**If you know your altitude and the temperature of your water, Figure 1 will tell you the maximum allowable distance between the pump cylinder and the lowest water level expected. If the graph shows that lift pumps are marginal or will not work, then a force pump should be used. This involves putting the cylinder down in the well, close enough to the lowest expected water level to be certain of proper functioning.**

**The graph shows normal lifts. Maximum possible lifts under favorable conditions would be about 1.2 meters higher, but this would require slower pumping and would probably give much difficulty in "losing the prime."**

**Check predictions from the graph by measuring lifts in nearby wells or by experimentation.**

**Example:**

**Suppose your elevation is 2,000 meters and the water temperature is 25[degrees]C. The graph shows that the normal lift would be four meters.**

**Source:**

**Baumeister, Theodore. Mechanical Engineer's Handbook, 6th edition. New York: McGraw-Hill Book Co., 1958.**

**SIMPLE PUMPS**

**Chain Pump for Irrigation**

**The chain pump, which can be powered by hand or animal, is primarily a shallow-well pump to lift water for irrigation (see Figure 1). It works best when the lift**

**fig1ax96.gif (486x486)**

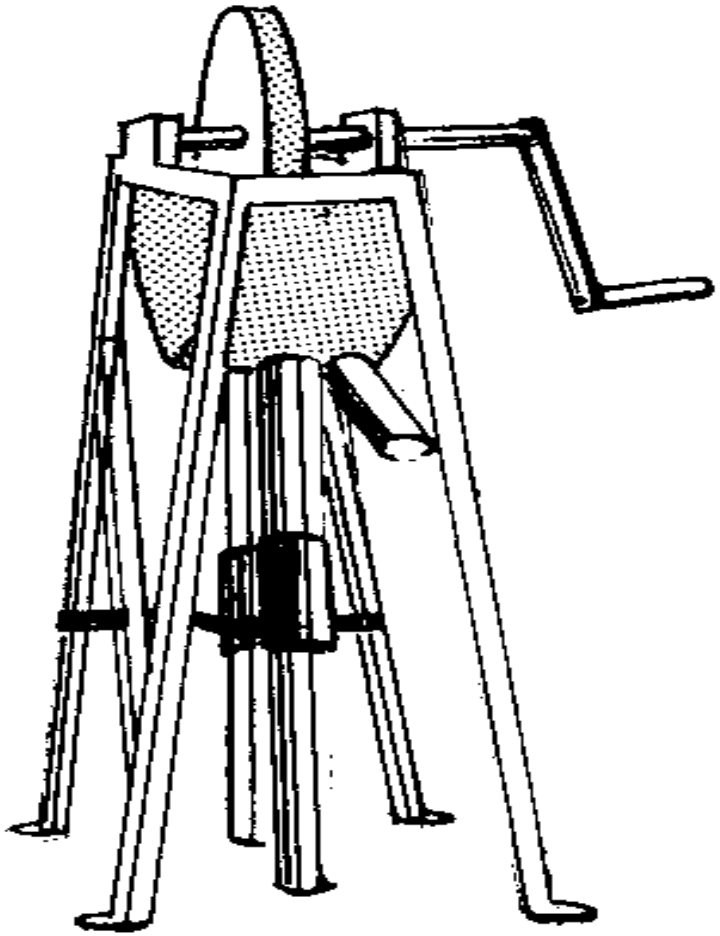


FIGURE 1

**is less than 6 meters (20'). The water source must have a depth of**

**about 5 chain links.**

**Both the pump capacity and the power requirement for any lift are proportional to the square of the diameter of the tube. Figure 2**

**fig2x97.gif (437x437)**

FIGURE 2

| LIFT | QUANTITY |
|---|---|
| 6 METERS (18 FEET) | 11 CUBIC METERS/HOUR (2906 GALLONS/HOUR) |
| 3 METERS (9 FEET) | 20 CUBIC METERS/HOUR (5284 GALLONS/HOUR |
| 1.5 TO 2 METERS (4.5 TO 6 FEET) | 25-30 CUBIC METERS/HOUR (6605 TO 7926 GALLONS/HOUR |

**shows what can be expected from a**

**10cm (4") diameter tube operated by four people working in two shifts.**

**The pump is intended for use as an irrigation pump because it is difficult to seal for use as a sanitary pump.**

**Tools and Materials**

**Welding or brazing equipment**
**Metal-cutting equipment**
**Woodworking tools**
**Pipe: 10cm (4") outside diameter, length as needed**
**5cm (2") outside diameter, length as needed**
**Chain with links about 8mm (5/16") in diameter, length as needed**
**Sheet steel, 3mm (1/8") thick**
**Sheet steel, 6mm (1/4") thick**
**Steel rod, 8mm (5/16") in diameter**
**Steel rod, 12.7mm (1/2") in diameter**
**Leather or rubber for washers**

**The entire chain pump is shown in Figure 3. Details of this pump can be changed**

**fig3x98.gif (600x600)**

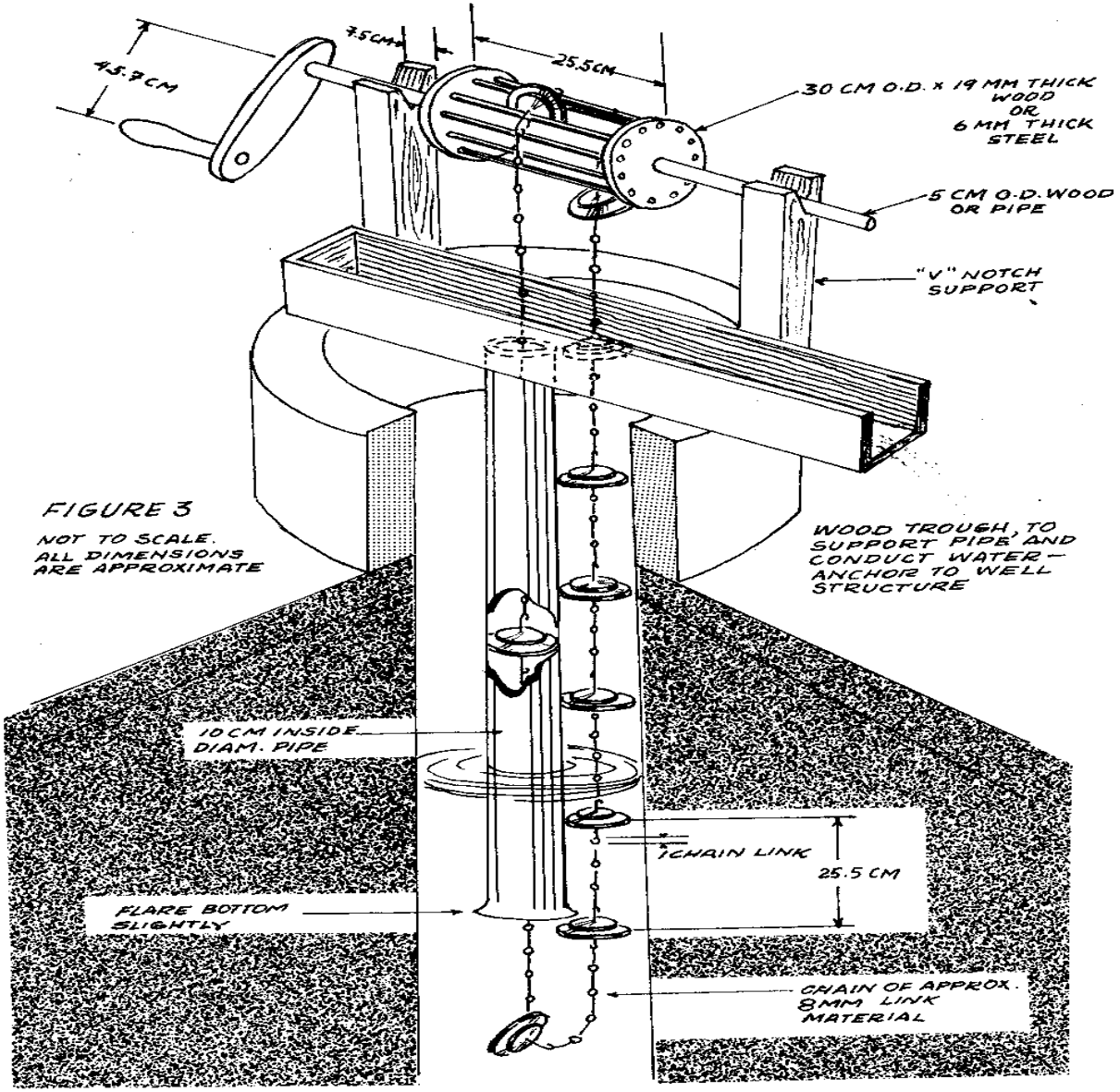
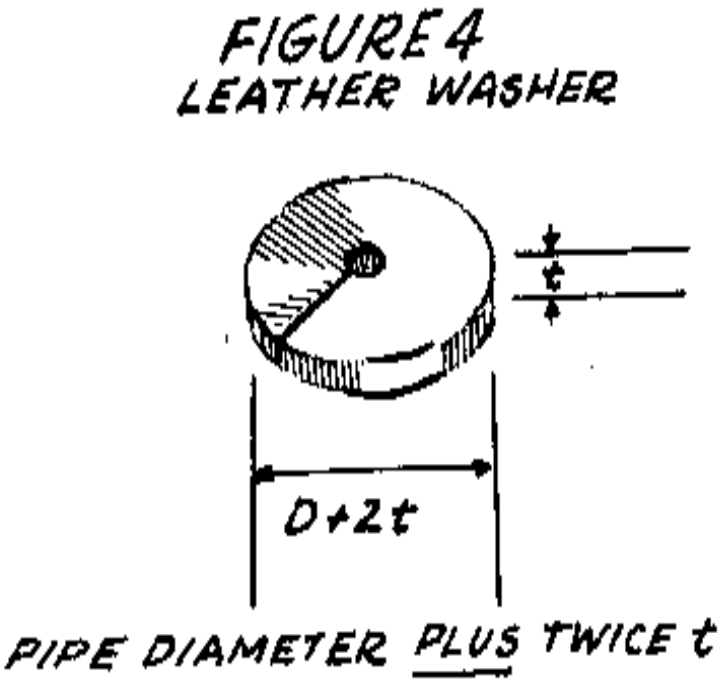



FIGURE 3
NOT TO SCALE. ALL DIMENSIONS ARE APPROXIMATE

**to fit materials available and structure of the well.**

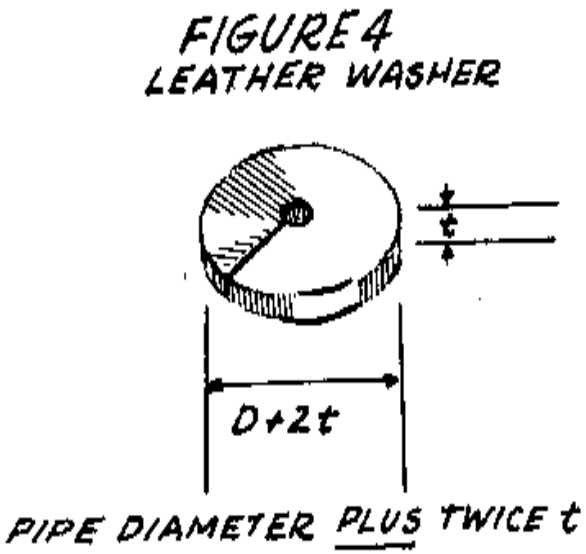
**The piston links (see Figures 4, 5, 6 and 7) are made from three parts:**

**fig4x990.gif (393x393)**




**1. a leather or rubber washer (see Figure 4) with an outside diameter about**

**fig4x99.gif (317x317)**

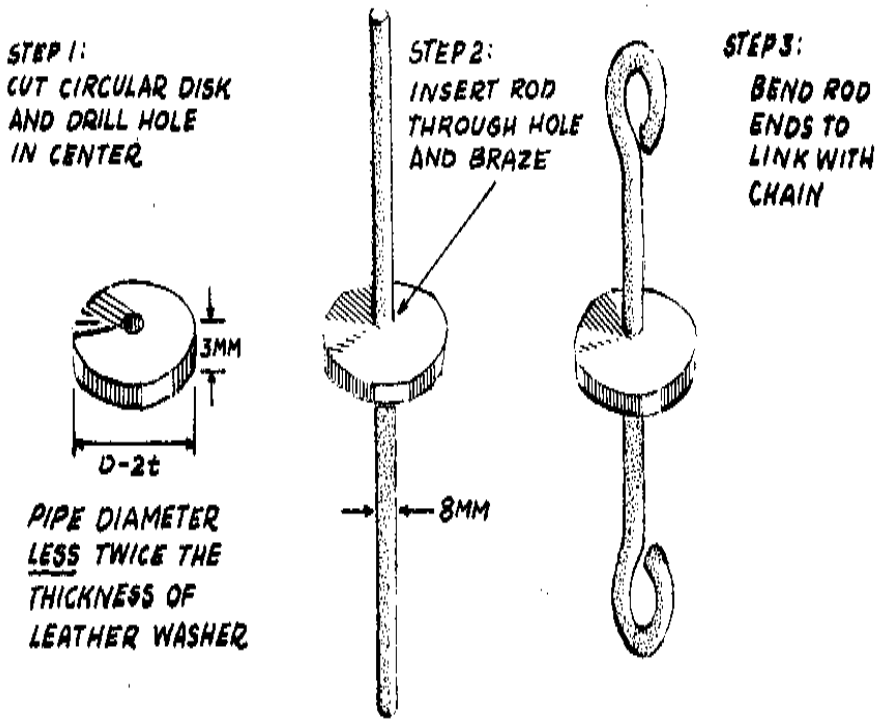



**two thicknesses of a washer larger than the inside diameter of the pipe.**

**2. a piston disk (see Figure 5).**

**fig5x99.gif (437x437)**

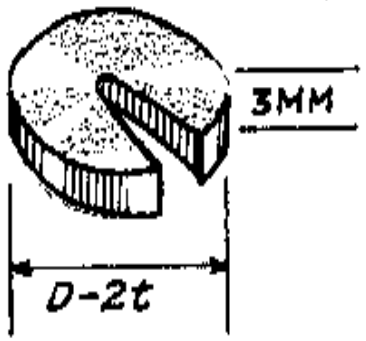
FIGURE 5




**3. a retaining plate (see Figure 6).**

**fig6x100.gif (317x317)**

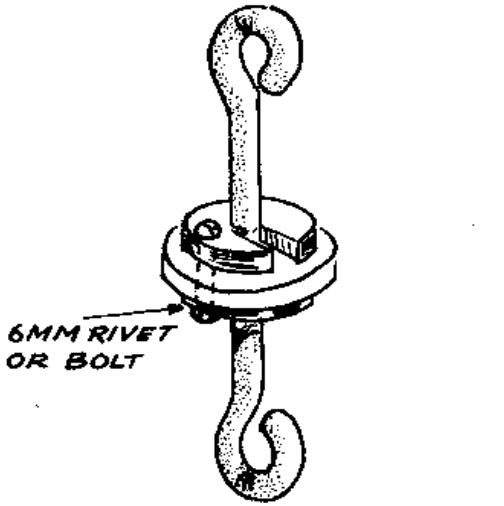
FIGURE 6
RETAINING PLATE




**The piston link is made as shown in Figure 7. Center all three parts and clamp**

**fig7x100.gif (317x317)**

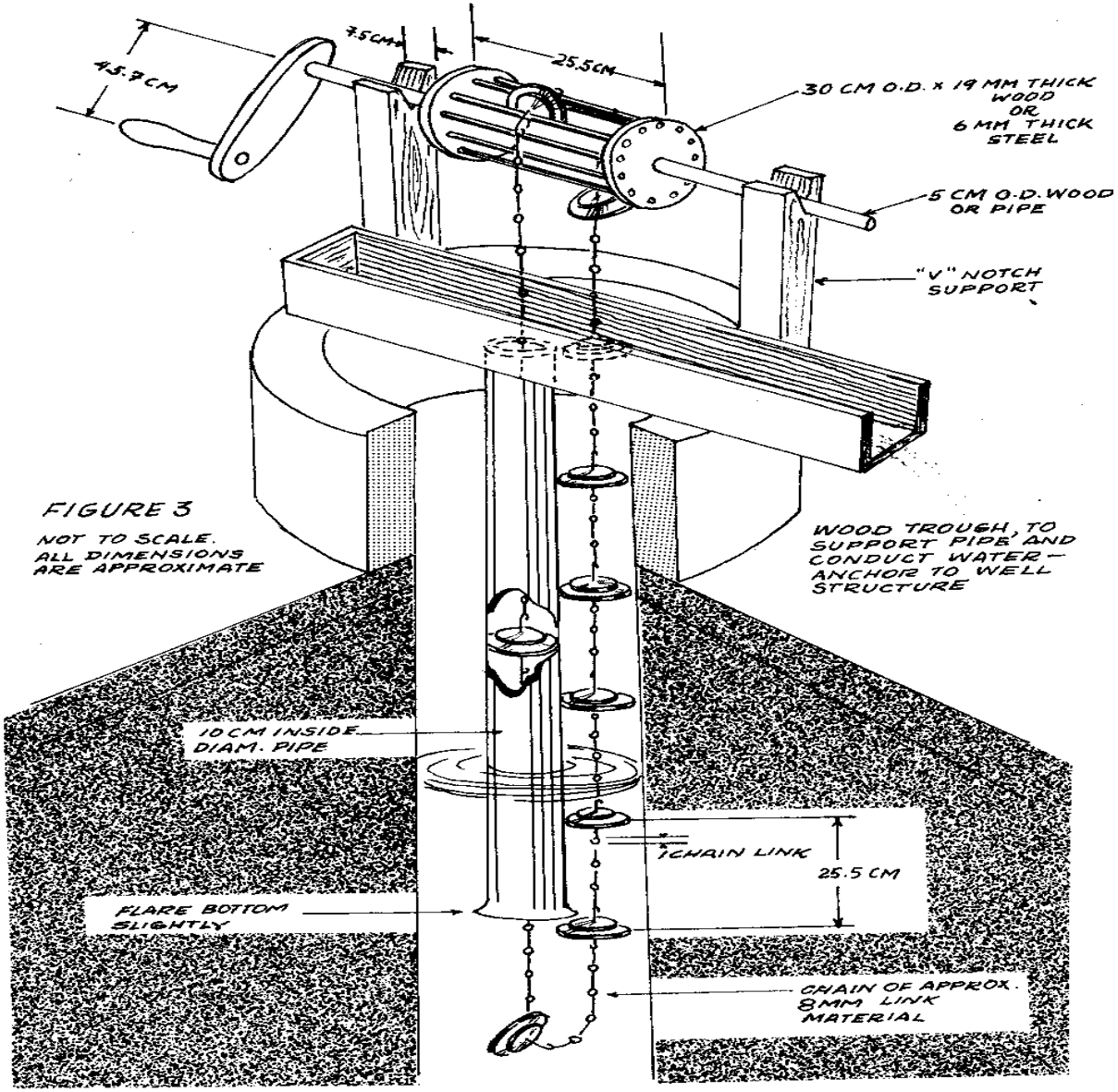
FIGURE 7
PISTON LINK
ASSEMBLED




**them together temporarily. Drill a hole about 6mm (1/4") in diameter through all three parts and fasten them together with a bolt or rivet.**

**The winch is built as shown in Figure 3. Two steel disks 6mm (1/4") thick are**

**fig3x98.gif (600x600)**




**welded to the pipe shaft.**

**Twelve steel rods, 12.7mm (1/2") thick, are spaced at equal distances, at or**

near
the outside diameter, and are welded in place. The rods may be laid on the outside of the disks, if desired.

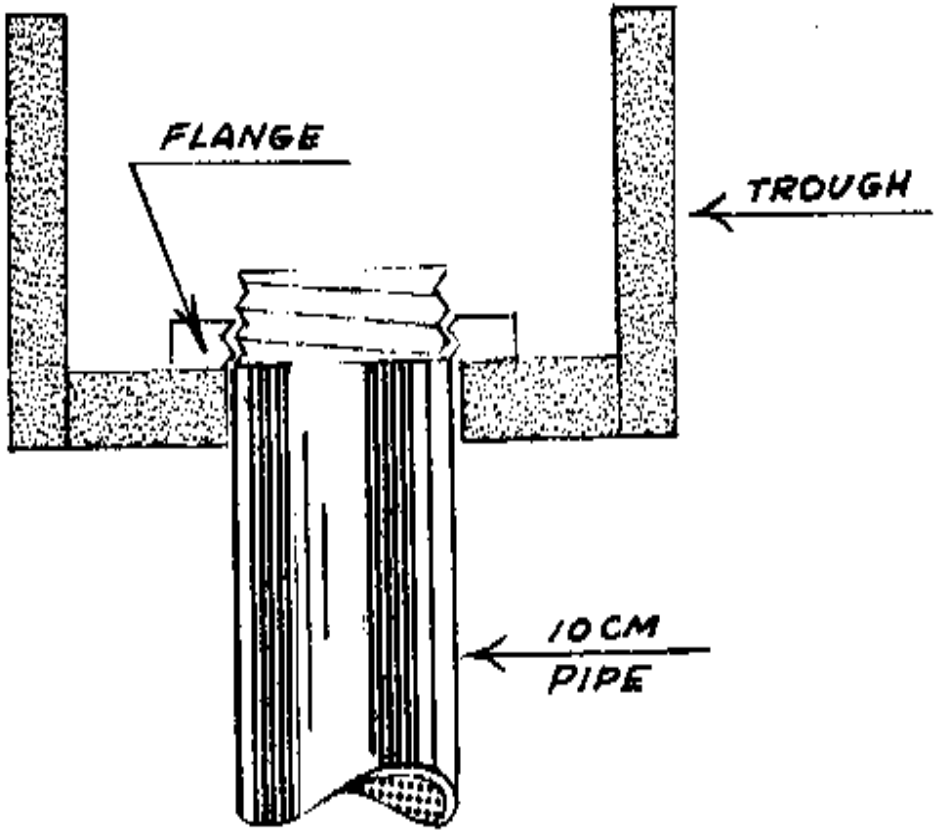
A crank and handle of wood or metal is then welded or bolted to the winch shaft.

The supports for the winch shaft (see Figure 3) can be V-notched to hold the shaft, which will gradually wear its own groove. A strap or block can be added across the top, if necessary, to hold the shaft in place.

The pipe can be supported by threading or welding a flange to its upper end (see Figure 8).

fig8x100.gif (540x540)

FIGURE 8 PIPE SUPPORT




**The flange should be 8mm to 10mm (5/16" to 3/8") thick. The pipe passes through a hole in the bottom of the trough and hangs from the trough into the well.**

**Sources:**

**Robert G. Young, VITA Volunteer, New Holland, Pennsylvania**

**Molenaar, Aldert. Water Lifting Devices for Irrigation. Rome: Food and Agriculture
Organization, 1956.**

**Inertia Hand Pump**

**The inertia hand pump described
here (Figure 1) is a**

**fig1x101.gif (600x600)**