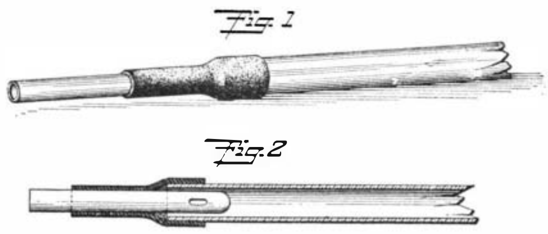
be heated over a stove. While the shade is still hot a piece of wax or ordinary candle is rubbed over both sides of the brass. The heat of the brass melts the wax and forms a thin wax coating. When the brass becomes cold, the design, which shows through the wax, is traced with a pointed instrument. The parts of the brass which are to be burned out are scraped free of wax. The shade is then immersed in nitric acid. The acid eats through the exposed brass and the required design is very cleanly cut out.

The lamp, electric, and drop-light shades are made in the same way. Without much expense or trouble these larger pieces can be improved by placing different colored glass behind the designs.

STOPCOCK OF GLASS TUBING.

A small stopcock may be easily made out of two glass tubes and a rubber sleeve. The outside diam-

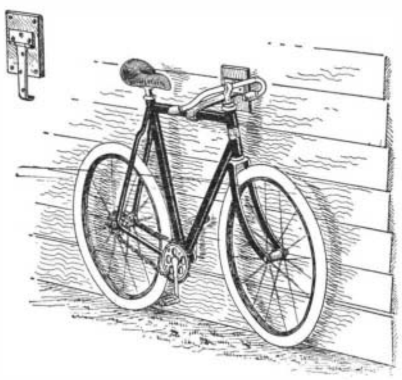


STOPCOCK OF GLASS TUBING.

eter of one tube is smaller than the inside diameter of the other. The end of the smaller tube is softened in the flame of a Bunsen burner and closed. With a file a small slot is cut in the side of this tube. A piece of rubber tubing is fitted over the two glass tubes, as shown in Fig. 1. The smaller tube is not held so tightly by the rubber sleeve as is the larger tube, and it will slide quite readily therein. When the smaller tube is drawn outward, the rubber sleeve covers the slot therein, preventing the passage of liquids or gases through the two tubes. To open the cock, the smaller tube is forced inward, as shown in Fig. 2, and the liquids or gases can then flow freely through the two tubes by way of the slot in the smaller tube.

SIMPLE SUPPORT FOR BICYCLES.

A very convenient device which may be attached to the side of a house or any other support, to hold a bicycle, is shown in the accompanying drawing. It



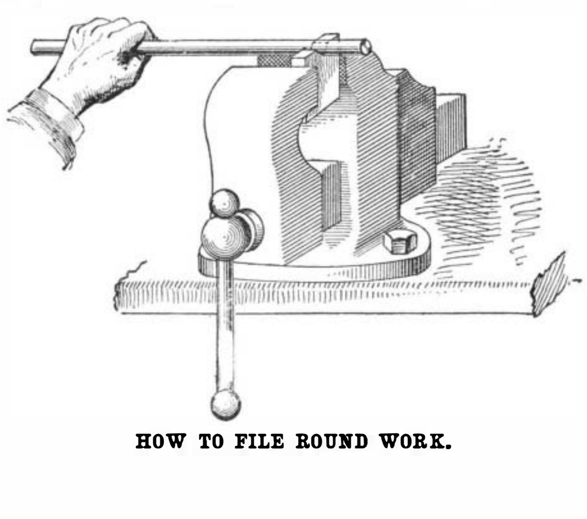
SIMPLE SUPPORT FOR BICYCLES.

consists of a gate hinge with one leaf secured to a block. The block is nailed to the side of the house. The other leaf of the hinge, which should be a very long one, is bent over at the end to form a hook. This is caught over the upper horizontal bar of the bicycle frame. The bicycle wheels are placed close to the house, so that the upper part leans outward, and is held from falling by engagement with the hook.

HOW TO FILE ROUND WORK.

BY A. V. SEARING, JR.

It is an easy matter to file the ends of round rods if a piece of wood with a notch cut in the top is placed in the vise, as shown in the cut, and the rod revolved toward you as the file is run over it. The file will make a steady, smooth cut, and will not chatter if the notch is of the right depth. This simple trick seems to be but little known. Usually the mechanic tries to rest the rod he is filing between the partly open jaws of the vise, but this makes a very unsatisfactory chattering support, which is quite sure to mar the work.



HOW TO FILE ROUND WORK.

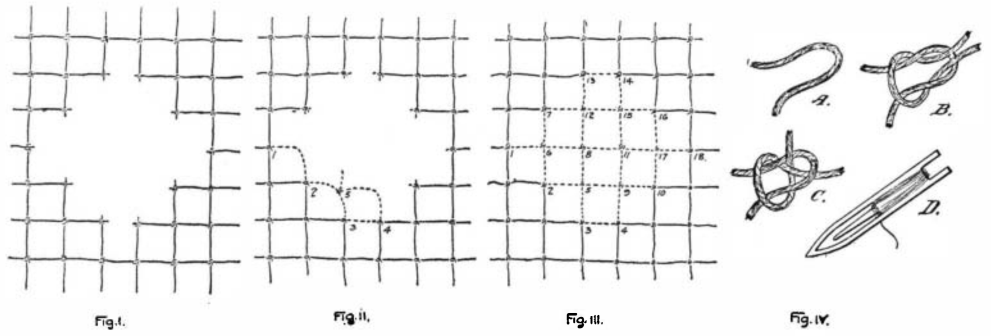
HOW TO MEND A HAMMOCK OR FISHING NET.

It is safe to state that not one per cent of persons using a hammock or handling a fishing net know how to mend them, should they get torn or damaged in any way.

Whether the tear is a large or small one, the meshes or small squares of which the net is made must be cut out, until a symmetrical figure is made, as shown in Fig. 1; i. e., there must be a single square or mesh and a double one on opposite sides of the tear.

Fig. 2 shows the commencement, and Fig. 3 the tear completely mended.

Always commence in the middle of the double mesh, and end in the opposite one. Each successive stitch and knot is numbered, from 1 to 18, as clearly shown in Figs. 2 and 3.



HOW TO REPAIR A HAMMOCK OR FISH NET.

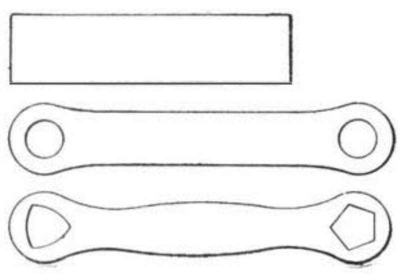
The knots are formed by pinching the meshes, as at 5, for instance, into a loop, as shown in Fig. 4 at *A*. Then threading the cord through the loop, a knot is made, either a flat or true lover's knot, as shown at *B*, or better still a fisherman's bend knot, as shown at *C*. The latter is not only easier to make, since it only passes through the eye once, but it will not slip so easily.

If the tear is a large one, it is well to make a needle, as shown at *D*, which is made from a piece of thin wood, about 5 or 6 inches long by ¾ of an inch wide, cut out as shown. The cord or twine is wrapped around this needle, and as the stitches and knots are being made, is unwound.

A FIRE-PLUG WRENCH.

To prevent mischievous boys, or any other persons, meddling with the fire plugs of the city, special wrenches are made, different from the ordinary hexagonal wrench which can be found in almost any home. The making of these wrenches is interesting and instructive, and is done in the following manner:

A piece of steel, a little thicker than the finished size of the wrench, and the same width as the two ends, is drawn out to the proper length. A hole is punched in each end having a diameter the same as the inside of the shaped hole in the finished article. The next step is to make a three-cornered drift pin having a tapered or barrel shape, so that it can be more easily driven through the round hole. The other end has a five-sided or pentagon-shaped hole, a drift pin being made for it likewise, of the proper shape.



A WRENCH FOR FIRE PLUGS.

The handle is shaped and the whole given a finished appearance. The three successive stages are illustrated in their proper order.

HOW TO SOLDER ALUMINIUM.

BY WILLIAM HOOPER, E.E.

There is no solder which operates with aluminium in the same way that ordinary solders operate with copper, tin, etc. There are two reasons for this.

First. Aluminium does not alloy readily with solders at temperatures as low as the other metals require, and it is consequently necessary, in soldering aluminium, to use a much higher temperature. Furthermore, aluminium alloys with lead only with great difficulty and with but a small proportion of lead at that; consequently lead solders are useless with aluminium.

Second. The surface of all aluminium is covered with a thin invisible coating of aluminium oxide. This coating forms instantly on the surface of aluminium and is very refractory, and its presence is responsible for the high resistance of aluminium to corroding agents, since, although aluminium itself is soluble in a great many chemical compounds, this protective coating of oxide is insoluble in almost everything excepting hydrofluoric acid. While in general this coating of oxide is beneficial, in that it forms a perfect protection to the aluminium underneath, it is, by reason of its efficiency in this particular, responsible for the principal portion of the difficulty which occurs in soldering aluminium, as naturally no solder will alloy with aluminium oxide.

In soldering aluminium, therefore, it is necessary that this oxide must be removed before the soldering can take place; and as it forms again instantly after removal, it is necessary that the removal of the oxide and the covering with solder shall be simultaneous. In soldering other metals, the oxide can be removed chemically. With aluminium this is not possible, and it must be removed mechanically by abrasion.

Bearing these facts in mind, it will be readily understood how aluminium soldering must be done. All the surface to which it is intended that the solder shall adhere must first be tinned. This is accomplished by heating the metal to a temperature above the fusion point of the solder used, and then rubbing the surface with a stick of the solder, thus rubbing the oxide off the surface with the solder itself, and covering the exposed points with melted solder, all in the same motion. In order to make sure that the tinning is thorough, it is better to rub the surface with a steel or brass scratch brush while the solder on this surface is still molten. This insures a thorough job of tinning. After the edges to be united are thus tinned, they may be sweated together with pure block tin, with the aid either of a soldering iron or blast lamp.

With regard to the composition of aluminium solders, zinc appears to alloy with aluminium more readily than any other metal available for the constituent part of the solder; consequently all solders which will readily tin aluminium contain zinc in varying proportions. The solders which we have found to be most satisfactory are composed usually of tin, zinc, and a very small proportion of aluminium. These solders do not run very freely nor fuse as readily as ordinary solders, and it is necessary, as stated above, to use a higher temperature—so high in fact that extreme difficulty is found in using these solders with a soldering iron, and it is generally necessary to use a blast lamp.

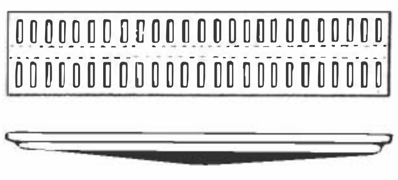
Another thing which must be borne in mind is that solder will not flow into an aluminium joint, even when tinned, by capillary action as it does into copper or tin joints, and it is therefore necessary to place on the surfaces to be united all of the material necessary to sweat them together before the edges are brought into contact. In soldering aluminium joints, it is necessary that both the tinning and sweating shall be most thoroughly done; otherwise the joint will not be durable.

On account of the presence of zinc in the tinning solder, the solder is decomposed by moisture, and unless the work is so well done that the joint is absolutely waterproof, it will not be durable. The quality of the workmanship has more influence than anything else on the permanence of the work.

STRAIGHTENING BUCKLED CASTINGS.

It is a rare occurrence for a long casting to leave the molds perfectly true and level. When cooling off in the sand, they often buckle out of shape. It is necessary, as in the case of drainage cover castings, for instance, to have them level, so that when the horses and vehicles pass over them, they will not tilt or shake. These castings are usually straightened in the blacksmith's shop in the following manner:

Take, for example, a grating like that shown below, which is used by street railways to allow the surface water to drain into the sewers, and which has to fit very snugly the recess of the trap box in which it lies. The casting is placed in the fire, and heated to a dark cherry red, when it is taken out and placed upon the anvil upside down. Two blocks of iron, about the size of a half brick, are placed at either end of the casting, and a section of car rail the length of the casting is placed on top. A couple of clamps are slipped over the rail and casting, in the center or where the buckling of the casting appears. The bolts of the clamps are then screwed up, at the same time using the wrenches with a quick turn, until the hollowness of the grating is about one-eighth of an inch more than necessary, which is tried by means of a straight edge. When the clamps are removed, the hollowness will be gone, and the casting will be found to be perfectly level.



STRAIGHTENING BUCKLED CASTINGS.