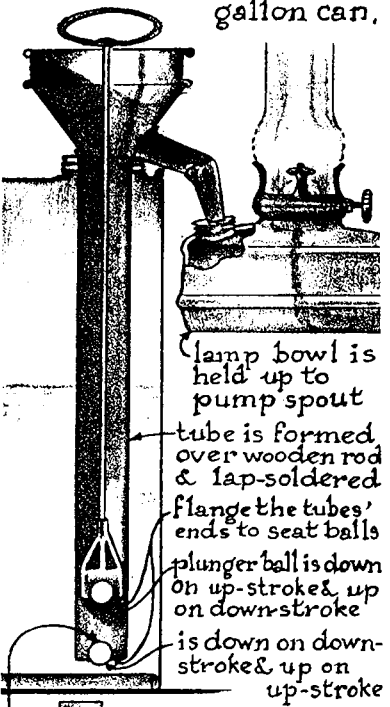
To make such a pump I followed a very simple design used throughout the Orient, where people pump kerosene from a five-gallon can into the little lamps they use every night.

It was in Java, Indonesia, that I saw such a little pump made before my own eyes. In the marketplace the tinsmith soldered together the various parts he had cut out with tinsnips from flattened five-gallon cans. None of the moving parts had been machined or put together in a machine-precisioned way.

The pumping is done by quick, short up-and-down movements of the plunger. There is some backflow leaking between the plunger and the cylinder, but it somehow does not reduce the pump's effectiveness. The liquid rises quickly to fill the open top part of the pump body so that the kerosene gently flows by gravity through the small spout into the lamp bowl.

It is this design, as I adapted it, that we are now following in the making of a larger pump to recycle waste water during a drought year.

pump to fill lamps with kerosene from standard gallon can.



lamp bowl is held up to pump spout

tube is formed over wooden rod & lap-soldered

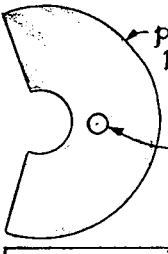
flange the tubes' ends to seat balls

plunger ball is down on up-stroke & up on down-stroke

is down on down-stroke & up on up-stroke

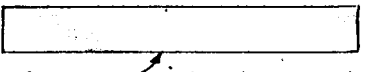
pattern for plunger cage is folded over a rod & lap-soldered

toy marbles act as valves

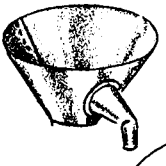


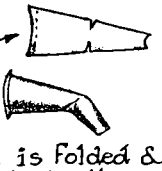
pattern for funnel part of pump top is joined with soldered lap joint

hole over which pump spout is soldered



after strip is bent in circle & soldered, it is flanged top & bottom, & folded over the funnel flange or soldered on



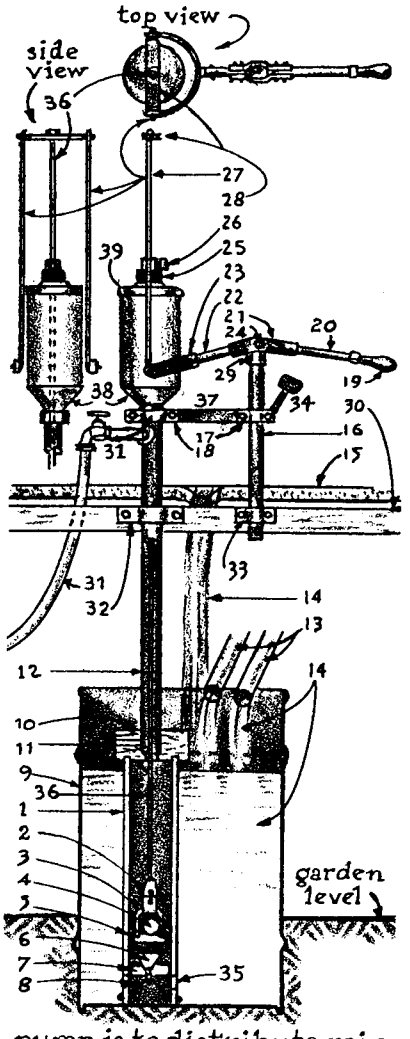


spout pattern is folded & bent, soldered at elbow & flanged at base to fit onto funnel & soldered to it

It must be remembered that each person wishing to make such a pump must do it from the odds and ends he has accumulated and that his supply is bound to differ from mine. The final appearance of his product, therefore, will probably be quite unlike the one I am showing here.

First note that the waste water from the bathroom tub and washbowl is collected in a fifty-gallon drum. The idea is to pump the water high up into some kind of a holding tank (38) and to make a bottom valve arrangement (6–7) to hold the column of water above it—without leaking, if possible. In this way the water can flow by gravity out of the holding tank for as long as it takes the hose to distribute the water.

Place the top holding tank a few feet *above* the garden level so the water will flow easily to it by gravity. Hand-pumping from time to time will distribute the water, saving on the use of electric energy at the same time.



pump is to distribute rain & waste water to garden

1 pump body is made of waste plastic drainpipe material
2 copper link~3 copper wire cage~4 rubber ball valve
5 copper valve seat~6 rubber valve~7 copper valve seat
8 rubber band~9 waterdrum
10 wooden coupling~11 set screw
12 electrical conduit pipe
13 plastic drainpipe~14 water
15 outdoor porch~16,17,18 clamps & brace~19 pump handle
20 handle bar~21 yoke~22-23 fork arm of handle bar
24 yoke hinge pin
25 rubber buffer~26 collar~
27 two linkage rods~28 yoke
29 hinge body~30 porch timber
31 garden hose take-off & bib
32 installation clamps~33 rain water from porch~34 rubber stop for pump handle
35 intake holes~plunger rod 36
37 brace
38 holding tank & lid 39

SELECTING THE MATERIAL FOR THE PUMP

Sections of ABS plastic drainpipes can often be found on house construction site scrap piles. This salvaged section was 4 inches in diameter.

The storage can is a fifty-gallon oil drum, often discarded or available at minimum cost in scrap yards. Coat it on the inside with hot roofing tar to make it rustproof.

Large diameter electrical conduit pipe is available from wrecking yards at very little cost or from heaps of waste thrown out during reconstruction of old buildings.

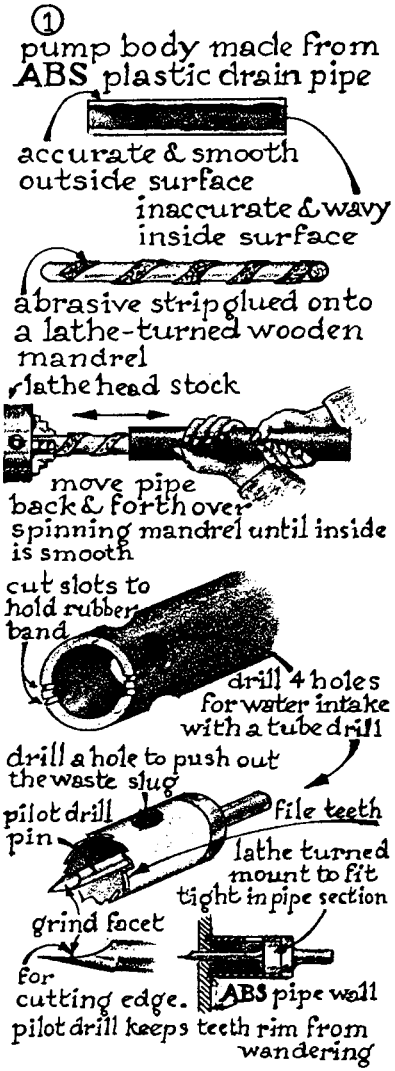
The three-gallon tank at the top happened to be on my own scrap pile. It was originally used in a milk separator machine. Anything else—a galvanized drum or small garbage can, for instance—would do.

The main pump rod (36) and linkage rods (27) are made from an unreeled coilspring heated at yellow heat and straightened (as described in my book *The Modern Blacksmith*). Hammer it out straight and remember that spring steel, even in an annealed state, remains resilient.

Large strips of steel are forged or bent into brackets or braces that can be anchored against a part of a building to brace the pump assembly spaced from the handle column in a clamping action.

All in all, the various small details shown in the illustration are likely to be accumulated, in one form or another, by most of us when gathering scrap steel, and especially by those who have geared their activities to such shop practices.

Once you have assembled the elements needed for this type of pump arrangement, begin with the major element.



THE PUMP BODY

The plastic pipe section I used proved to be smooth on the outside but not on the inside. Should this happen to be so in your case and should you have no other choice, you can make the inside accurate as shown in the illustrations.

First turn a wooden mandrel on the wood lathe. Glue onto it a cloth strip of coarse abrasive. It should barely fit the inside diameter of the pipe section. With the mandrel clamped in the lathe chuck, rotate it at normal speed. Slip the pipe section back and forth over the full length of this abrasive core. The pipe interior will thus be smoothed out.

THE INTAKE VALVE

It is here that you must apply some ingenuity to make do with the material that you have. My own decision was to let the total pump assembly rest upon the bottom of the fifty-gallon drum. This called for drilling intake holes 1 inch from the rim of the pipe bottom to allow the water to enter the pump chamber and placing the bottom valve just above them. I used a rubber toilet ball (6) for the bottom valve. To it I attached a strip of copper ending in a hook. I attached a rubber band to the hook to hold the ball down for a good seating. Each end of the rubber band was anchored in slots cut in the pipe rim.

NOTE: The holes in the plastic pipe body that let the water enter must be drilled with a drill that cannot wander sideways. A wandering drill in soft material might ruin the job.

Make a special drill with a 2-inch length of 3/4-inch conduit pipe. File teeth in its rim and crimp the other end on a little mandrel, which is turned on a lathe. It should have a protruding pilot pin as shown, which can act as a guide to the drill to prevent wandering. This mandrel can then be clamped into the drill chuck. Naturally, such special tools can serve for similar jobs in the future.

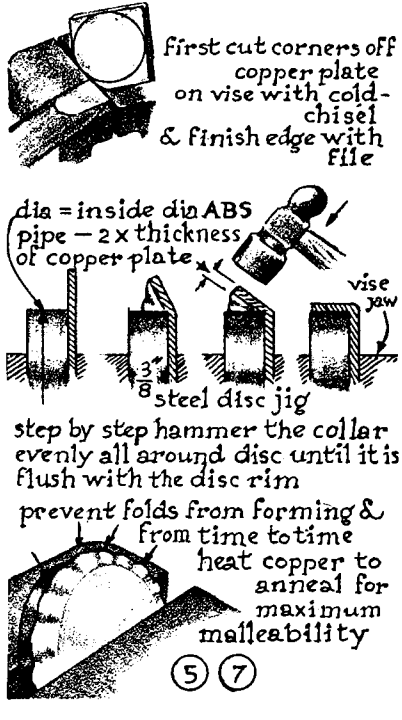
THE VALVE-SEATING DIAPHRAGMS

Over the years I have salvaged things made of copper, and for this job I chose an obsolete photoengraver's copper plate from which to make the valve-seating diaphragm.

Find a similar plate and cut out a disc with a cold chisel. Next, turn from a 3/8-inch thick scrap steel disc a base on which to form the ball-seating diaphragm. The illustration shows how to hammer gradually the edge of the copper disc around the 3/8-inch steel base. Once flanged over that base, the diaphragm will fit perfectly on the three-jaw chuck of the metal-turning lathe. Clamp it on and turn all hammered parts to an accurate fit after drilling a 5/8-inch-diameter hole in its center.

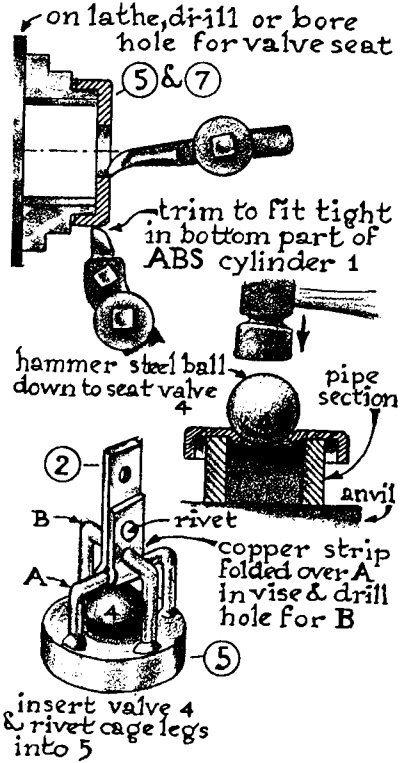
Next, rest the diaphragm on the anvil and place a 3/4-inch-diameter, large ball-bearing ball on the smaller valve hole in the diaphragm. Several gentle hammerblows on the ball will form a spherical seating in the copper, which yields readily to the blows.

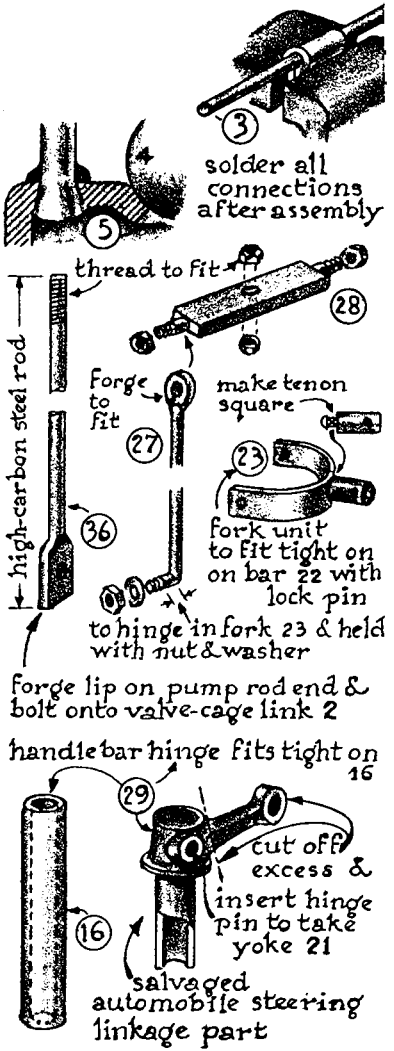
It is for an operation like this one that I never pass up the chance to collect the large steel balls from enormous ball bearings when I come across them. Most electric motor repair shops will have some to spare. Being of extreme hardness, they take a heavy hammerblow without denting, but will themselves dent softer material on which they are hammered, thus creating perfectly curved seatings.



Making the plunger valve is a little more complicated, but it is somewhat simplified if we keep in mind that none of its parts needs to be machine-accurate. If there is some leakage through backflow of the water it will prove to be insignificant. Up-and-down pumping will open the bottom valve at each stroke and add more water to the column above it, filling the holding tank on top in no time while the bottom valve easily holds it there without leaking.

Carry out the step-by-step procedure as illustrated and connect the plunger diaphragm to the pump plunger rod with a rivet. Notice from the illustrations how the copper strips are first bent over the pin with light hammering and then clamped in the vise to tighten them together. Next solder the pin and bent-over copper strip. Tin soldering is done best if the contact surfaces of the parts to be soldered are *previously* tinned so that, in assembly, the melting heat causes all tinned surfaces to fuse together easily.





THE PLUNGER ROD

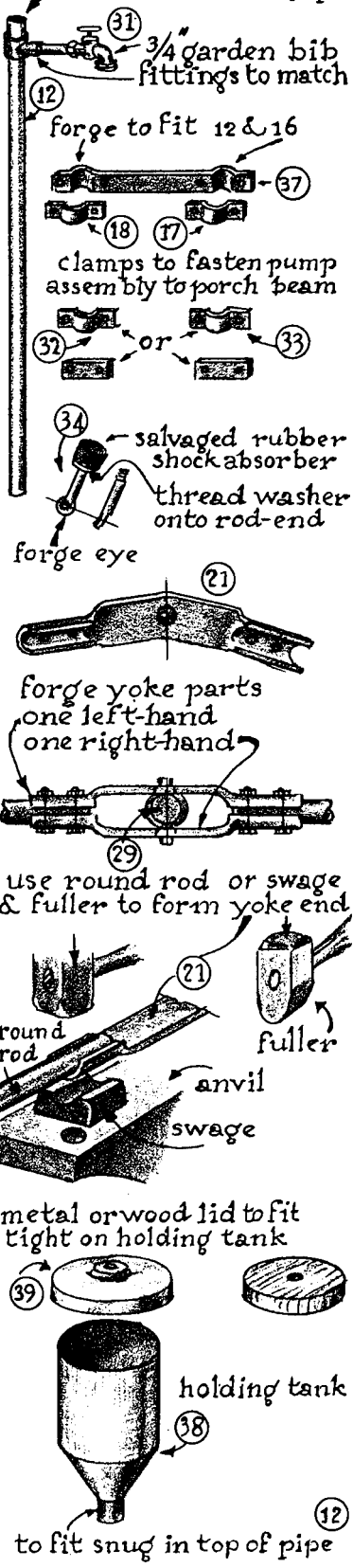
Widen by peening the hot end of the high-carbon steel plunger rod in a forging action. Drill a hole in the end to receive the rivet, which fastens it to the plunger valve unit (5).

The top end of the plunger rod is threaded to fit the yoke (28). This yoke has at each end a threaded stub to receive the two linkage rods (27), which in turn allow the forked unit (23) to fit the hooked-over endings of these linkage rods with little nuts and washers. The fork itself is riveted onto a bar (22). This bar is clamped with small bolts between the split yoke parts.

The *yoke* is made with two bars of suitable size and could be angled somewhat to suit the position of the operator in relation to the pumping action.

Hot forge the bar ends into a swage on the anvil to fit the roundness of the fork and handlebars. Depending on where you think the hinging point should be, drill holes in the bars to receive the hinge pins of the hinge body as shown in 29. Now all moving parts can be assembled.

galvanized plumbing pipe
or electrical conduit pipe



It seems unnecessary to elaborate how the remaining parts of the pump assembly are made and connected, since you will never find yourself in the identical circumstances as I was when gathering material to make those parts. The main thing is to understand the working of the pump, after which inventiveness is in order. You should not hesitate to make the pump as shown; it is very much within your reach to do so, if you use the illustrations simply as guidelines.

This chapter should have made clear that the craftsman with knowledge of machine-shop and blacksmith work never needs to shy away from making everything that he needs.