the case if it were drilled through.

Having fixed the springs, etc., the lining boards, which are of ⅜-in. red deal, may be put in, first giving the insides a heavy coat of smudge paint, also the inside of the outer panels, which will preserve them from the wet which is certain to find its way between them.

The side wheels are 3 ft. 2 in. high when tyred, the stocks 7 in. long by 5½ in. in diameter, the twelve spokes are 1⅜ in. wide, the felloes are 1½ in. deep by 1⅝ in. wide; 1¼-in. tyres are used. The front wheel is 1 ft. 5 in. high when tyred. It has eight spokes 1½ in. wide, shaved on both sides alike. They are mortised in, in line with one another in the centre of the stock, which is 5 in. long by 4 in. in diameter in the centre, turned down at the ends to 2½ in. The wheel has an iron hoop round it, similar to the side wheels; it runs on a ⅝-in. bolt, which passes through the centre, and the iron stay, as shown in Fig. 146. To prevent the wood wearing away, a small box is made out of stout coach hooping to fit the bolt, with a flange left on to prevent it turning in the stock (see Fig. 147).

In Fig. 141 the iron stay which carries the front part is shown with the flap on the outside of the bottom side, it being so drawn in order to indicate the kind of flap and its position. Properly, it should be fixed on the inside. In the boss at the front is a round hole, which fits on to the spindle of the fork. A brass washer is afterwards put on to take the wear. The iron to which the shafts are fixed must have a square hole in the centre to fit exact on a square made on the spindle, the whole being kept tight with a nut on the



Figs. 148 and 149.—Side Elevation and Plan of Shaft.

top. The ash shafts, of which Figs. 148 and 149 give the rise and side cant, are fixed to this iron with two $\frac{3}{4}$-in. bolts, which are put through each one at the back end, and the flaps on the stay.

The driving-wheel for grinding is 2 ft. 2 in. in diameter, and should have either a light tyre of hoop-iron, or a hooping plate screwed on the face of the felloes on both sides. The stock is 7 in. long by 4½ in. in diameter in the centre. The ends are turned down to 3 in., and are hooped similarly to the front wheel. There are twelve spokes, 1¼ in. wide, mortised into the

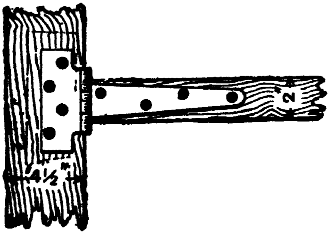


Fig. 150.—Parts of Front Cross Bar and Treadle.

stock alternately right and left of the centre of the stock. This will bring all the inner faces in line with the centre. The crank is made of ¾-in. square iron, with a throw of 2½ in., and should measure between the bearings, when ready for fixing, 1 ft. 7½ in. It is, of course, made in two parts, which meet in the centre of the stock, and care must be taken, when wedging them in, to see that the wheel runs truly.

The pedals, or foot-plates, are 2 ft. 2 in. long by 2 in. wide. They are made of 1-in. birch or other hard wood, fixed with cross-garnets at the front end, as shown in Fig. 150, connected to the crank by the eye-plate and rods, as shown in Fig. 142. The front grinding- and buff-wheels are about 8 in. in

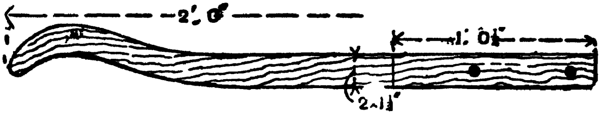


Fig. 151.—Wood Handle to replace Iron Stay.

diameter, mounted as shown in Fig. 143. There should also be a water-barrel to supply the grindstone, and a tool box fixed to the board behind the buffing-wheel.

The name-board for the back end is 2 ft. 2 in. long by 1 ft. deep, with a moulding fixed all round the

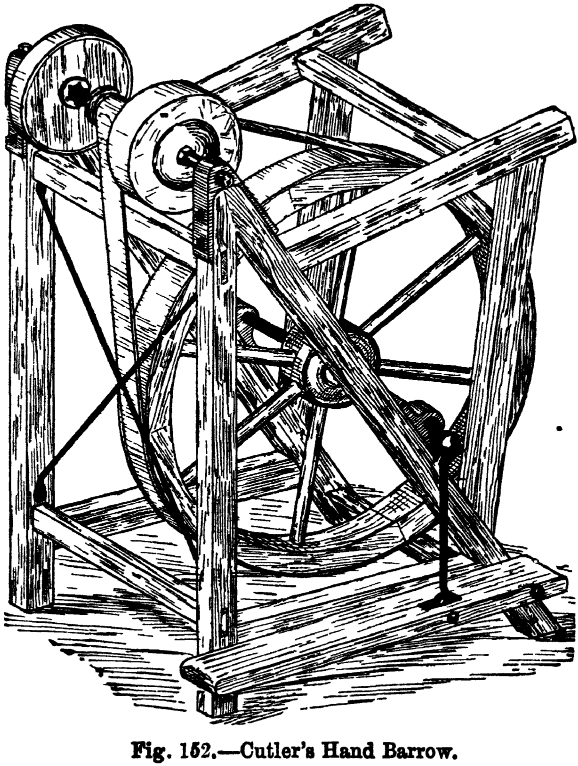
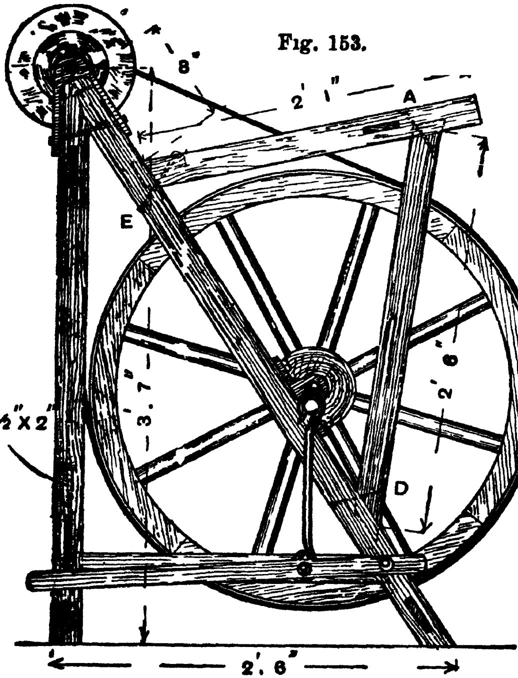


Fig. 152.—Cutler's Hand Barrow.

edge of the face side, to give it a finish. When it is desirable to push it by hand, take the bolts out which fix the iron stay, draw this away, and put on, in its place, the wooden handles made as shown in Fig. 151.

To give the barrow a smart appearance in

Fig. 153.



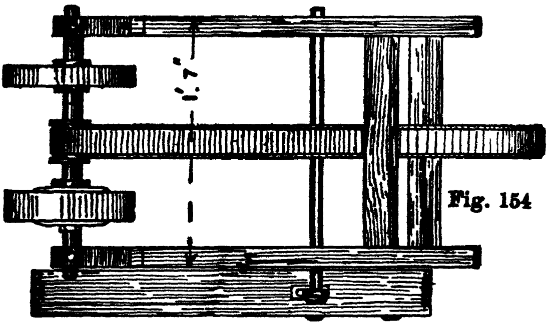


Fig. 154

Figs 153 and 154.—Side Elevation and Plan of Cutler's Hand finishing, it may be painted blue, the shaving out on the bottom sides and hind-bar being filled in with red, and edged up with a fine line of orange chrome. The wheels and springs may be painted red, picked out with black. The writing on the name-board and panels may be done in chrome to match the lining

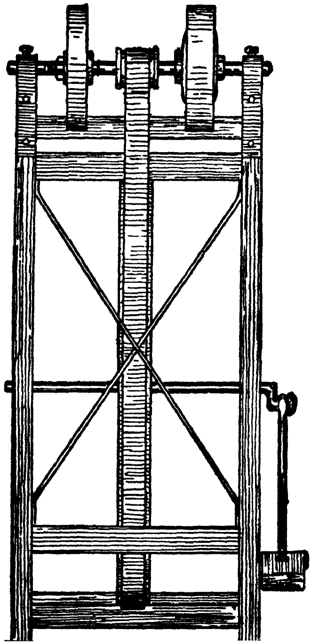


Fig. 155.—End Elevation of Cutler's Hand Barrow.

out; or, better still, it may be done in gold leaf and shaded off to match.

The second barrow to be described in this chapter is the hand machine illustrated by Figs. 152 to 156. The wheel for driving the stone is also used in propelling the machine from place to place. Fig. 153

is a side elevation of the machine in position for grinding; Fig. 154 is a plan projected from Fig. 153; Fig. 155 is an end elevation; and Fig. 156 is a side elevation of the machine in position for travelling, showing it with the strap taken from the flywheel,

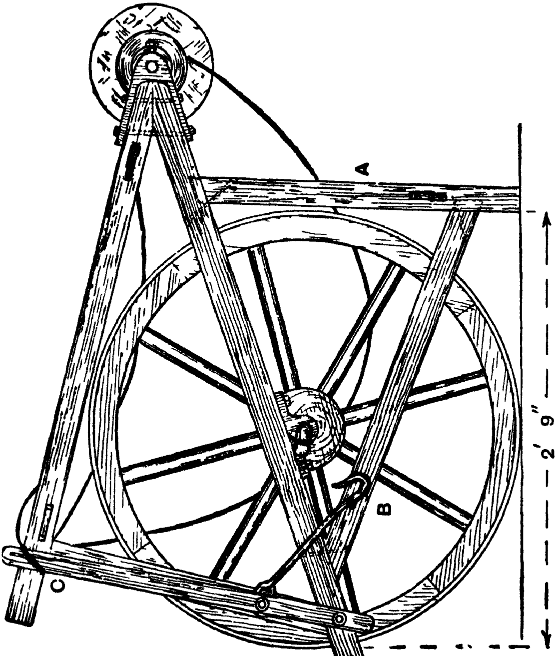


Fig. 156.—Side Elevation of Cutler's Hand Barrow in Position for Travelling

and with the framework pulled over so that the parts of the framing marked A form legs on which the machine may rest when required By taking hold of the side framework at the ends of the spindle, the legs are raised and the machine can be pushed along. The connecting-rod is unfastened from th-crank and attached to the framework as shown at B. A handy way of fastening the treadle is by means of a strap fixed to the bottom of the framework, as indicated at C.

The leading dimensions are set out on the illustrations. The framework may be of good red deal, but oak, of course, would be stronger. The main pieces should be about 2¼ in. by 1¾ in., the cross rails being 2 in. by 1½ in. As will be seen, the several pieces are connected together by means of mortise-and-tenon joints some of the tenons passing right through, so as to allow of their being wedged, whilst the oblique joints are stub-mortised and tenoned together, being secured with bolts and nuts as indicated at A, D, and E (Fig. 153).

To give greater rigidity to the framework, two braces of ½-in. round iron, having their ends flattened and bored for screws, should be secured in the

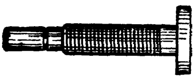


Fig. 157 —Spindle for Grindstone and Emery Wheel.

position shown at Fig. 155. The bearings for the spindle may be of wrought-iron or cast-iron, and should be bored to form bearings for the spindle, and also for the bolts by which they are fixed to the framework.

The spindle is shown separately at Fig. 157. Each end, it will be seen, is of less diameter than the middle, in order to prevent side-play in the bearings. Two collars are shrunk on, and the spindle is threaded as shown, so that the grindstone and emery wheel, when placed on, may be fixed in position with collars and nuts working on the threaded parts of the spindle The pulley is of the ordinary wooden construction, in two halves, and bolted together on to the spindle, and further secured to it with an iron key fitting into a chase made in both the spindle and pulley.

The driving wheel, which should be rather heavy, to give it the necessary momentum, should be constructed as follows: The rim should be made of four segments dowelled together with two dowels in each joint. The spokes are of ash, round or oval in section, and have their ends turned to a smaller diameter to fit into holes bored in the segments and nave; the latter may be of elm or other hardwood, and is bored for the crank shaft. When the woodwork of the wheel has been fitted together, the tyre is shrunk on and further secured with several screws. The bearings for the crank shaft are of simple form, and are fixed in position with coach screws.

The treadle has one end hinged to the framing by a bolt, another bolt being inserted in the treadle through a mortise made in it immediately below the crank. This bolt also passes through the lower end of the connecting-rod, and in this way transmits the motion from the treadle to the crank. The crank shaft should be made of about 1-in. round iron, one end being forged to form the crank, with a head to it, so as to keep the connecting-rod from slipping off while in use. To keep the crank shaft in the right position, two collars fastened with set screws should be secured to it, one against each bearing.

INDEX

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