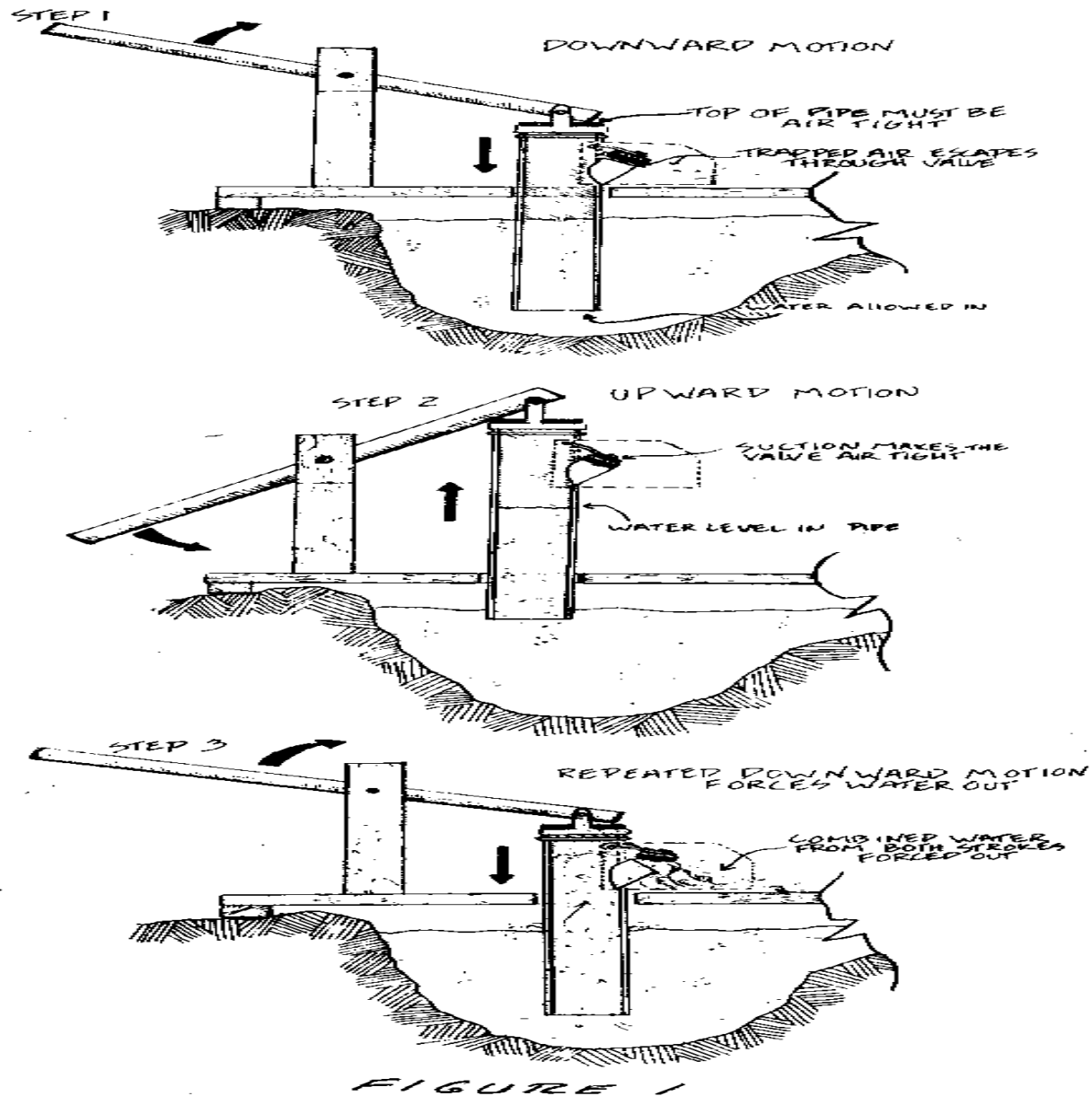Robert G. Young, VITA Volunteer, New Holland, Pennsylvania

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)

STEP 1

DOWNWARD MOTION

TOP OF PIPE MUST BE AIR TIGHT

TRAPPED AIR ESCAPES THROUGH VALVE

WATER ALLOWED IN

STEP 2

UPWARD MOTION

SUCTION MAKES THE VALVE AIR TIGHT

WATER LEVEL IN PIPE

STEP 3

REPEATED DOWNWARD MOTION FORCES WATER OUT

COMBINED WATER FROM BOTH STROKES FORCED OUT

FIGURE 1

**very efficient pump for lifting water short distances. It lifts water 4 meters (13') at the**

rate of 75 to 114 liters (20 to
30 U.S. gallons) per minute. It
lifts water 1 meter (3.3') at
the rate of 227 to 284 liters
(60 to 75 gallons) per minute.
Delivery depends on the number
of persons pumping and
their strength.

The pump is easily built by a
tinsmith. Its three moving
parts require almost no maintenance.
The pump has been
built in three different sizes
for different water levels.

The pump is made from galvanized
sheet metal of the
heaviest weight obtainable
that can be easily worked by
a tinsmith (24- to 28-gauge
sheets have been used successfully).
The pipe is formed
and made air tight by soldering
all joints and seams.
The valve is made from the
metal of discarded barrels and
a piece of truck inner tube
rubber. The bracket for

**attaching the handle is also made from barrel metal.**

**Figure 1 shows the pump in operation. Figure 2 gives the**

**fig2x103.gif (600x600)**

## FIGURE 2

| PART | MATERIAL | 8 CM PIPE | 10 CM PIPE | 15 CM PIPE |
|---|---|---|---|---|
| HANDLE BRACKET | BARREL METAL | | | |
| A | | 34 CM | 40 CM | 54 CM |
| B | | 24 | 30 | 44 |
| C | | 5½ | 5 | 8½ |
| D | | 7 | 10 | 17 |
| SHIELD | GALVANIZED TIN | | | |
| E | | 43 | 49 | 61 |
| F | | 14 | 16 | 20 |
| G | | 14 | 16 | 20 |
| H | | 3 | 3 | 2½ |
| I | | 8 | 10 | 15 |
| J | | 4 | 4 | 4 |
| K | | 30 | 30 | 32 |
| SHIELD COVER | GALVANIZED TIN | | | |
| L | | 15 | 17 | 21 |
| M | | 20 | 20 | 22 |
| N | BARREL METAL | 6 | 8 | 12 |
| O | INNER TUBE RUBBER | 11 | 13 | 18 |
| P | BARREL METAL | 11 | 13 | 18 |
| Q | WIRE (4 MM) | 16 | 18 | 22 |
| HANDLE | WOOD POLE | | | |
| POST | WOOD POST | | | |

dimensions of parts for pumps
in three sizes and Figure 3

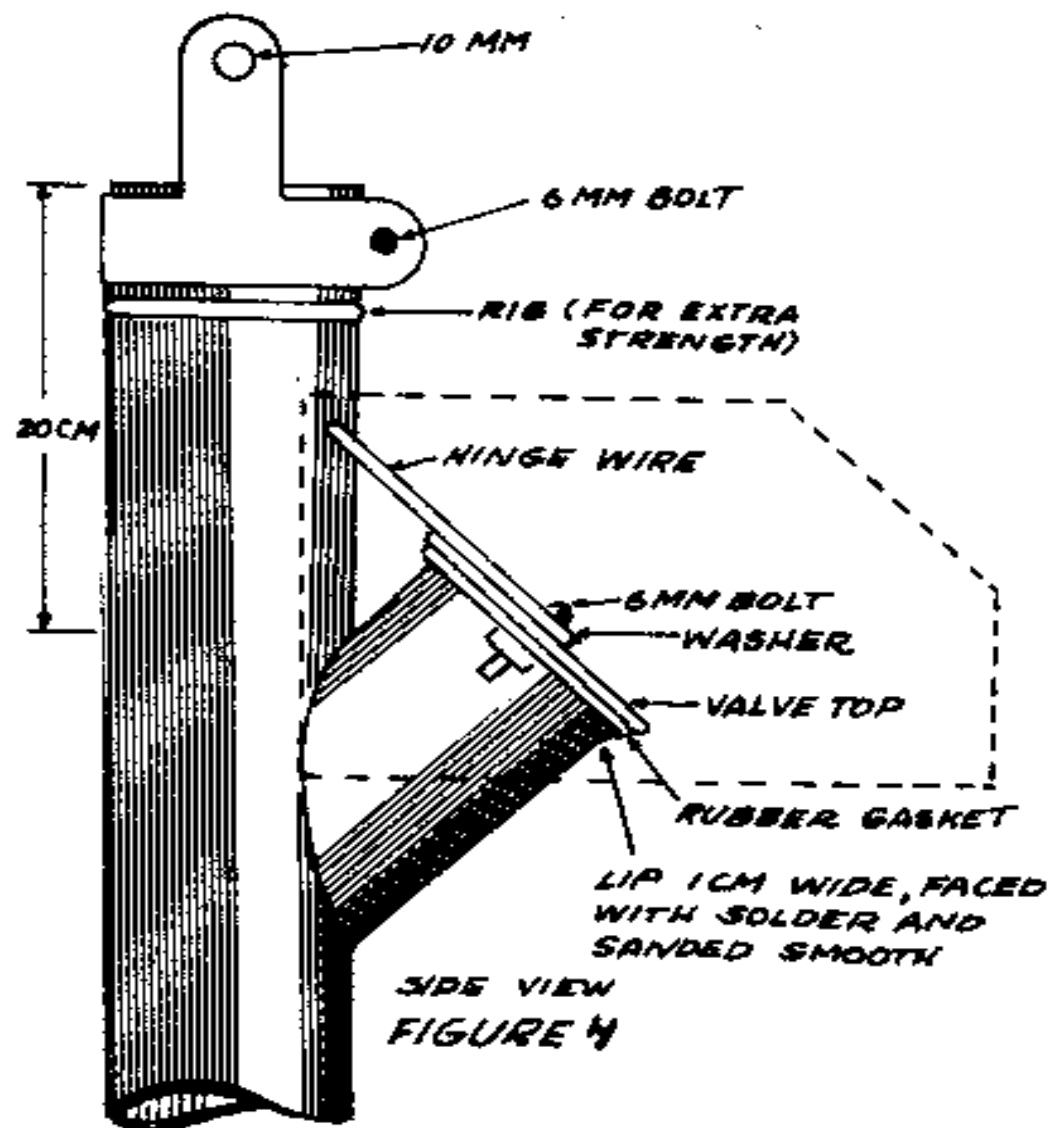**fig3x103.gif (393x393)**

FIGURE 3

| DIAMETER OF PIPE | LENGTH OF PIPE | HEIGHT OF LIFT | LITERS PER MINUTE AT 1830 METERS ELEVATION |
|---|---|---|---|
| 8 CM | 450 CM | 2 TO 4 METERS | 75 TO 114 |
| 10 CM | 270 CM | 1 TO 2 METERS | 114 TO 152 |
| 15 CM | 140 CM | 1 METER | 227 TO 284 |

**shows the capacity of each size. Figures 4, 5, and 6 are**

**fig41030.gif (600x600)**

10 MM

6 MM BOLT

RIB (FOR EXTRA STRENGTH)

20 CM

HINGE WIRE

6 MM BOLT
WASHER
VALVE TOP

RUBBER GASKET

LIP 1 CM WIDE, FACED WITH SOLDER AND SANDED SMOOTH

SIDE VIEW
FIGURE 4

## Tools and Materials
## (for 1-meter (3.3') pump)

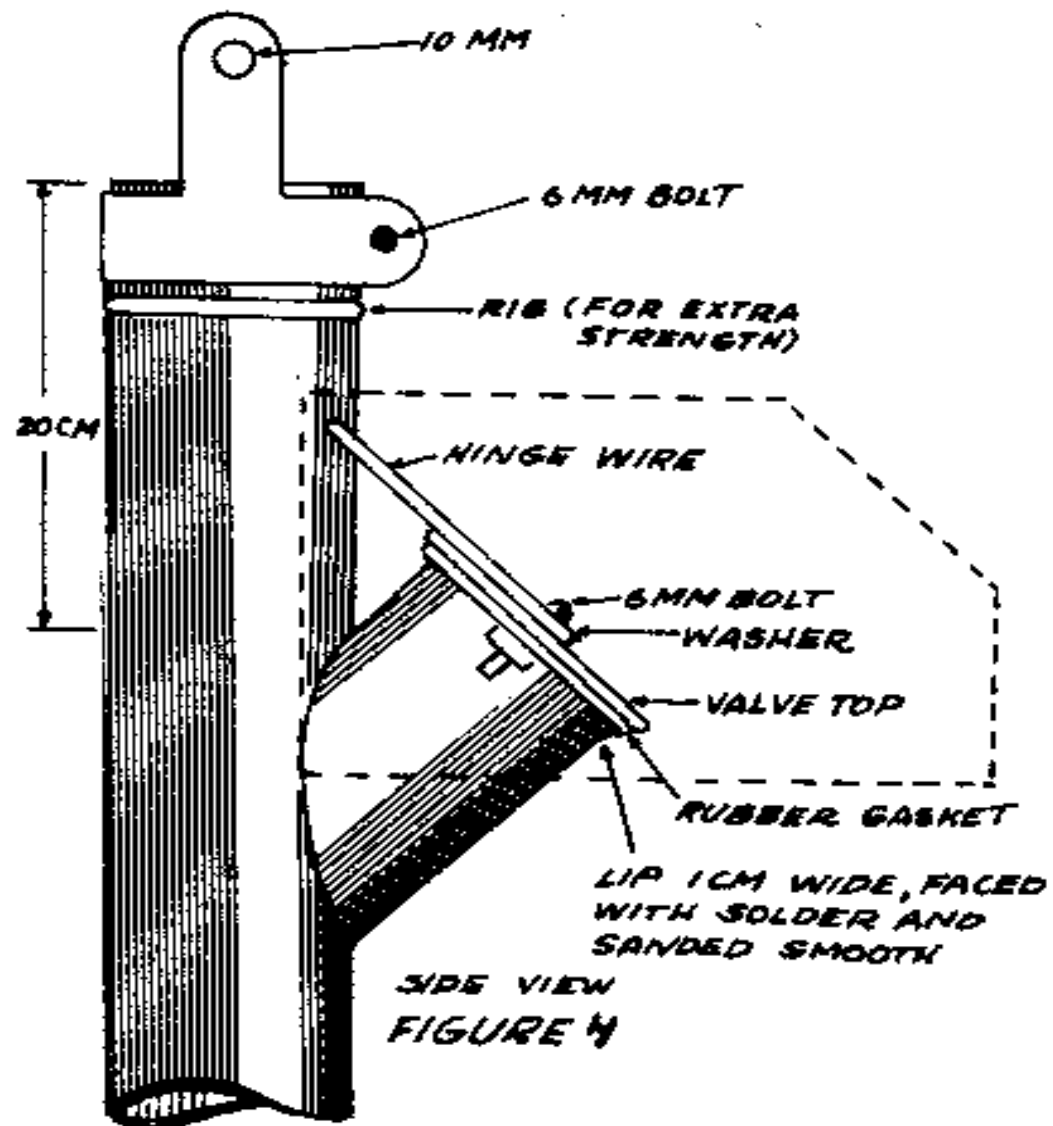Soldering equipment
Drill and bits or punch
Hammer, saws, tinsnips
Anvil (railroad rail or iron pipe)
Galvanized iron (24 to 28 gauge):
Shield: 61cm x 32cm, 1 piece (24" x 12 5/8")
Shield cover: 21cm x 22cm, 1 piece (8 1/4" x 8 5/8")
Pipe: 140cm x 49cm, 1 piece (55 1/8" x 19 1/4")
Top of pipe: 15cm x 15cm, 1 piece (6" x 6")
"Y" pipe: 49cm x 30cm, 1 piece (19 1/4" x 12")
Barrel metal:
Bracket: 15cm x 45cm, 1 piece (6" x 21 1/4")
Valve-bottom: 12cm (4 3/4") in diameter, 1 piece
Valve-top: 18cm (7 1/8") in diameter, 1 piece
Wire:
Hinge: 4mm (5/32") in diameter, 32cm (12 5/8") long


This pump can also be made from plastic pipe or bamboo.


There are two points to be remembered concerning this pump. One is that the
distance from the top of the pipe to the top of the hole where the short section
of pipe is connected must be 20cm (8"). See Figure 4. The air that stays in the


fig4x103.gif (600x600)

10 MM

6 MM BOLT

RIB (FOR EXTRA STRENGTH)

20 CM

HINGE WIRE

6 MM BOLT
WASHER
VALVE TOP

RUBBER GASKET

LIP 1 CM WIDE, FACED WITH SOLDER AND SANDED SMOOTH

SIDE VIEW
FIGURE 4

pipe above this junction serves as a cushion (to prevent "hammering") and regulates the number of strokes pumped per minute. The second point is to remember to operate the pump with short strokes, 15 to 20cm (6" to 8"), and at a

rate of about 80 strokes per minute. There is a definite speed at which the pump
works best and the operators will soon get the "feel" of their own pumps.


In building the two larger size pumps it is sometimes necessary to strengthen
the
pipe to keep it from collapsing if it hits the side of the well. It can be
strengthened
by forming "ribs" about every 30cm (12") below the valve or banding with
bands made from barrel metal and attached with 6mm (1/4") bolts.

The handle is attached to the pump and post with a bolt 10mm (3/8") in diameter,
or a large nail or rod of similar size.

Source:
Dale Fritz, VITA Volunteer, Schenectady, New York.

Handle Mechanism for Hand Pumps

The wearing parts of this durable handpump handle mechanism are wooden (see
Figure 1).

fig1x105.gif (600x600)