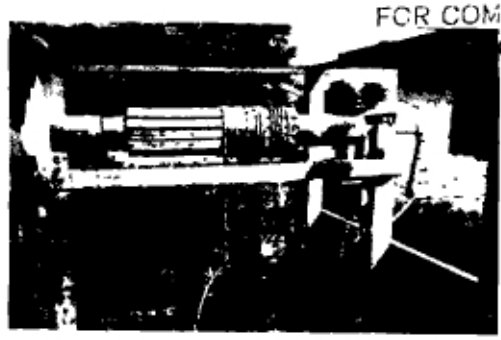
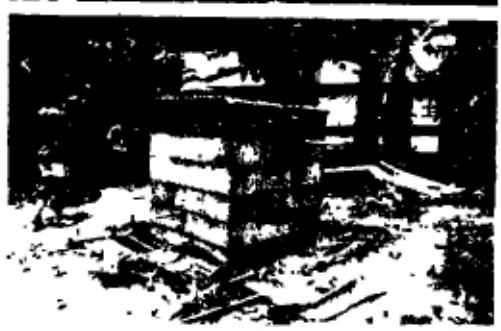
# REPUBLIC OF LIBERIA

# JAIL WINDLASS SHALLOW WELL

## CONSTRUCTION GUIDE







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**WHO Sanitary Engineer**

MOH SW

WHO

UNICEF

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# SAFE WINDLASS TYPE SHALLOW WELL

The well has been successfully tested for two years. The tests proved that the mechanism and the superstructure are very easy to construct, operate and maintain, prevent pollution of the water and the cost is much lower than the hand pump well. Besides handpumps often fail and it usually takes long time to be repaired for want of spare parts and skilled mechanics.

The lifting mechanism is the well known windlass, used for centuries. The new element is the hose, attached to the bottom of the bucket and the outlet pipe. When the bucket full of water is lifted above the level of the outlet pipe, the water flows out through the hose. This arrangement allows to completely close the well. There is no contact between the people or the environment and the water or the mechanism, therefore the water can not be contaminated. The bucket-hose-outlet pipe arrangement is very reliable and the position of the bucket is not critical as in other types of mechanisms.

This construction can be used for wells up to 33 ft. (10 m) deep from the ground surface to the water level.

When the well is deeper, more than 1/2 gallon (2 l) of the water remains in the hose and cannot reach the surface, thus reducing the efficiency.

Two alternatives have been considered in the following drawings. The windlass and the whole lifting mechanism are the same in both cases. Different are only the superstructures.

In the first alternative the superstructure is built out of logs. It looks heavy and not tidy, but is cheaper because wood is available everywhere and could be cut by the villagers at no cost. The total cost of the materials to be purchased including lifting mechanism, zinc sheet roof and cement is approximately $150. One of the roof sheets should be made removable for inspection, repairs and changing the pot chlorinator.

In the second alternative, the superstructure is made of planks and is more elegant, but the cost will be increased by $80.

The most critical component of the mechanism is the hose. It should be flexible, durable and should always retain its circular form. It should easily allow bending at a radius of 8" (20 cm) without changing the circular form. The best results have been obtained with 3/4" synthetic hose with light synthetic reinforcement, produced by the Greek Company A. G. Petzetakis S. A. (type "Helivyl Glass Clear"). After two years, this hose did not show signs of deterioration.

As the outside diameter of the outlet pipe is larger than the inside diameter of the hose, its edge should be heated for easier fixing.

The rope is ordinary nylon 05/16" (8mm) rope and should not tend to twist.

The lengths of the hose and the rope can be determined by means of the following relations.

Length of the hose = h + 59" (150 cm)

Length of rope = h + 130" (330 cm).

This length is with some reserve. The exact length, depending on the seasonal water level should be

determined practically and then the rope should be fixed on the windlass by means of a nail.

The construction starts with nailing the lowest layer of planks (Fig. 1), leveling the horizontal and vertical planks and temporarily fixing the tops of the vertical planks. When two planks are nailed in the front side, the outlet pipe on which the hose has already been attached, should be fixed on the supporting plank (Fig. 2). When the construction reaches the height shown in Fig. 3, the two 3" x 4" planks are leveled and nailed on the side planks. Then the windlass can be installed, followed by the rope and the bucket.

The position of the windlass in relation to the center of the well should be determined by the diameter of the well and the flexibility of the hose, so that the minimum distance between the rope and the wall of the well is 16" (40 cm).

After fixing on the rope, the bucket should be put several times up and down by means of the windlass until the rope finds its position on the windlass and stops spinning. Then the hose should be fixed to the bucket, observing the direction in which the hose naturally bends

(determined by the factory packing of the hose). Details for these attachments are shown in the drawings.

The metal parts should preferably be painted to reduce rusting. For lubrication of the windlass bearings any type of oil or grease can be used.

Fig. 3 and Fig. 4 show two different types of windlass. The wooden drum shown in Fig. 4 is made of one piece of wood (as shown also in the details). The type shown in Fig. 3 and on the close-up photograph (Fig. 5) is made of six short pieces, four of which are joined together by means of 3/4" planks.

After the construction is completed, the concrete apron around the well is made and covered with banana leaves or wet rugs (Fig. 6). After a week, the well can be used. Fig. 7 shows completed well in operation.

A hook made of rope should be attached to the windlass handle to keep the bucket in upward position, when not in use.

It is advisable to fix steel bands (appr. 1") around both sides of the windlass wooden drum by means of nails to reduce forming of cracks in the drum.

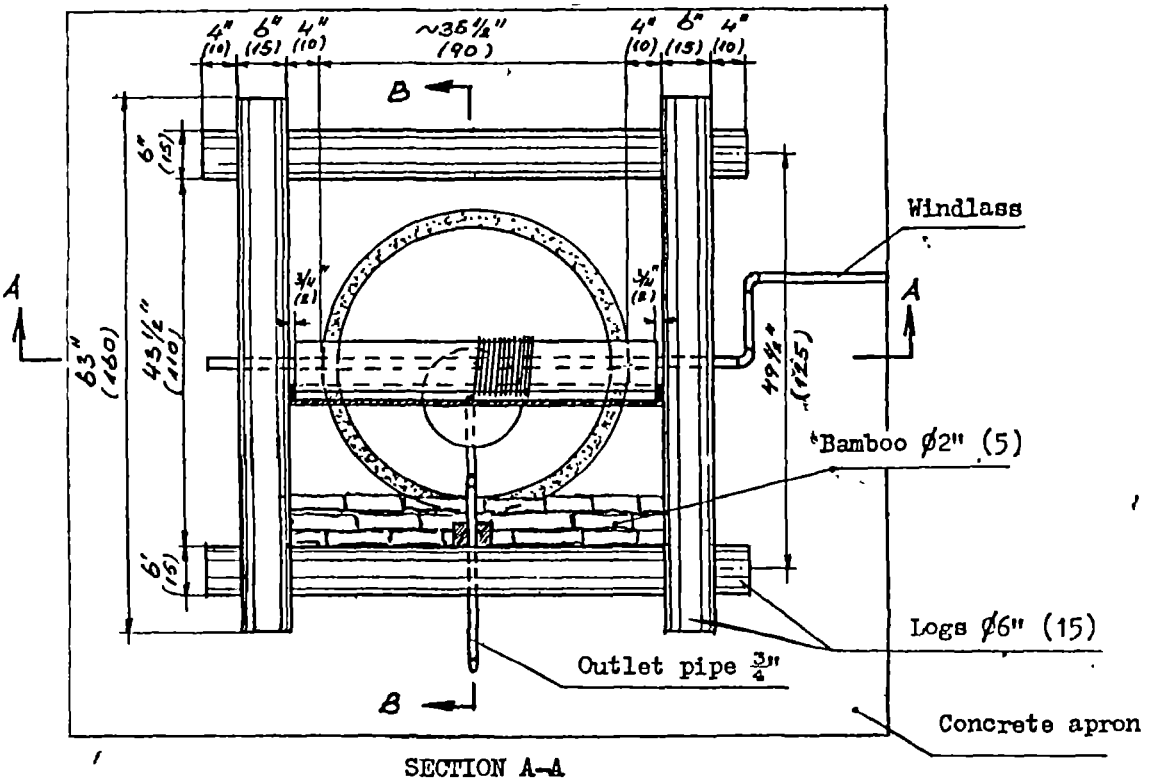
As buckets in this country are manufactured of very thin sheets, they are not very strong and durable. It is strongly recommended therefore that the bucket is made to order from 1.5mm thick steel sheet and painted with oil paint.

All dimensions are in inches. Dimensions in parenthesis are in centimeters.

This unit has been developed in the scope of project LIB/CWS/001. The experiments have been jointly financed by WHO and UNICEF and have been carried out with an active participation of the Ministry of Health and Social Welfare. Printing of this paper was possible through a grant provided by UNICEF.

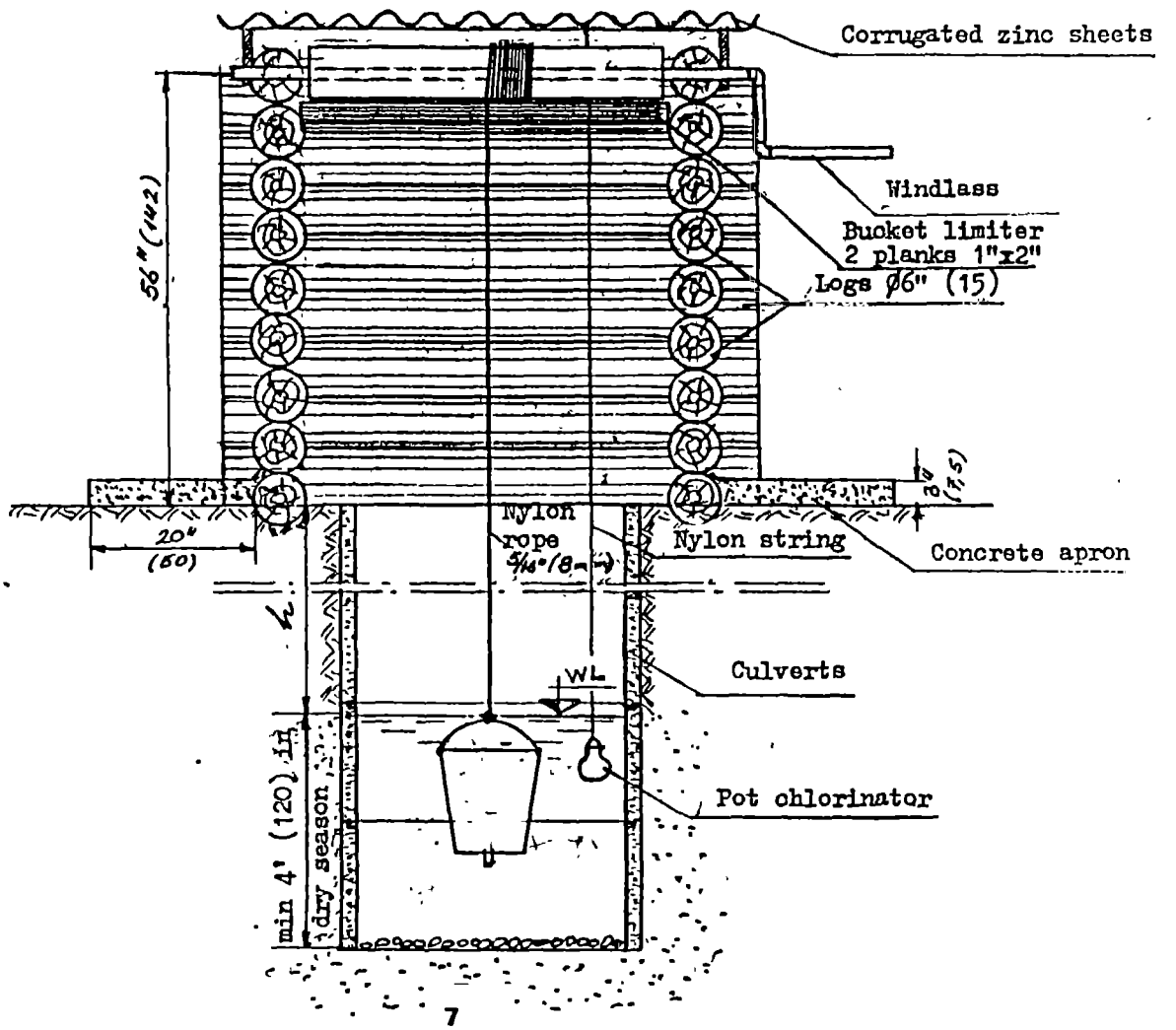
FIRST ALTERNATIVE

PLAN 1:20



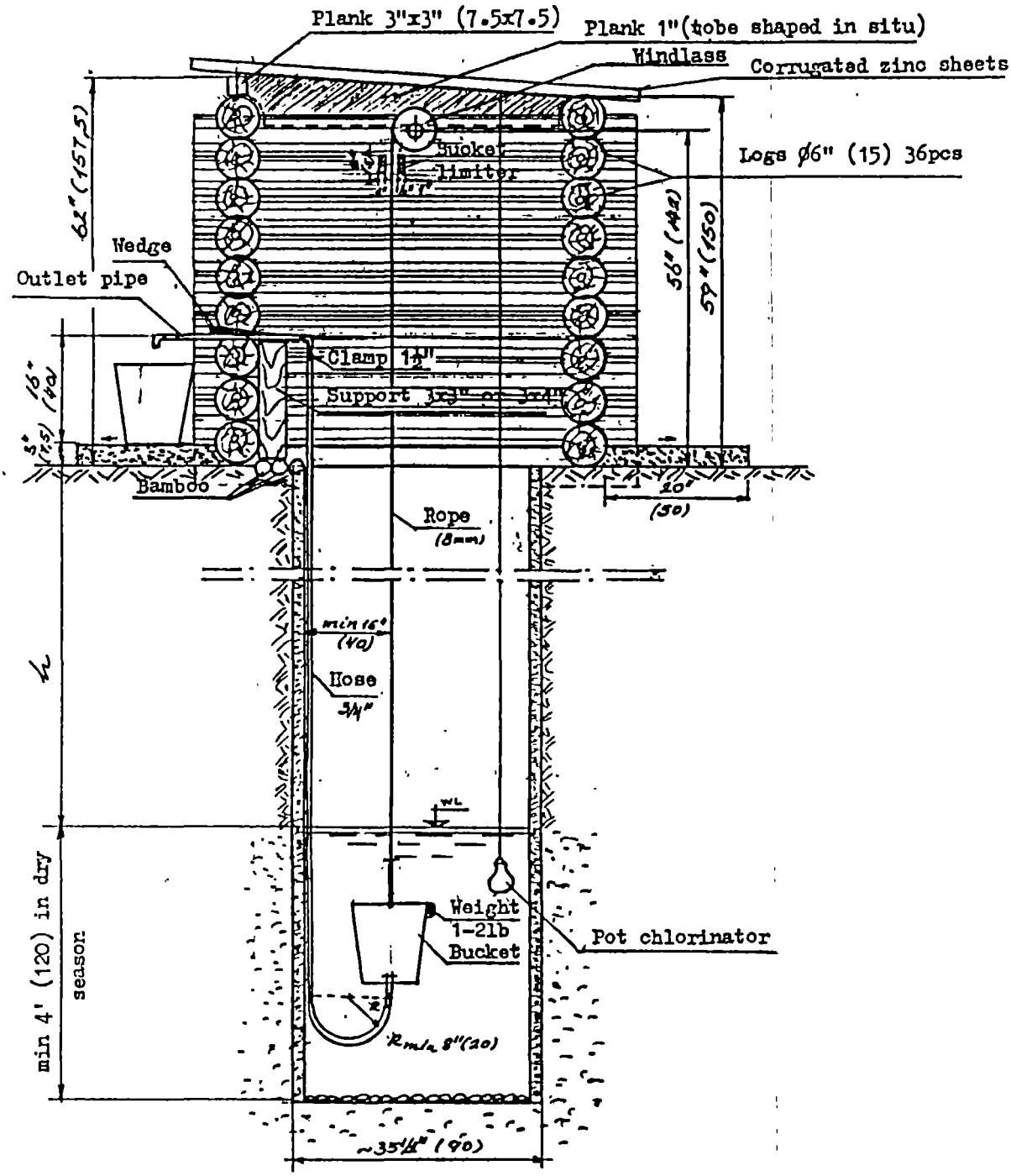

SECTION A-A

1:20



SECTION B-B

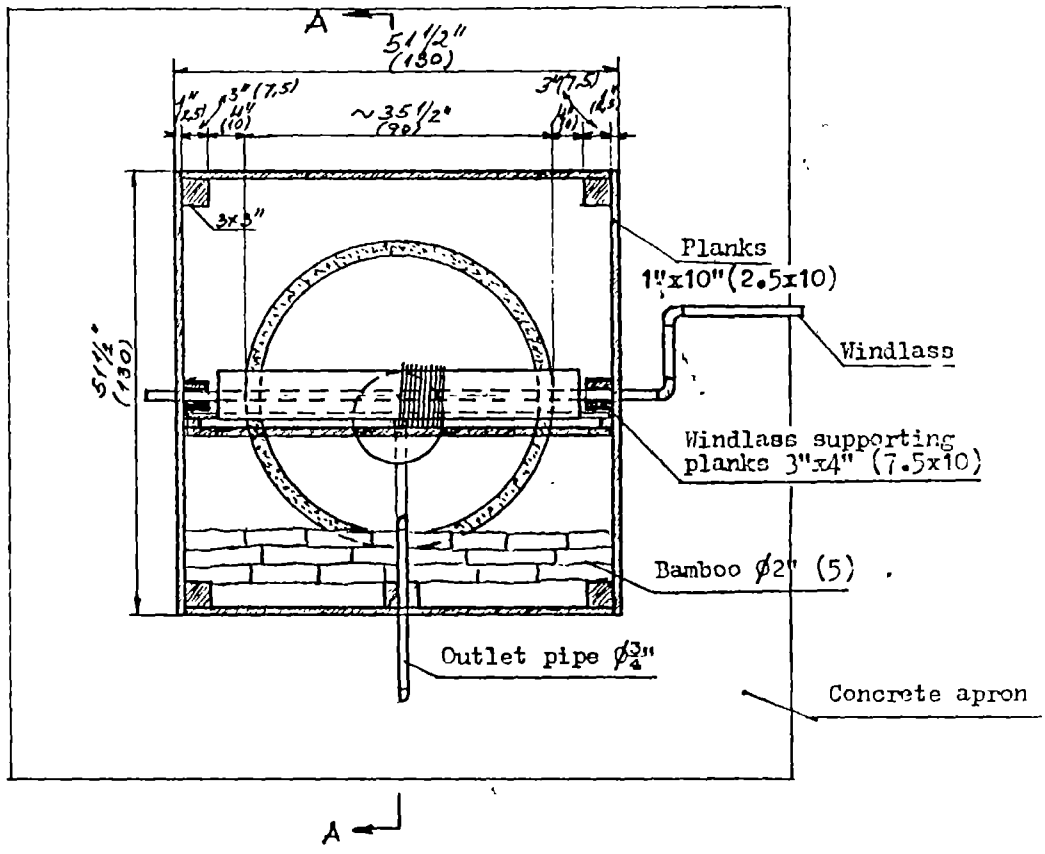
1:20



SECOND ALTERNATIVE

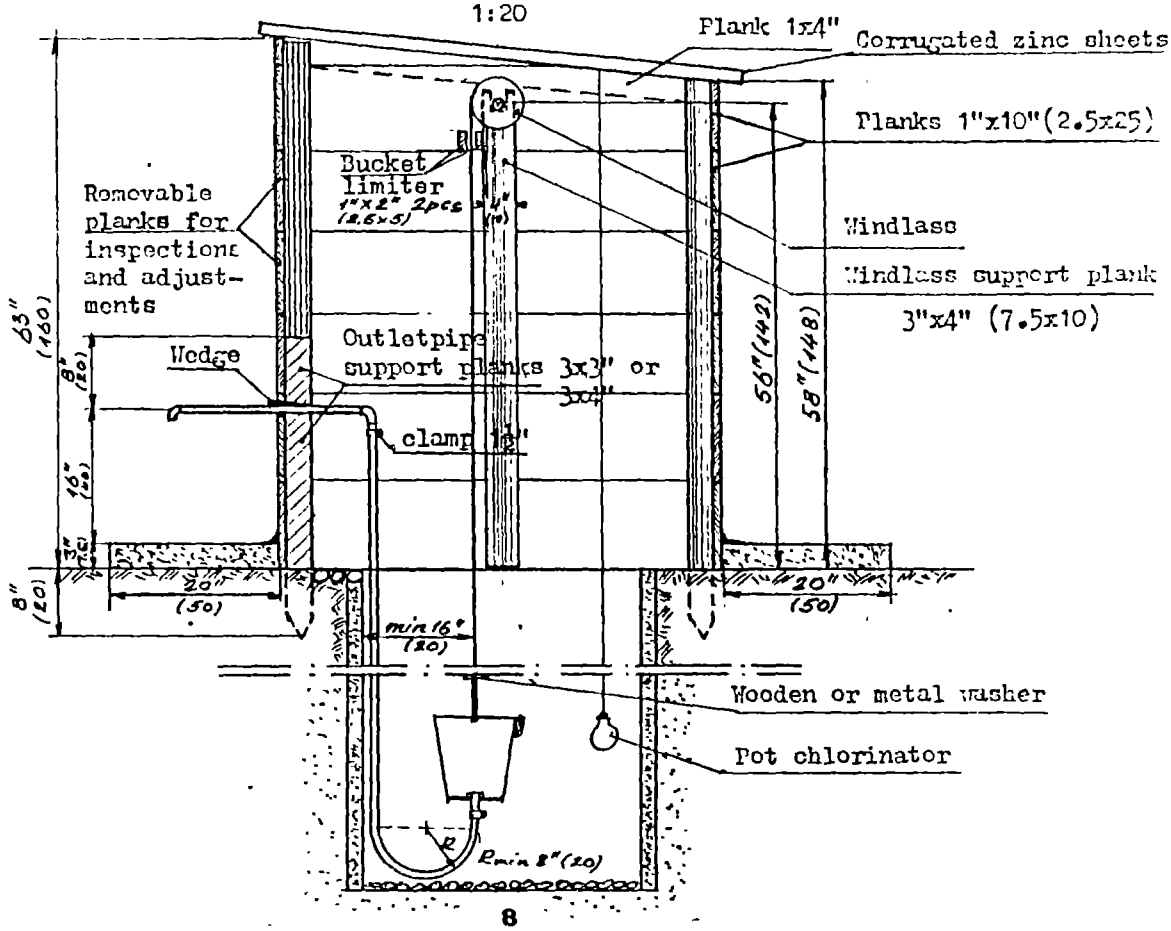
SUPERSTRUCTURE MADE OF PLANKS

PLAN 1:20




SECTION A-A

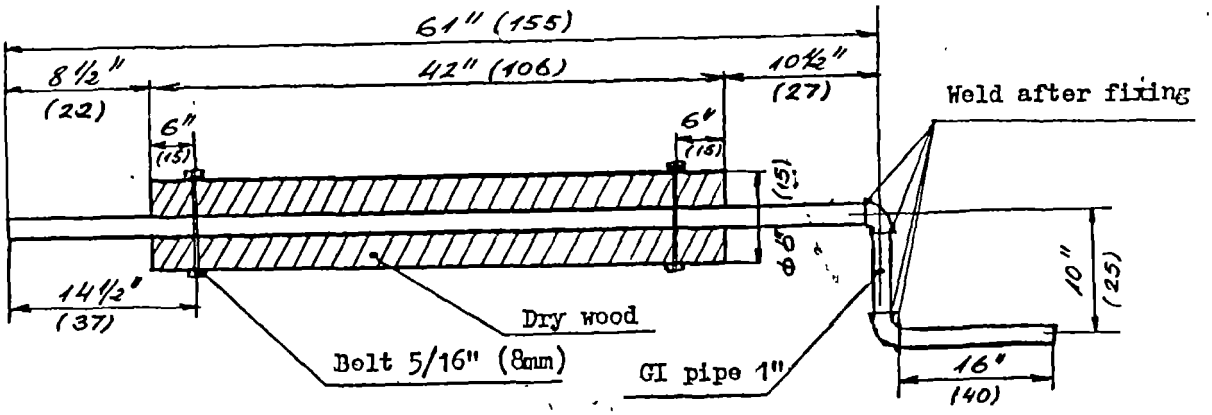
1:20



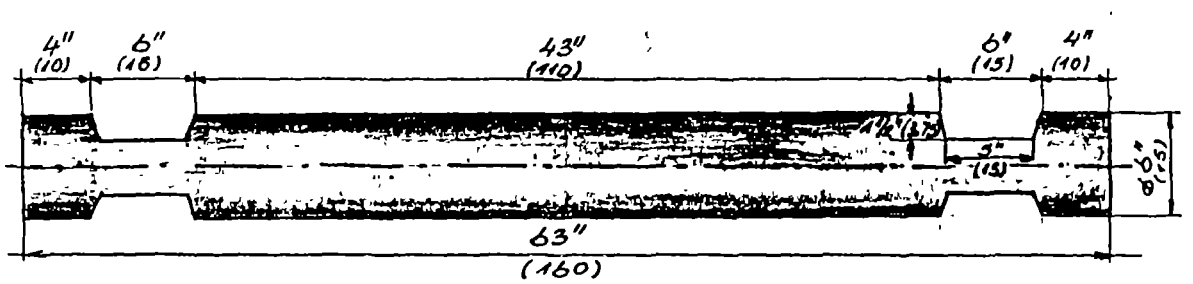
DETAILS

(not to scale)

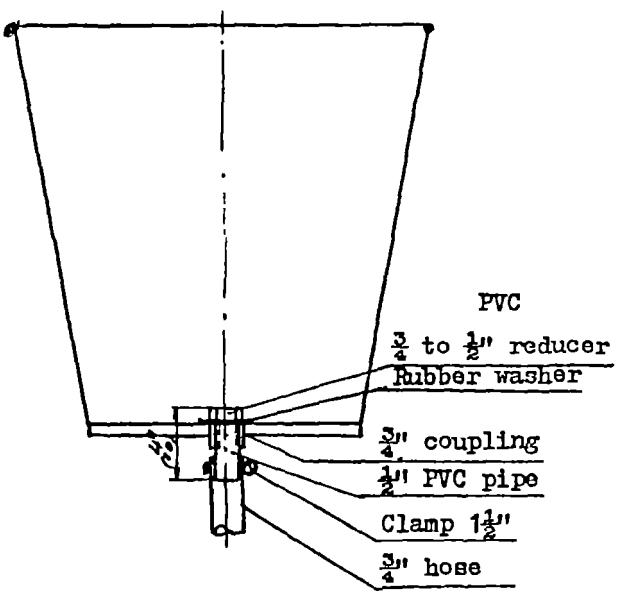
WINDLASS



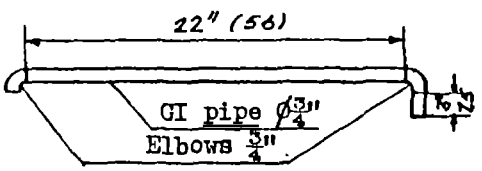

CUTTING OF NOTCHES IN THE LOGS




3-4 Gall (12-15l) GI bucket




OUTLET PIPE



## MATERIALS NEEDED FOR ONE WINDLASS WELL (SUPERSTRUCTURE AND LIFTING MECHANISM, DEPTH OF THE WELL - 35 FEET)

| | | |
|---|---|---|
| 1. | G1 pipe for the windlass ∅ 1", 8 feet | $6.00 |
| 2. | Elbows 90 degrees ∅1", 2 pcs | 2.00 |
| 3. | 3/4" PVC coupling, 3/4" to 1/2" PVC reducer and a piece (4") pipe for the bucket | 4.00 |
| 4. | G1 pipe ∅3/4", 30" | 1.50 |
| 5. | G1 elbows ∅3/4", 90 degrees, 2 pcs. | 3.00 |
| 6. | Hose 3/4", 40 feet (at $3.75 per meter) | 46.00 |
| 7. | Nylon rope 3/8", 50 feet | 8.50 |
| 8. | Zinc bucket | 6.50 |
| 9. | Nails 2" and 3", 5 boxes | 4.00 |
| 10. | Cement 1 bag | 6.50 |
| 11. | Bolts 3/8" x 6", 2 pcs | 3.50 |
| 12. | Washers | 0.50 |
| 13. | Corrugated zinc sheets 3 pcs. | 11.25 |
| 14. | Nylon string 1 roll | 1.00 |
| 15. | Clamps 1 1/2", 2 pcs. | 3.00 |
| 16. | Planks | 75.00 |
| 17. | Processing of windlass | 40.00 |
| 18. | Zinc nails 1/4 pack with washers | 0.20 |
| | TOTAL | 222.45 |

(Prices in Monrovia)

## LIST OF THE PLANKS

| | | |
|---|---|---|
| 1" x 10" x 52" | 24 pcs | |
| 1" x 6" x 52" | 3 pcs | |
| 3" x 3" x 71" | 4 pcs | |
| 3" x 4" x 58" | 2 pcs | |
| 1" x 2" x 52" | 2 pcs | |
| 3" x 4" x 20" | 1 pc | |
| 3" x 4" x 10" | 1 pc | |
| 1" x 3" for the apron | Total length | 370" |

One piece of 1" x 3" x 50" will be needed and cut in small pieces for adjustment of the bucket limiter, windlass etc.

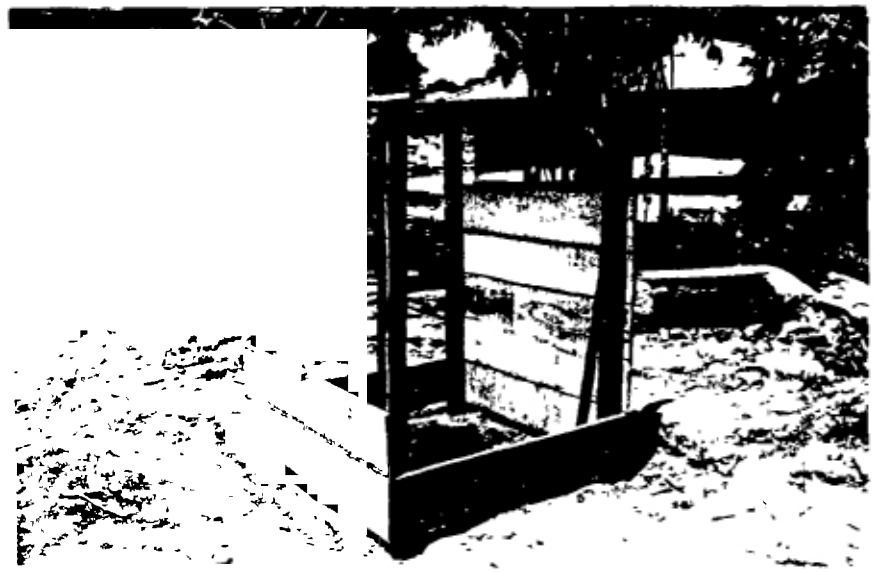


fig.1

fig.2

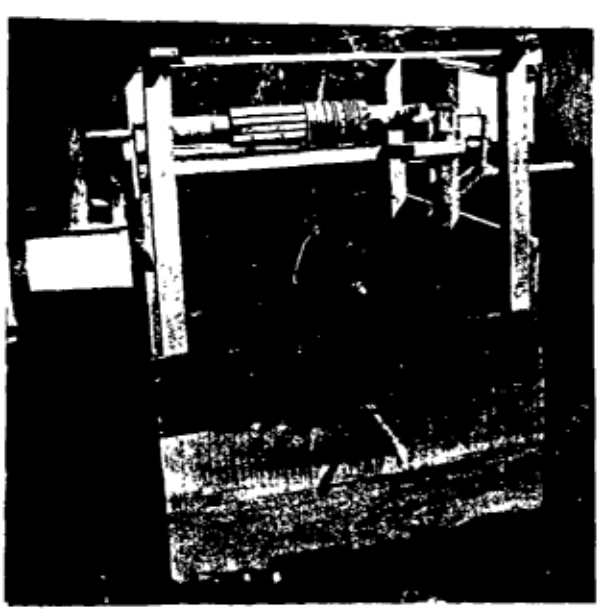


fig.3

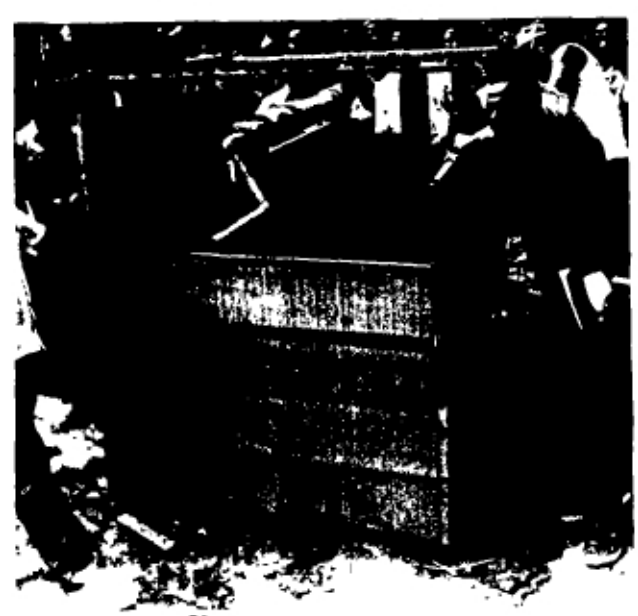


fig.4