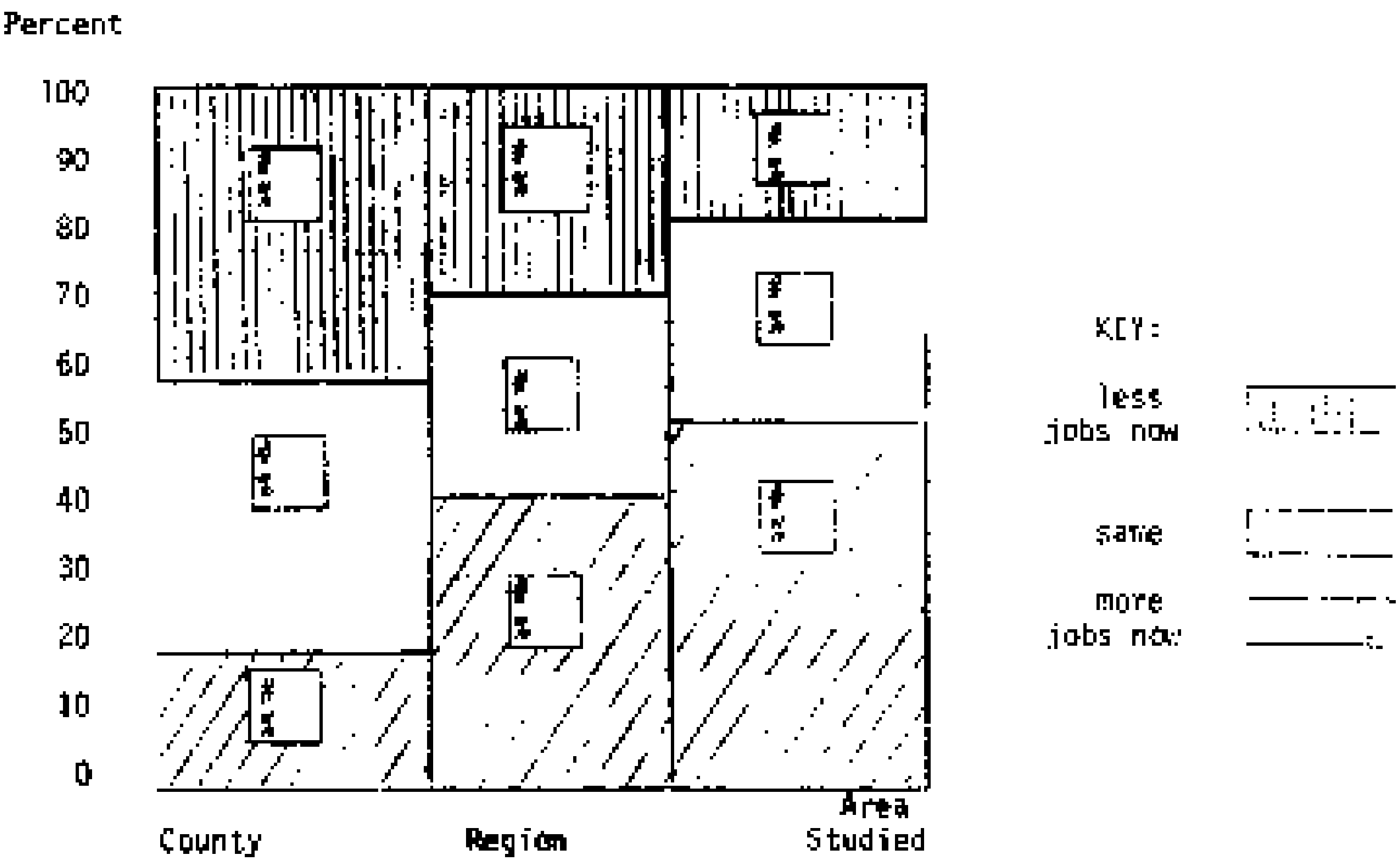
Figure 3

NUMBER OF JOBS COMPARED TO

FIVE YEARS AGO



Note: For certain key questions it has been found useful to present the information in figure form.

Shading for illustrative purposes only.

KEY ELEMENTS FOR DESIGNING AGRICULTURAL ACTIVITIES

- start small
- include local participation at every stage
- start with knowledge and information from the community enhanced with technical information
- seek technical information on soil, water, crops and seeds
- include training in the basic plan
- consider integration of conflicting land uses (agriculture, forestry, livestock) to maximize productivity of the farm system
- consider alternatives to chemical pesticides and fertilizers
- where tree planting is involved plan for maintenance and harvesting of the trees
- benefit the whole community
- build evaluation into the dynamic of implementing the planned activities/project

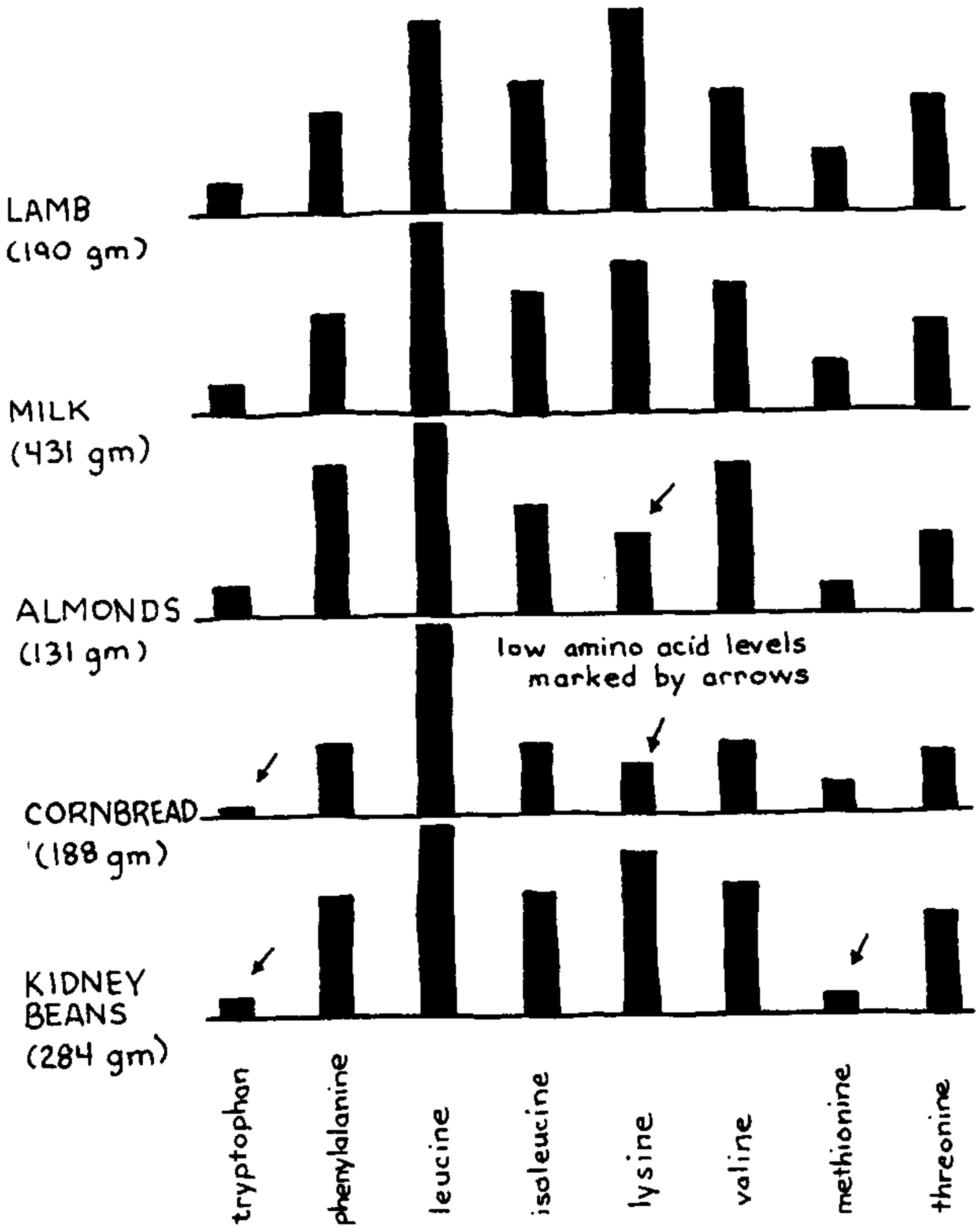
Source: Weber 3.8

LINKAGES BETWEEN AGROFORESTRY, LAND MANAGEMENT, AND SOIL CONSERVATION

Factors Affecting Sustainablity and Productivity	**AGROFORESTRY**	**FARM/RANGE MANAGEMENT** **FARM**	 **RANGE**	**SOIL CONSERVATION**
Soil Moisture Retention	- Alley cropping, line plantations and dispersed trees to provide: • Organic matter • Shade to reduce surface temperature	- Use of compost, cover-crops - Crop-residue left in fields - Mulch	- Controlled grazing - Rotational grazing - Fire Management	- Incorporating organic matter into the soil - Preparing micro-catchments, contour ridges or other micro-site improvements.
Soil Fertility	- Nutrient cycling and Nitrogen fixation	- Crop rotation (including legumes)	- Use of Animal Manure	- Contour vegetation strips
Water Erosion Control	- Surface Runoff reduction through: • Establishment of trees/ shrubs along physical conservation features • Trees along canals and waterways	- Contour farming - Maintaining soil tilth - Maintaining maximum plant cover	- Range rotation - "Grazing reserves" - Contract grazing linked to vegetation rehabilitation or protection. - Controlled lopping for fodder	- Berms, ditches, ridges - Benches or terraces - Waterway and gully control - Protection of stream banks
Wind Erosion Control	- Wind reduction through: • Dispersed Trees • Borderline Trees	- Maintaining maximum plant cover - Natural vegetation strips left when clearing new land - Minimum till cultivation		- Windbreaks - Palisades, other physical treatment in extreme cases - Dune stabilization
Access Control	- Live fencing - Alignment of livestock trails	- Stock driveways left when laying out fields. - Borderline Trees	- Herding as opposed to letting animals roam freely - Tethering or corraling livestock	- Layout of soil conservation plantings to reinforce fencelines and livestock trails.

Source: Weber and Stoney 3.8

AMINO ACID BALANCE



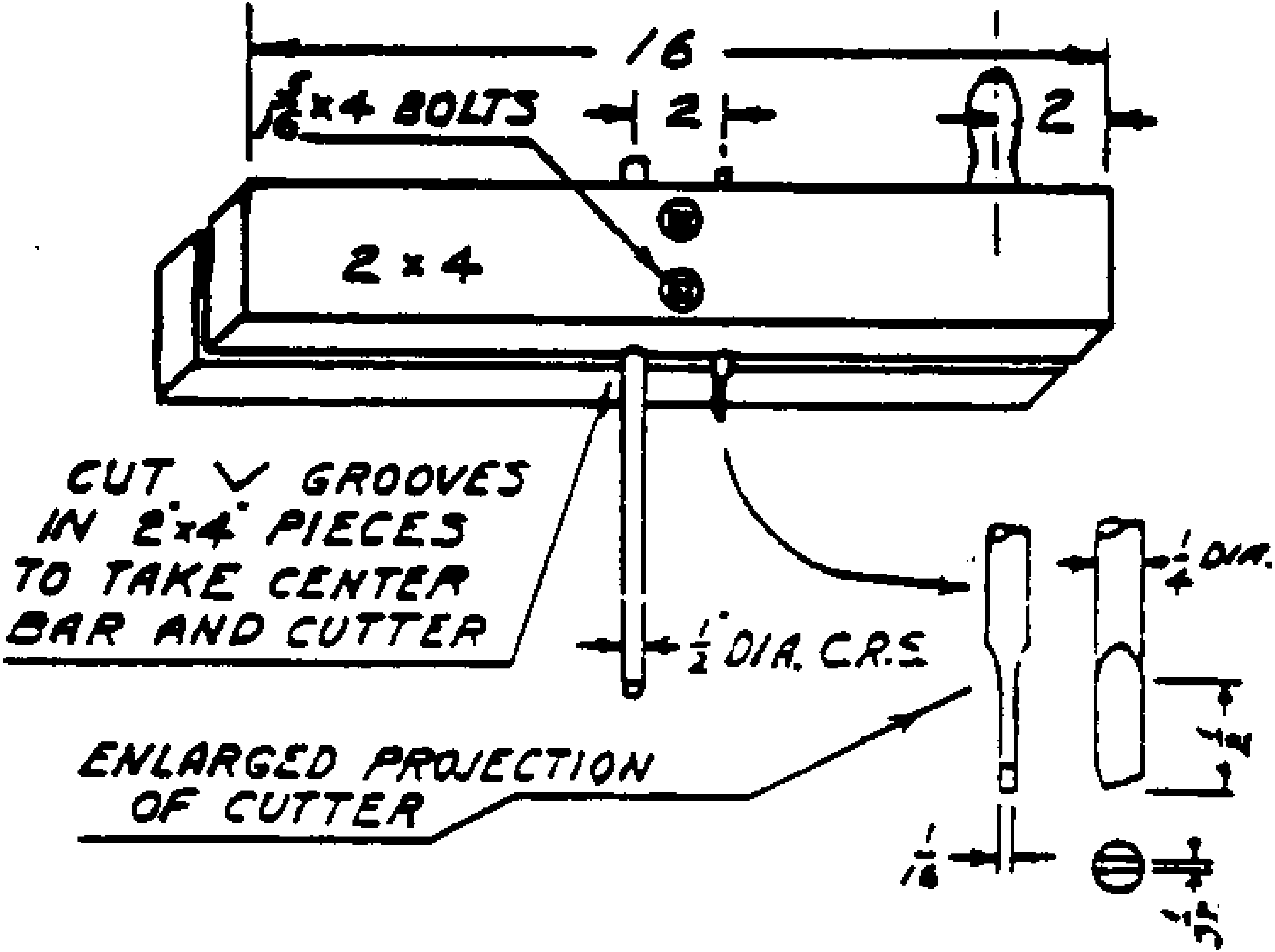
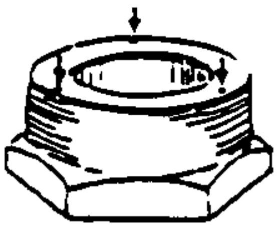
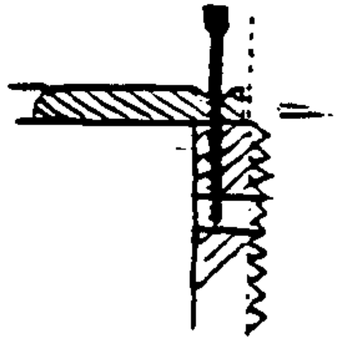
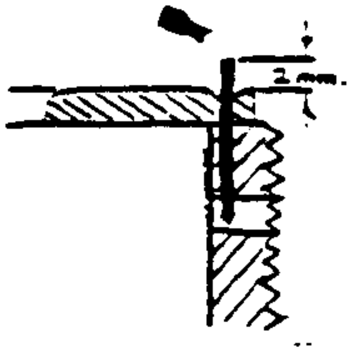
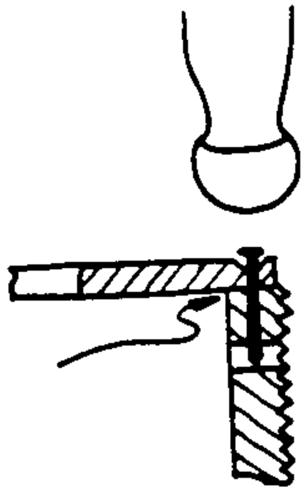


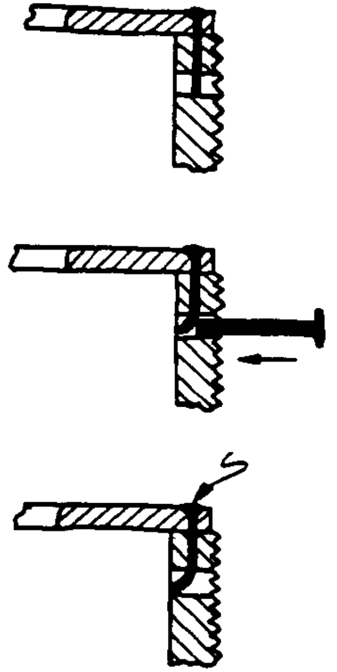
FIG. 4 DISC CUTTER

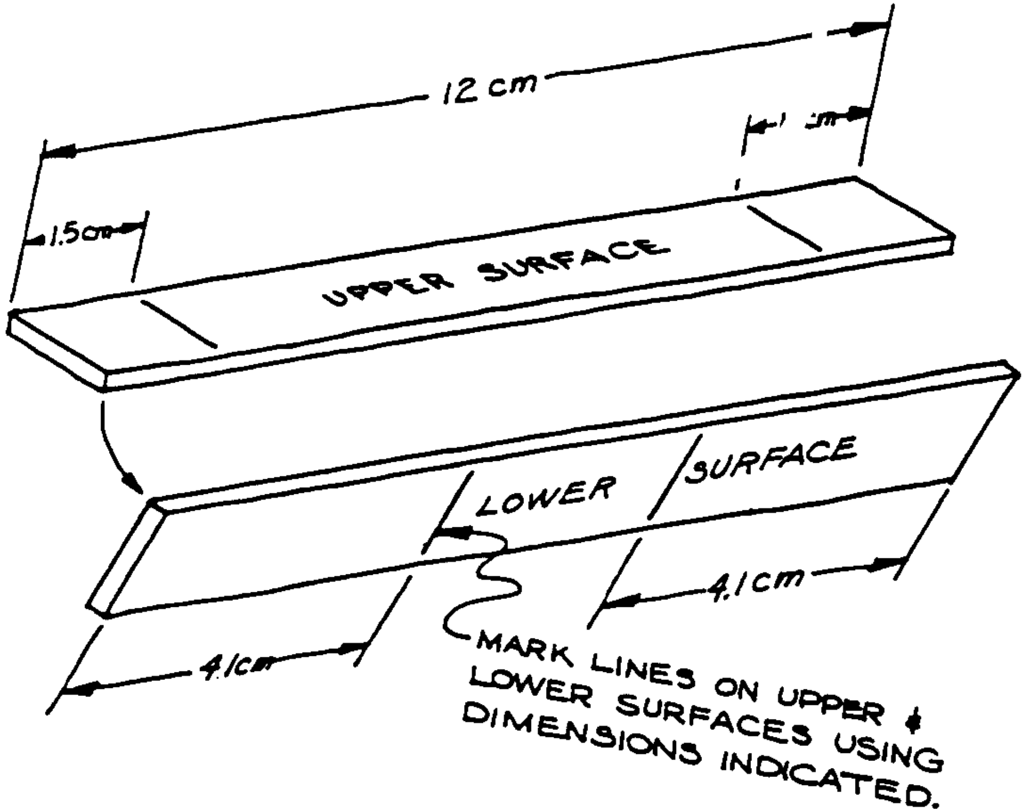


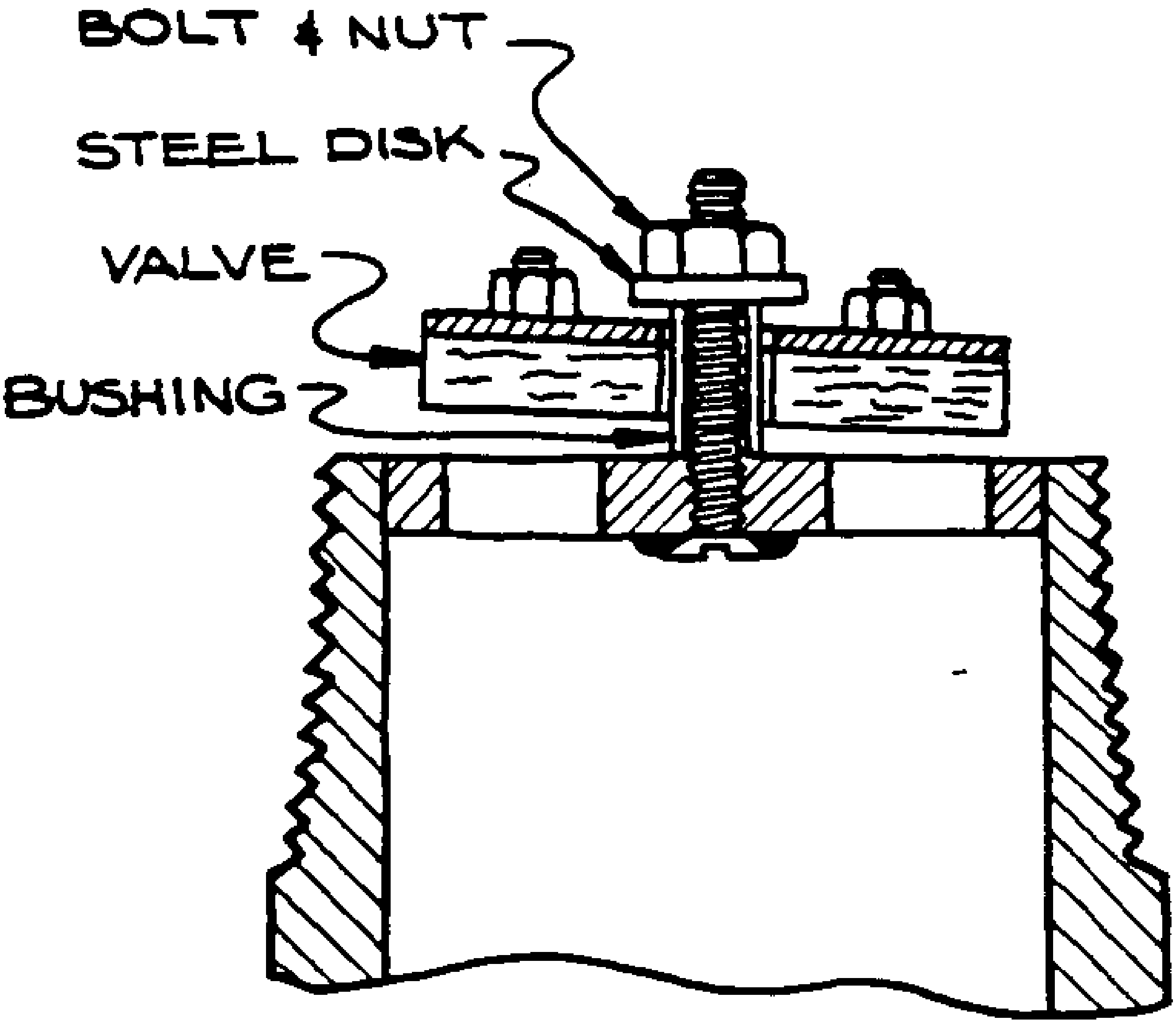



2 mm.






12 cm
1 cm
1.5cm
UPPER SURFACE
LOWER SURFACE
4.1cm
4.1cm
MARK LINES ON UPPER & LOWER SURFACES USING DIMENSIONS INDICATED.


BOLT & NUT
STEEL DISK
VALVE
BUSHING

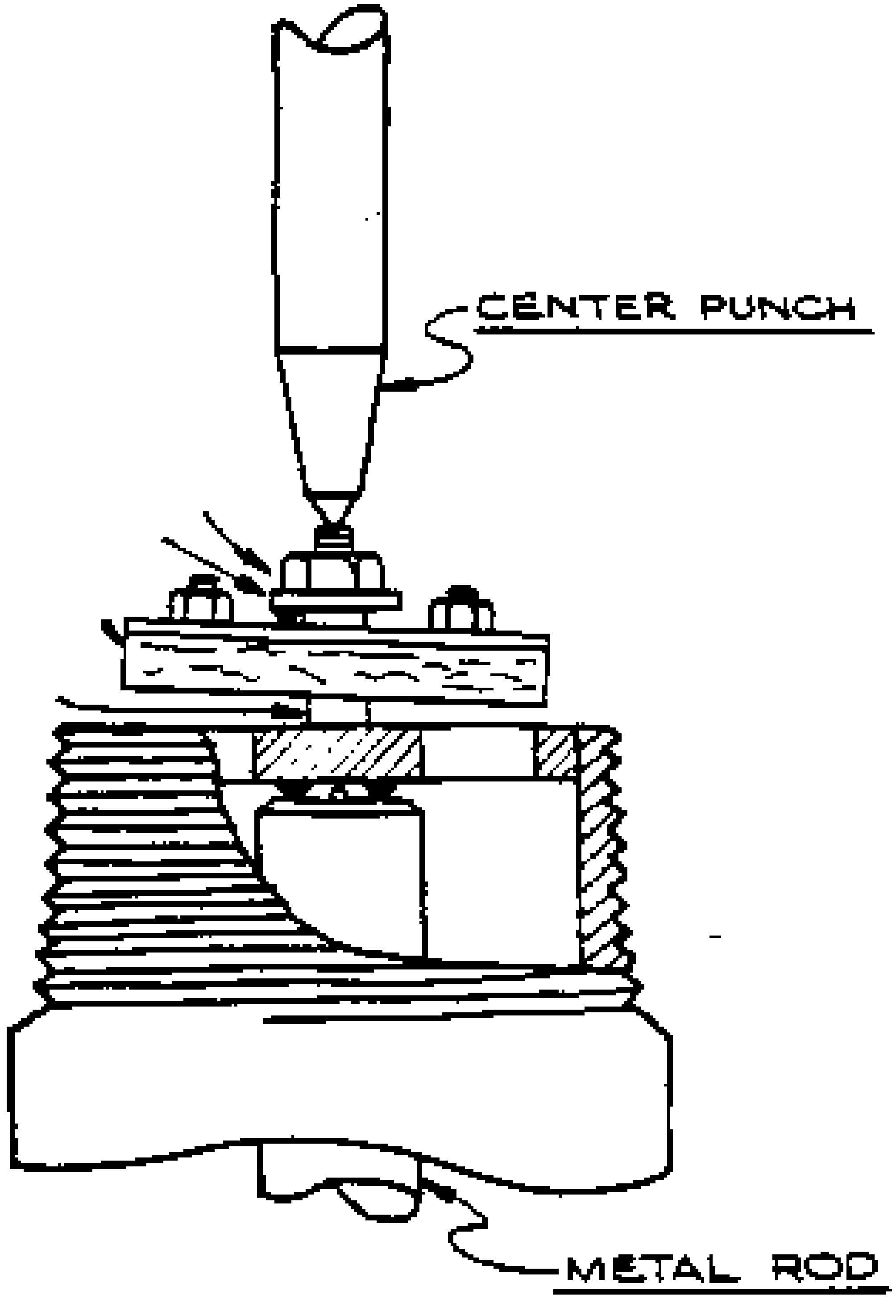
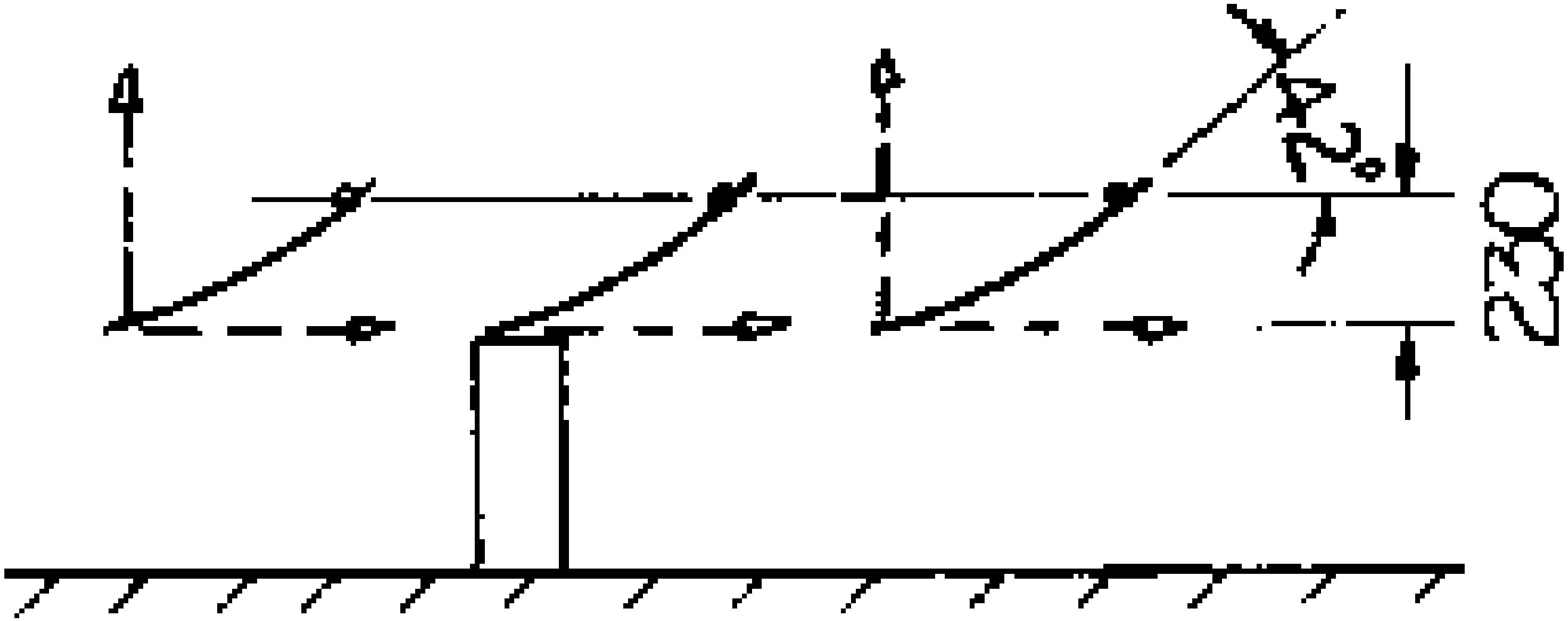
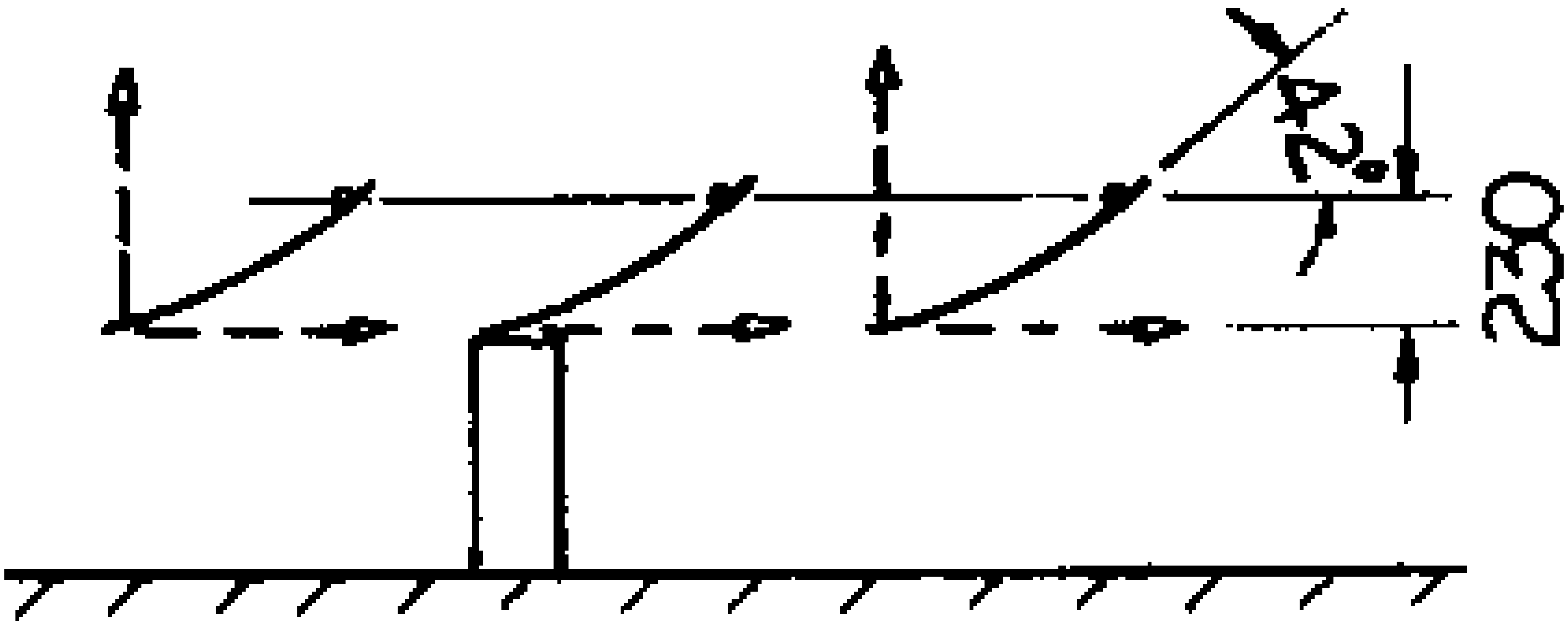

CENTER PUNCH
METAL ROD

fig. R7



blade tip alignment

Fig. R7



blade tip alignment

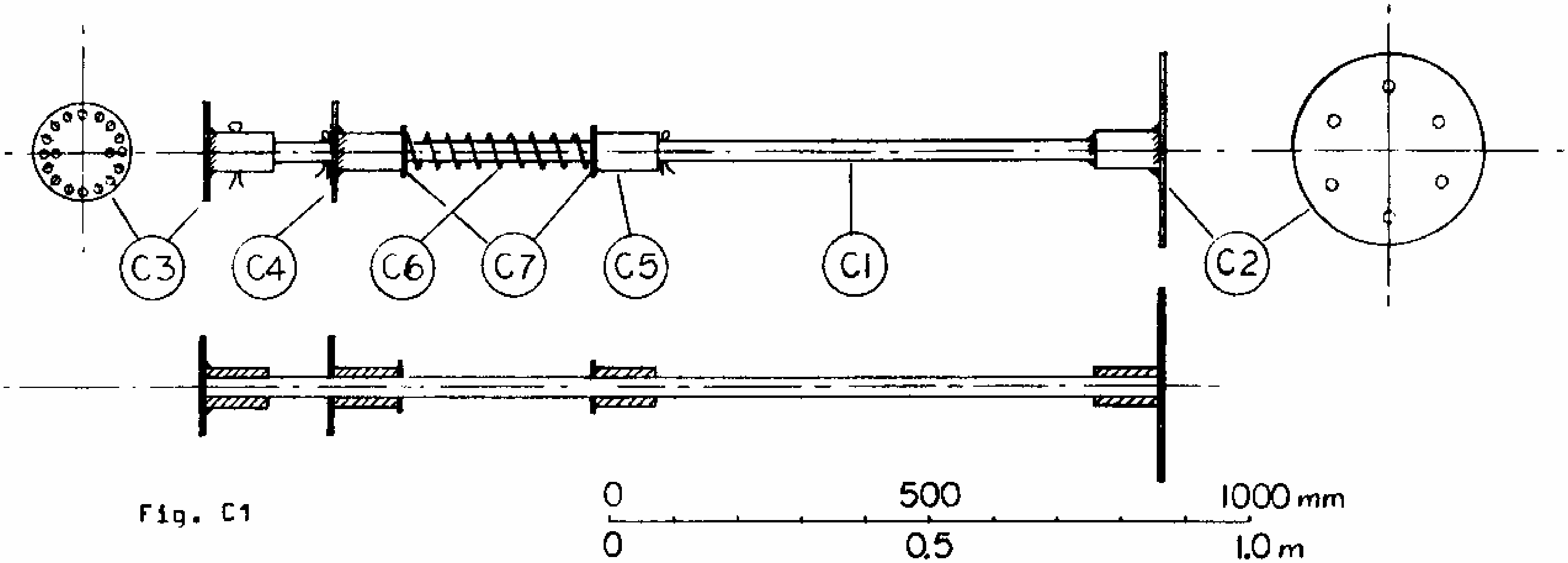


Fig. C1

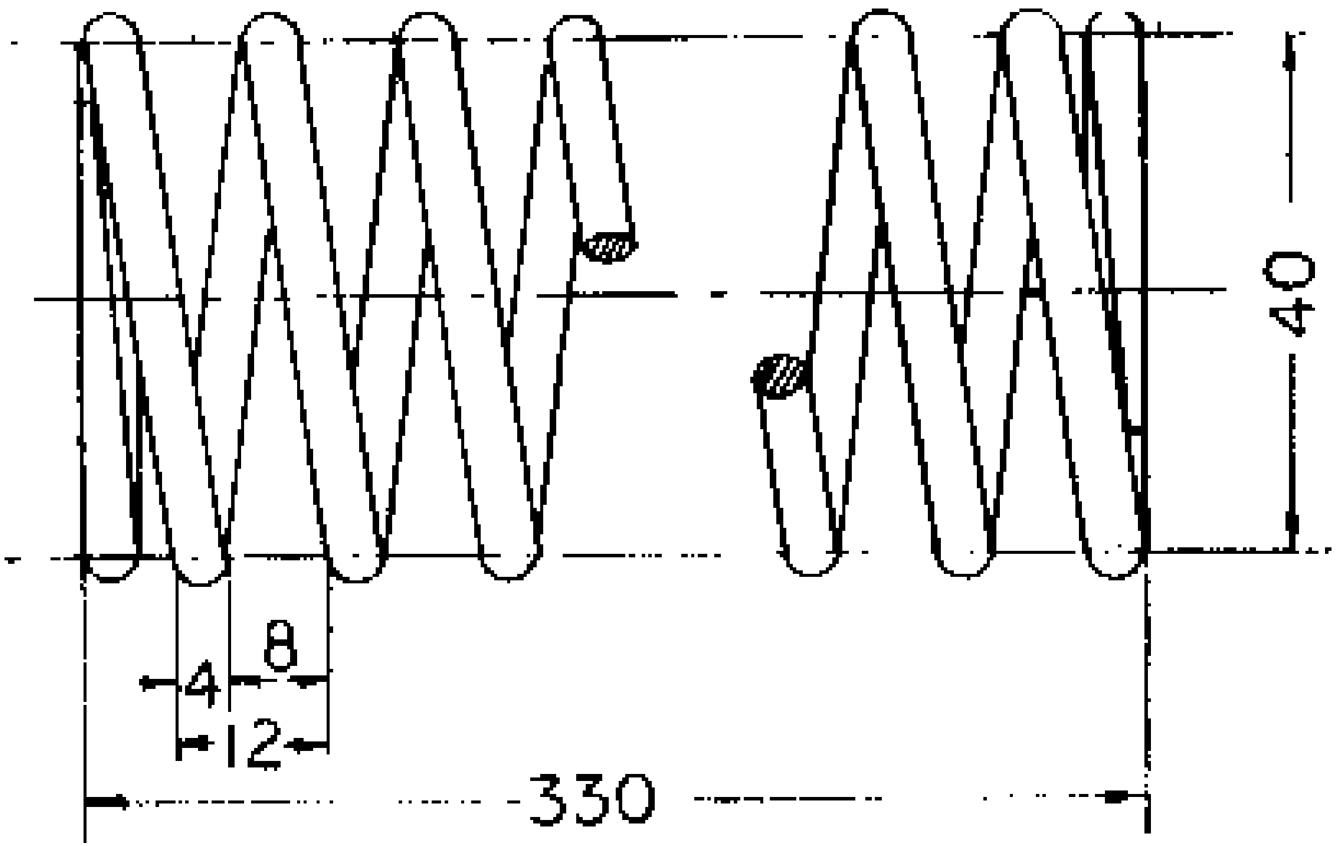


Fig. C2 - Control spring

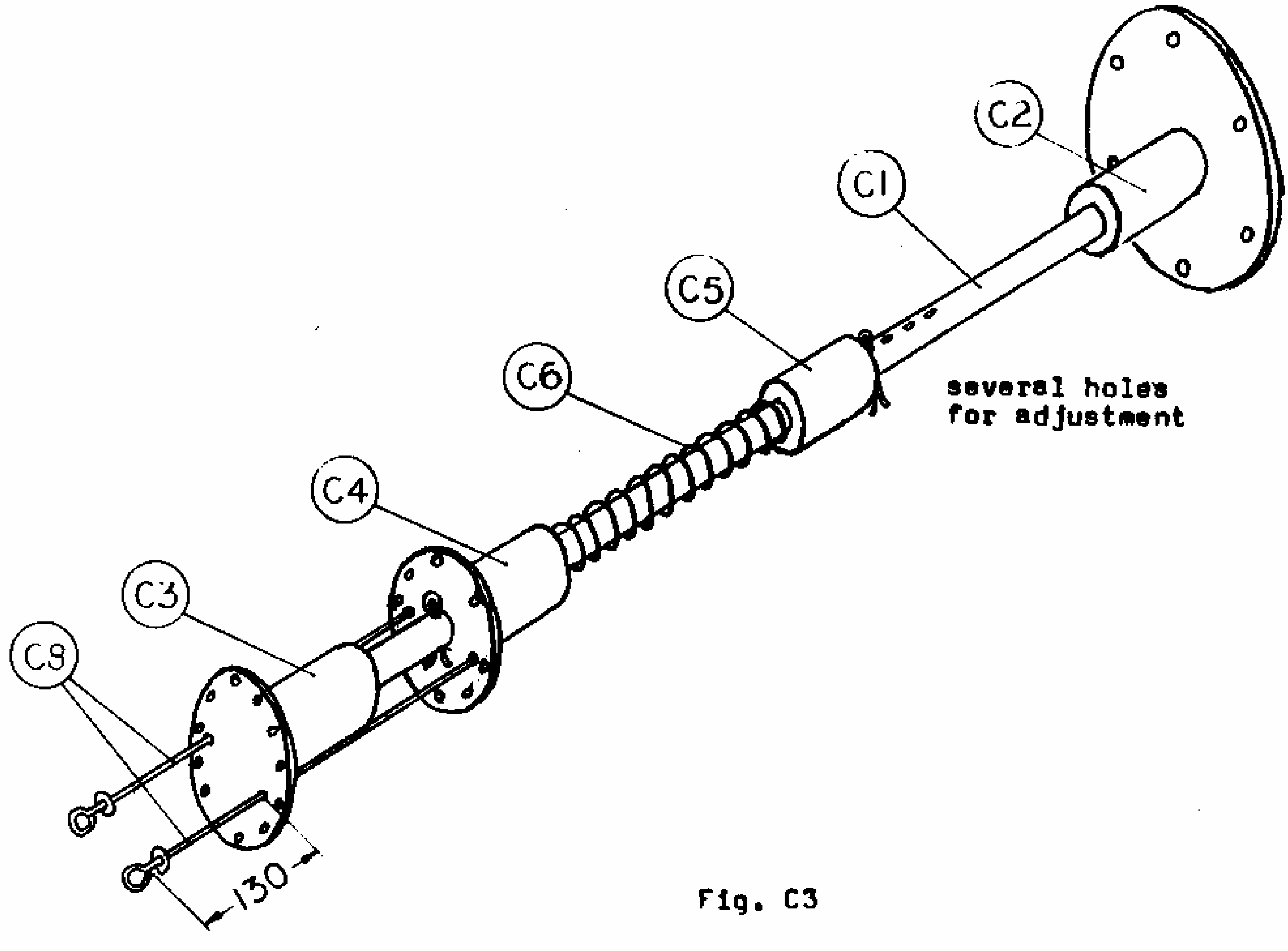


Fig. C3

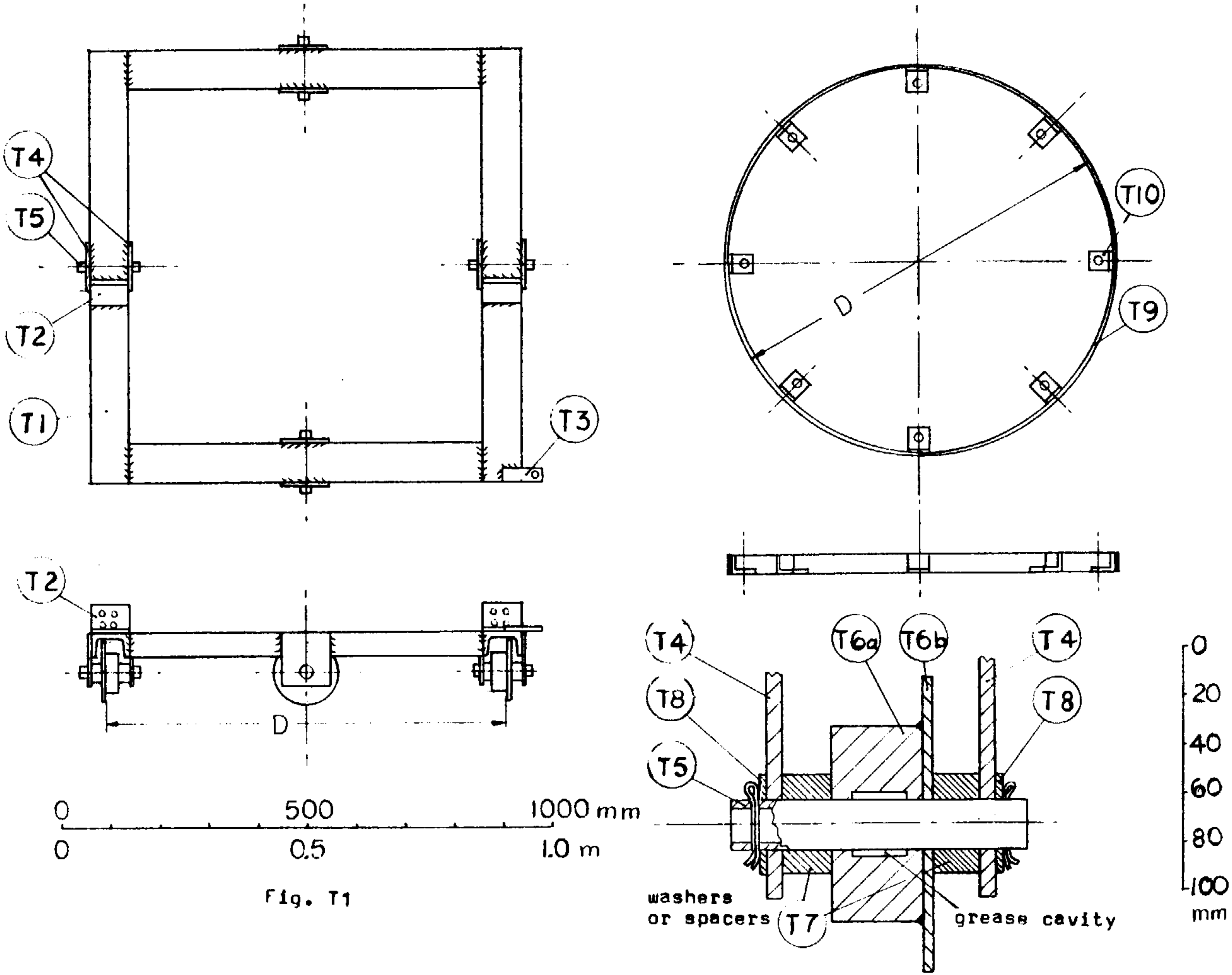

T4
T5
T2
T1
T3
T2
D
0
500
1000 mm
0
0.5
1.0 m
T10
T9
D
T4
T6a
T6b
T4
T8
T8
T5
washers
or spacers
T7
grease cavity
0
20
40
60
80
100
mm

Fig. T1

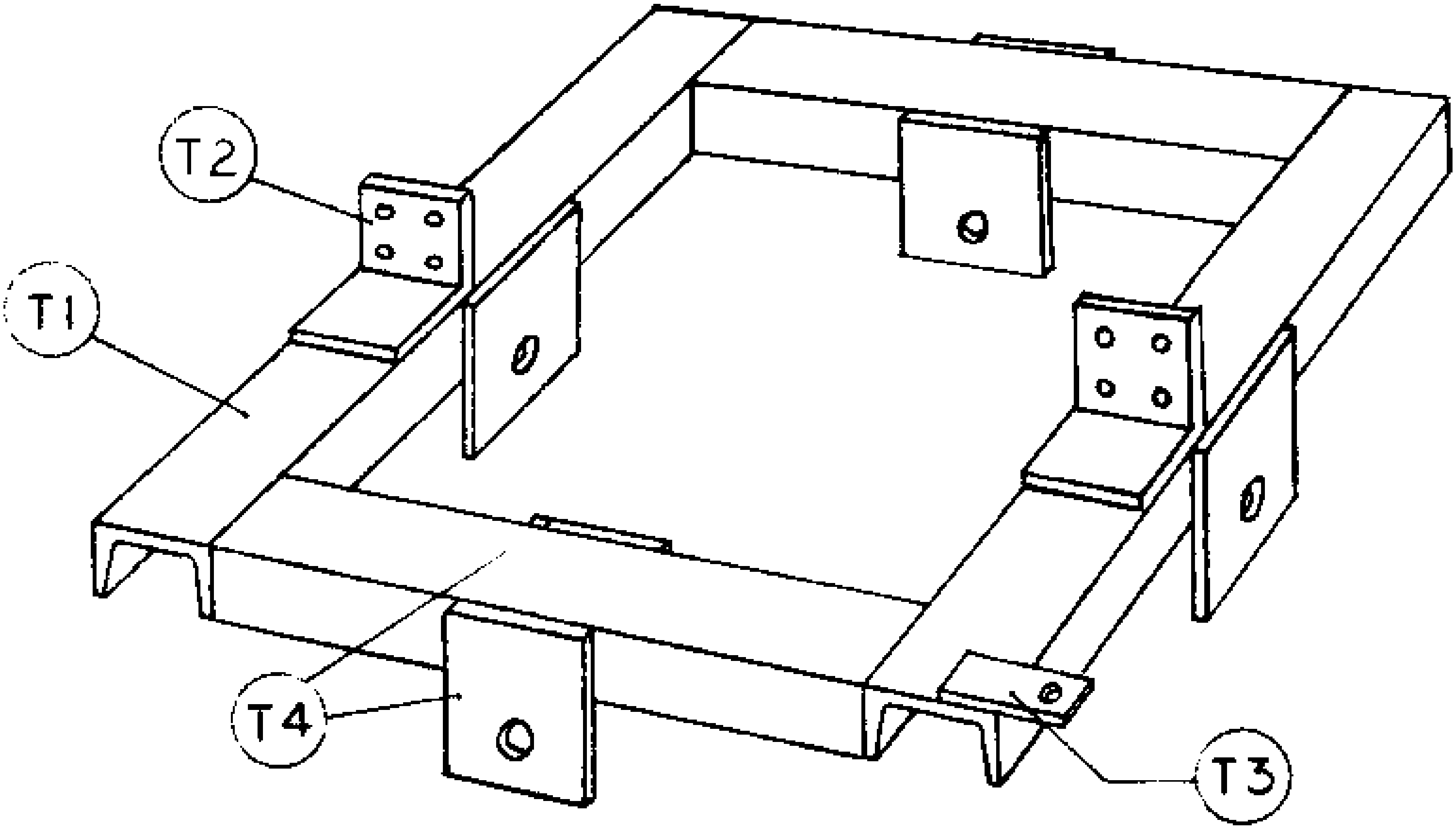


Fig. T2

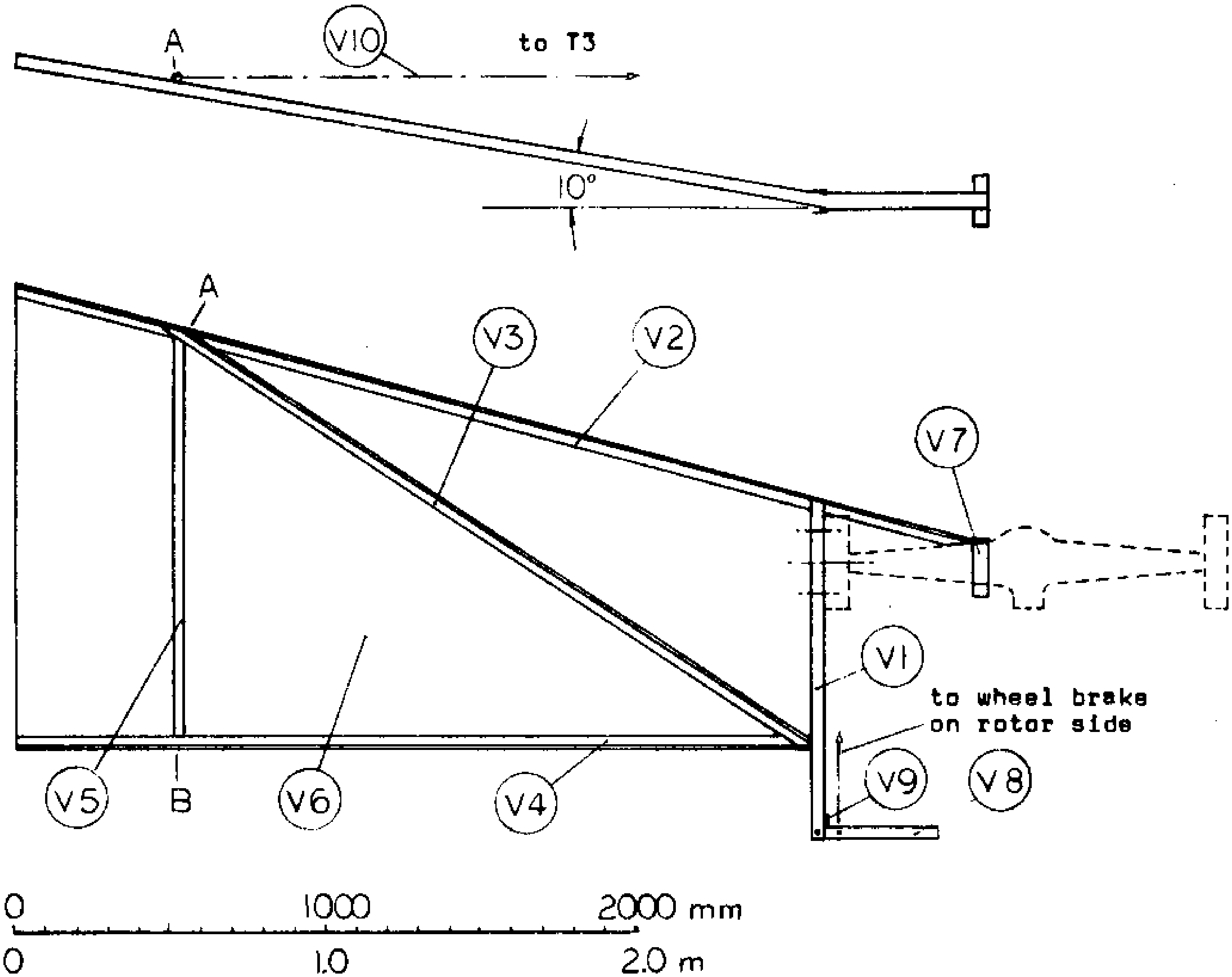

A
V10
to T3
10°
A
V3
V2
V7
V1
to wheel brake
on rotor side
V5
B
V6
V4
V9
V8
0
1000
2000 mm
0
1.0
2.0 m

Fig. V1

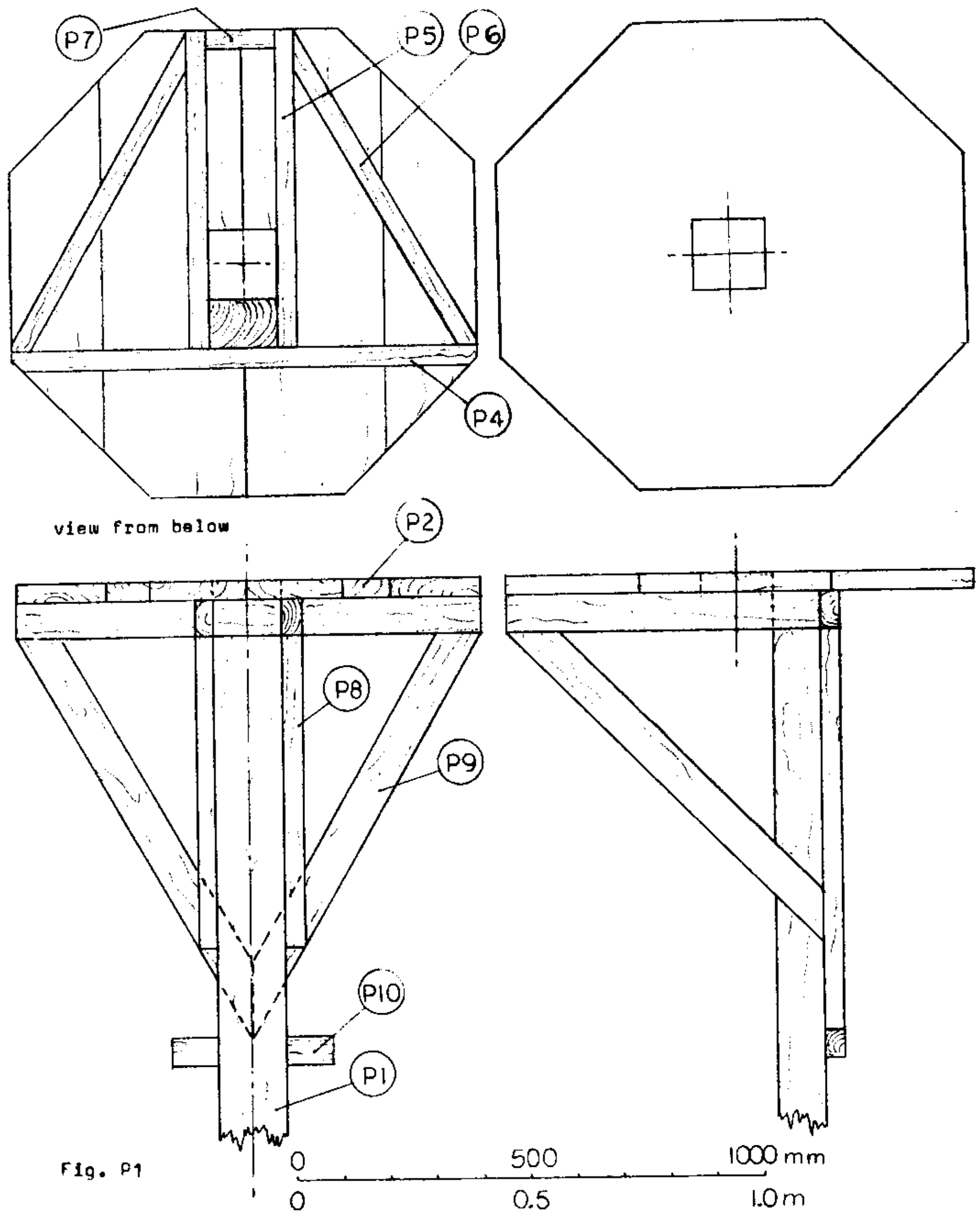


Fig. P1

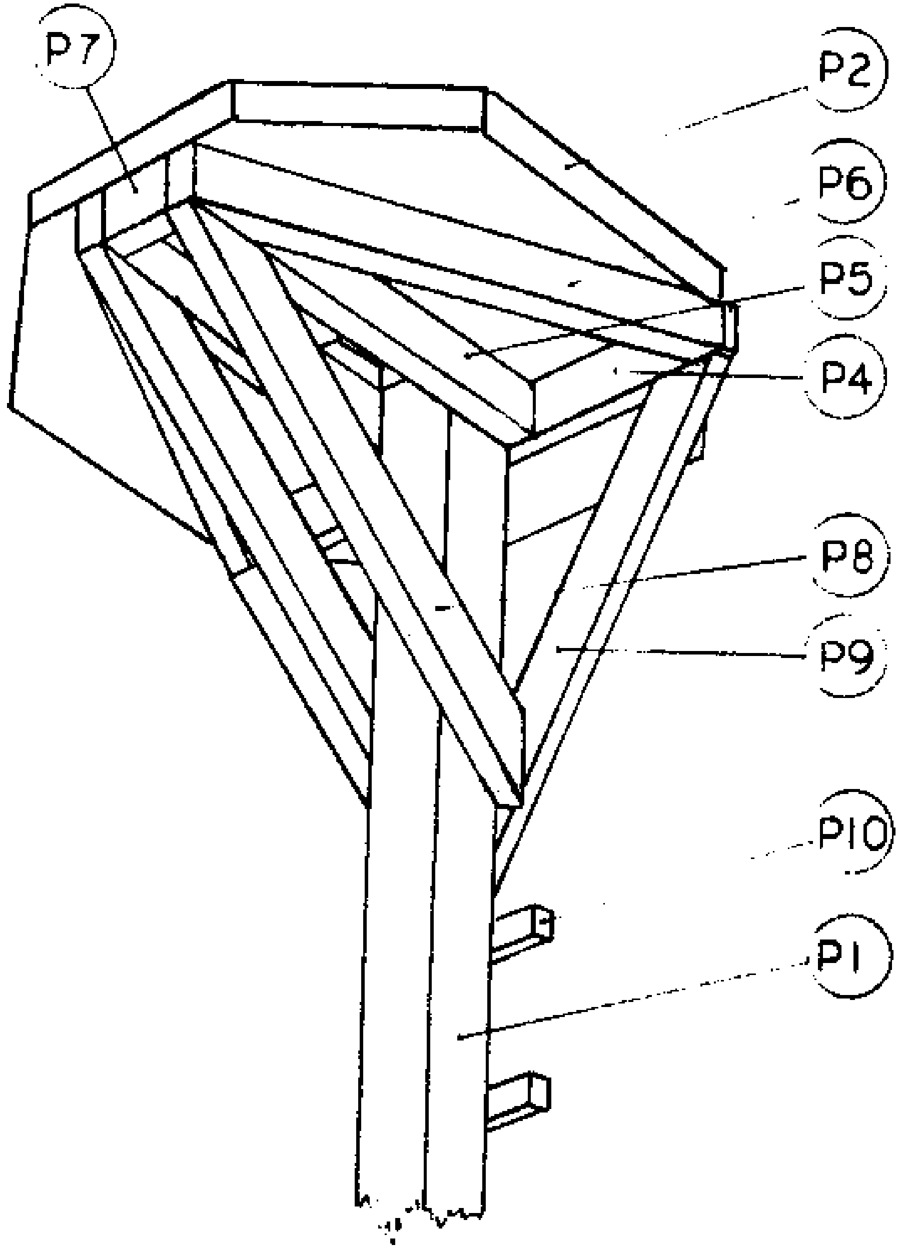


Fig. P2

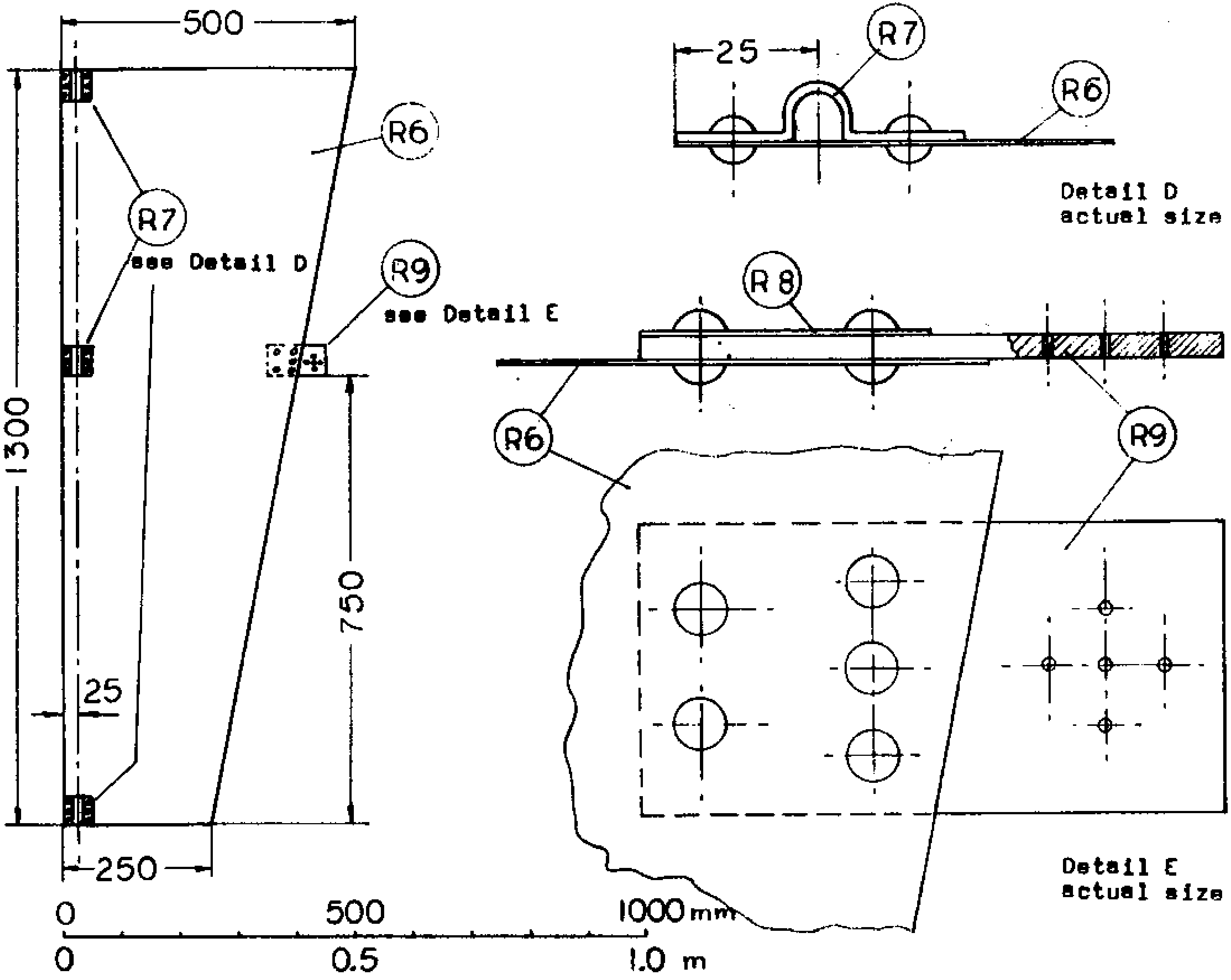

500
R6
R7
see Detail D
R9
see Detail E
1300
750
25
250
0
500
1000 mm
0
0.5
1.0 m
25
R7
R6
Detail D
actual size
R 8
R6
R9
Detail E
actual size

Fig. R2

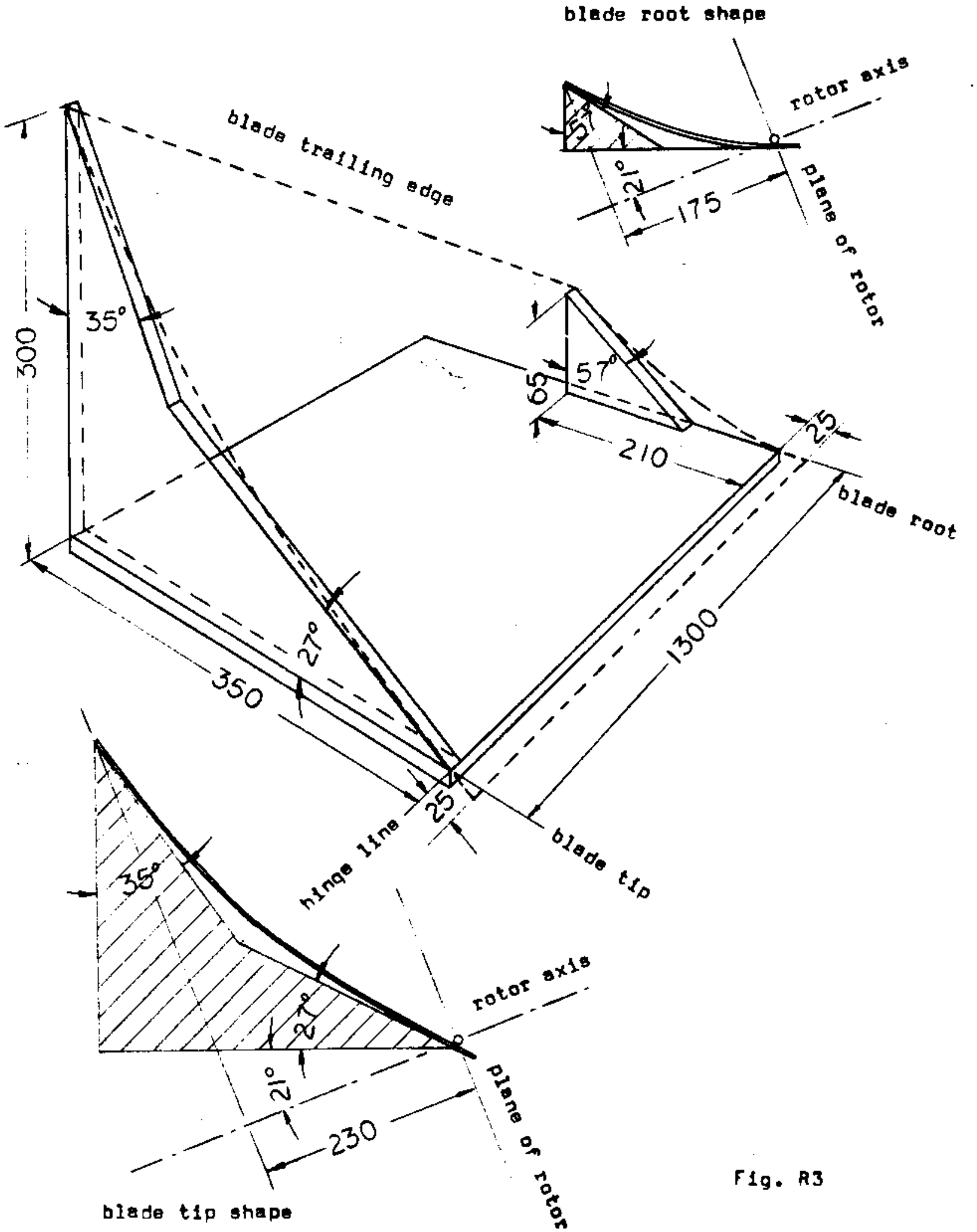

blade root shape
rotor axis
plane of rotor
57°
21°
175
blade trailing edge
300
35°
57°
65
210
25
blade root
1300
27°
350
25
hinge line
blade tip
35°
27°
21°
230
rotor axis
plane of rotor
blade tip shape

Fig. R3

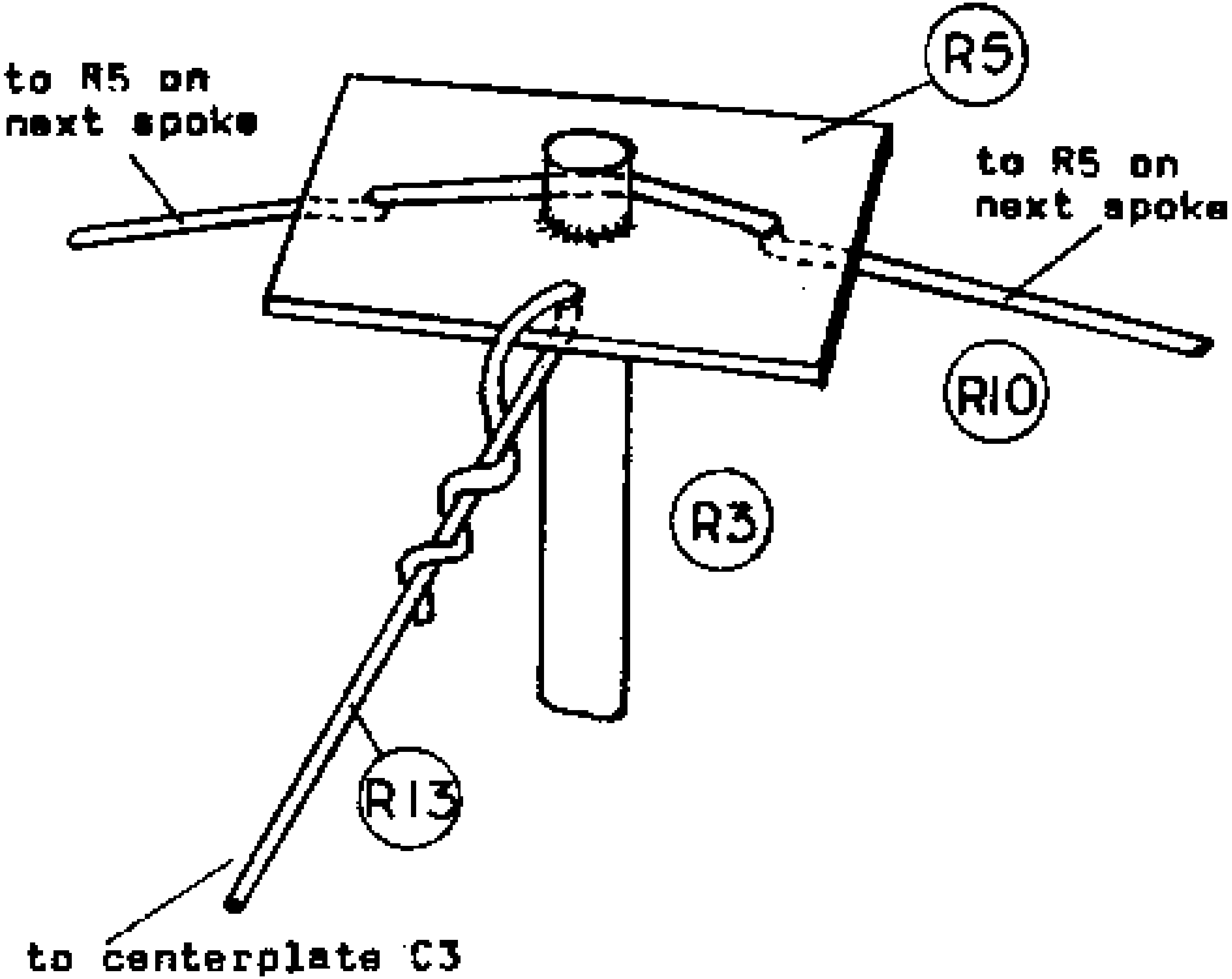

to R5 on
next spoke
R5
to R5 on
next spoke
R10
R3
R13
to centerplate C3

Fig. R4

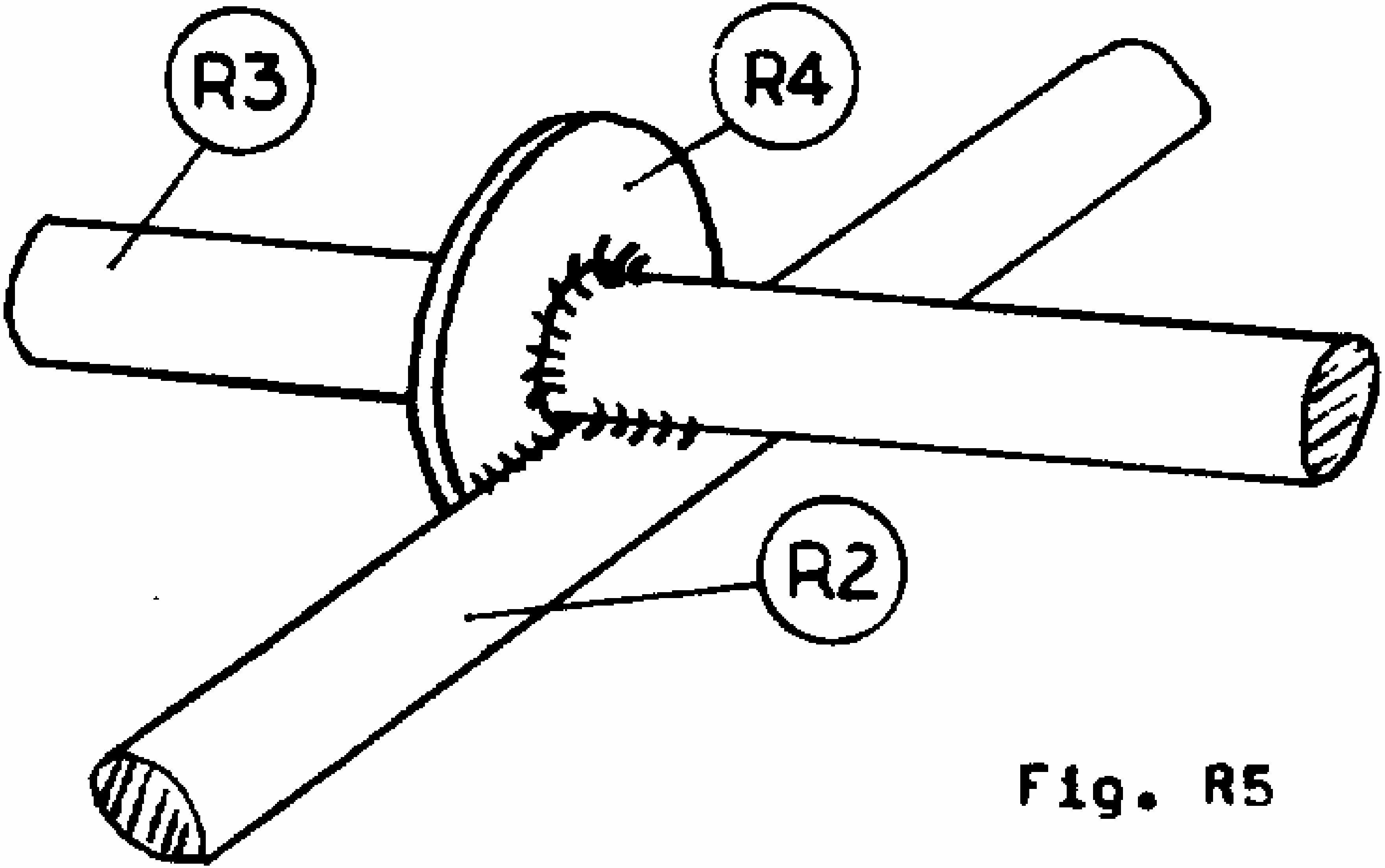


Fig. R5

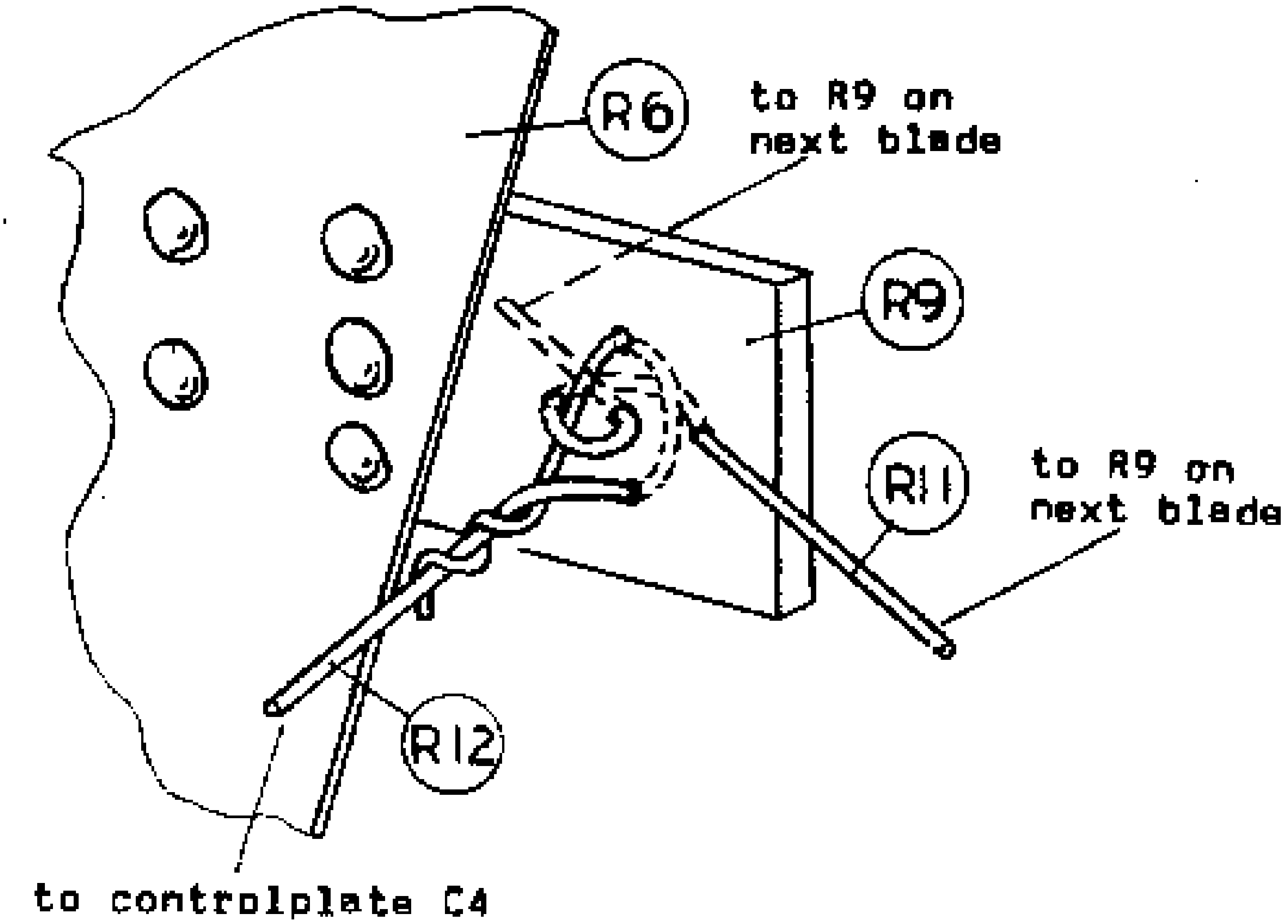
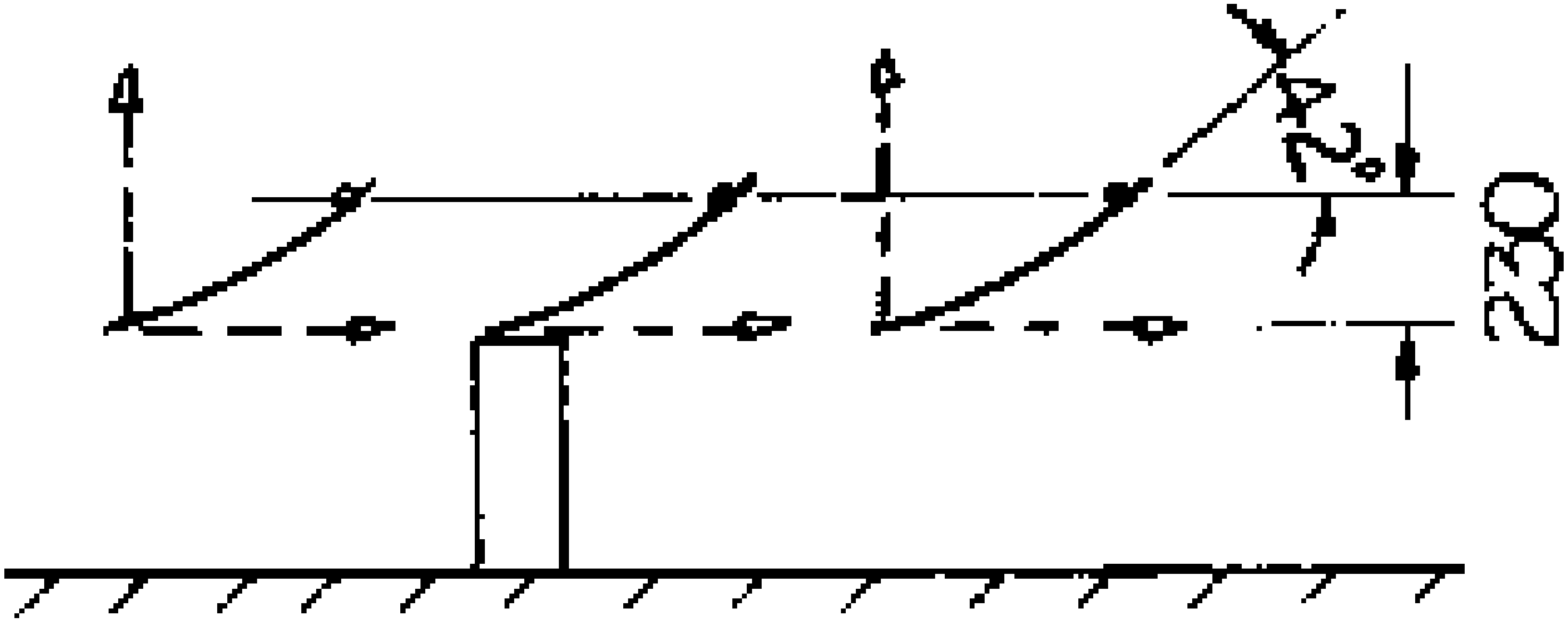

R6
to R9 on
next blade
R9
R11
to R9 on
next blade
R12
to controlplate C4

Fig. R6

fig. R7



blade tip alignment

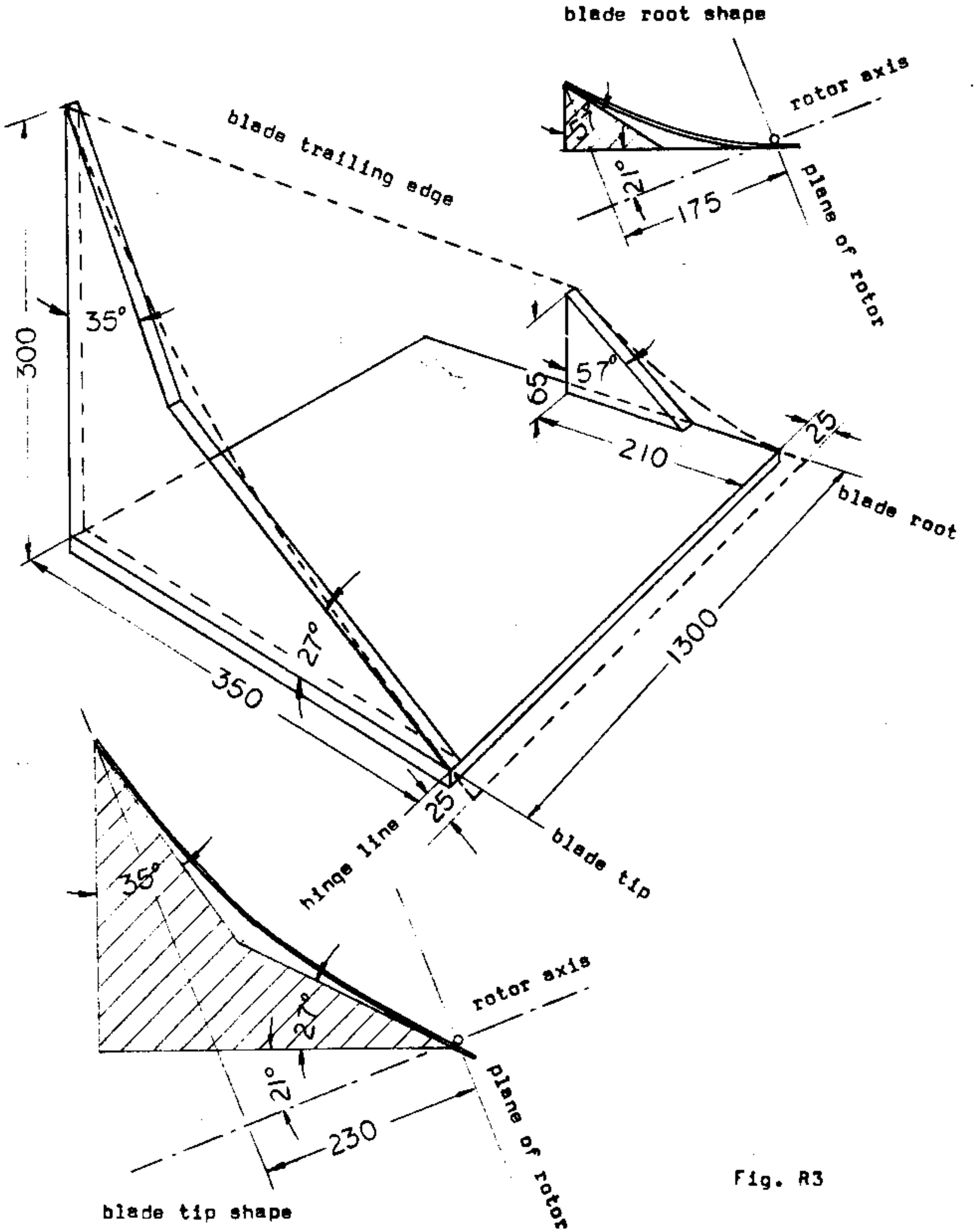
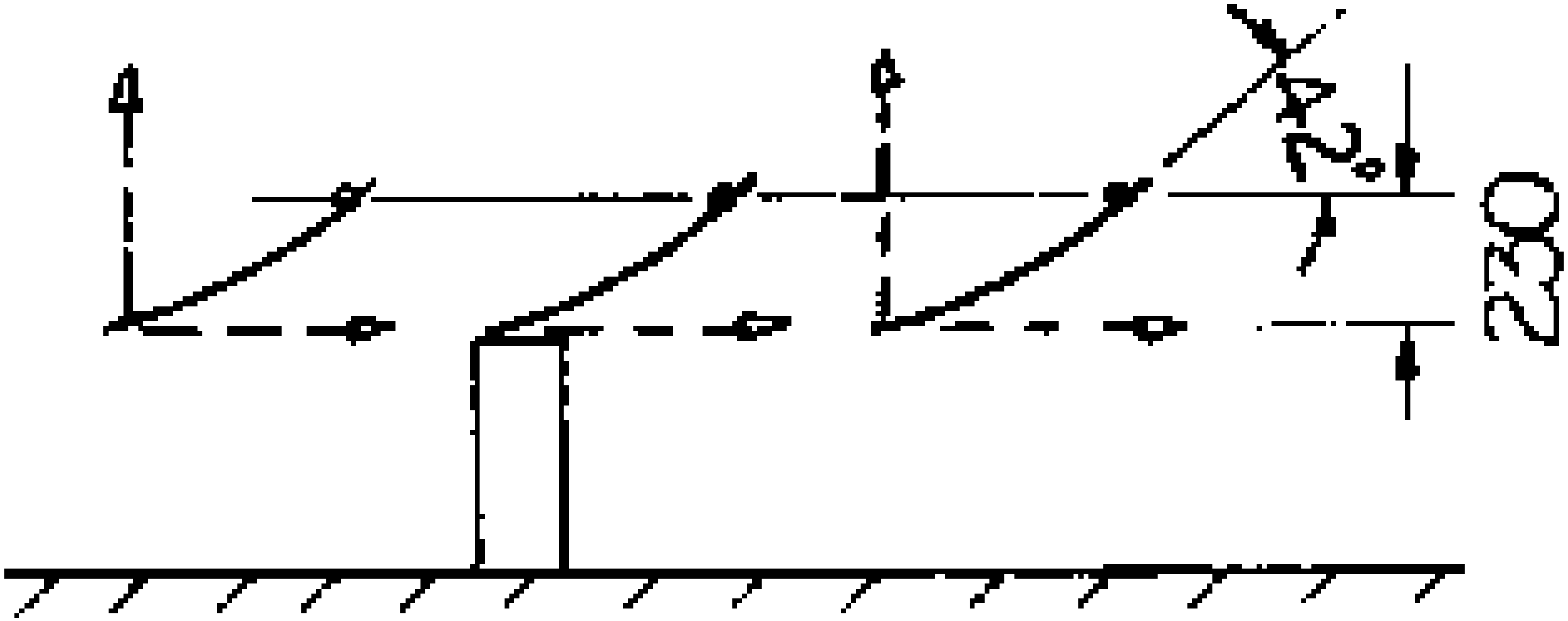

blade root shape
rotor axis
plane of rotor
57°
21°
175
blade trailing edge
300
35°
65
57°
210
25
blade root
27°
1300
350
25
hinge line
blade tip
35°
27°
21°
230
rotor axis
plane of rotor
blade tip shape

Fig. R3

fig. R7



blade tip alignment

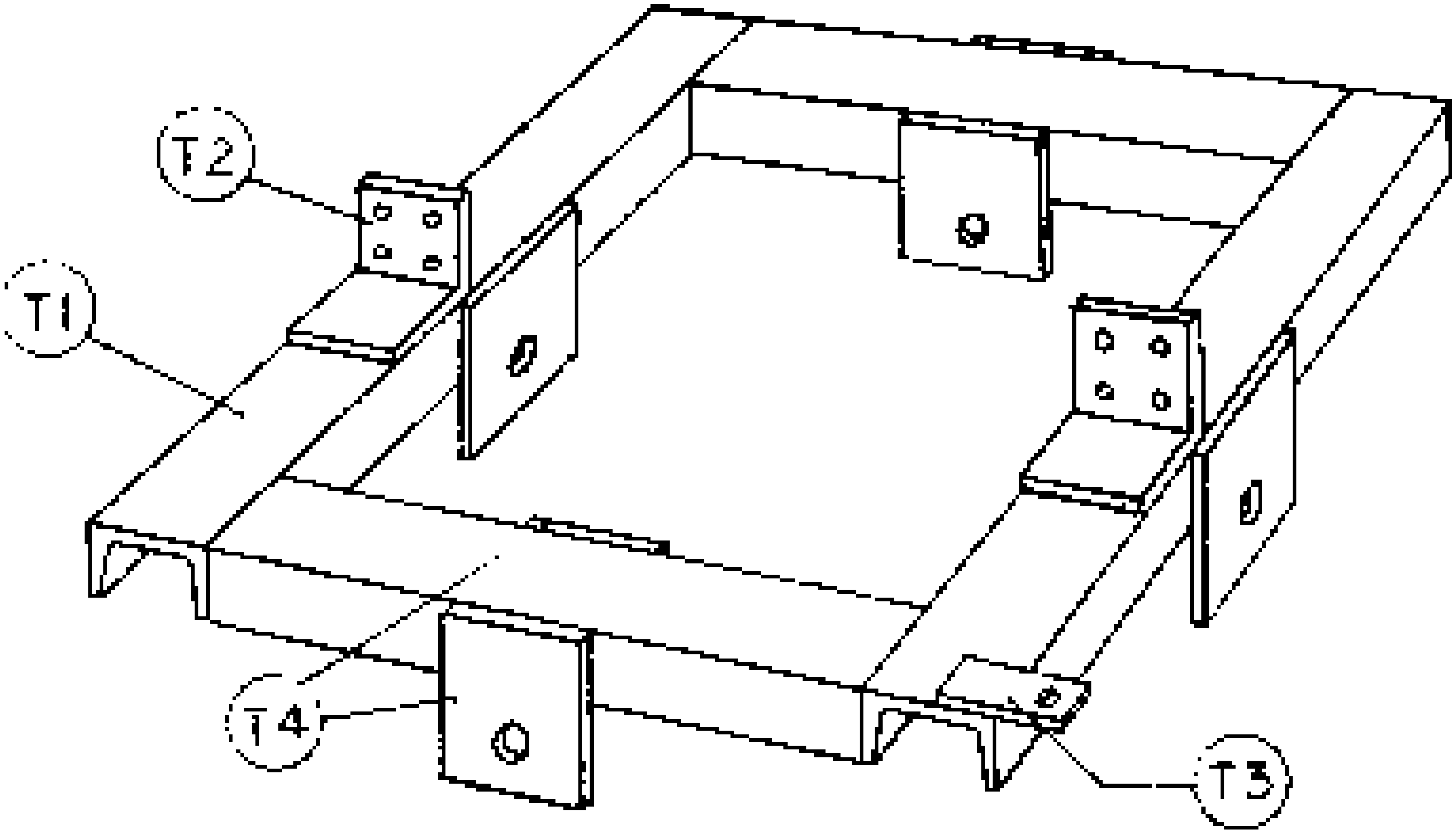


Fig. T2

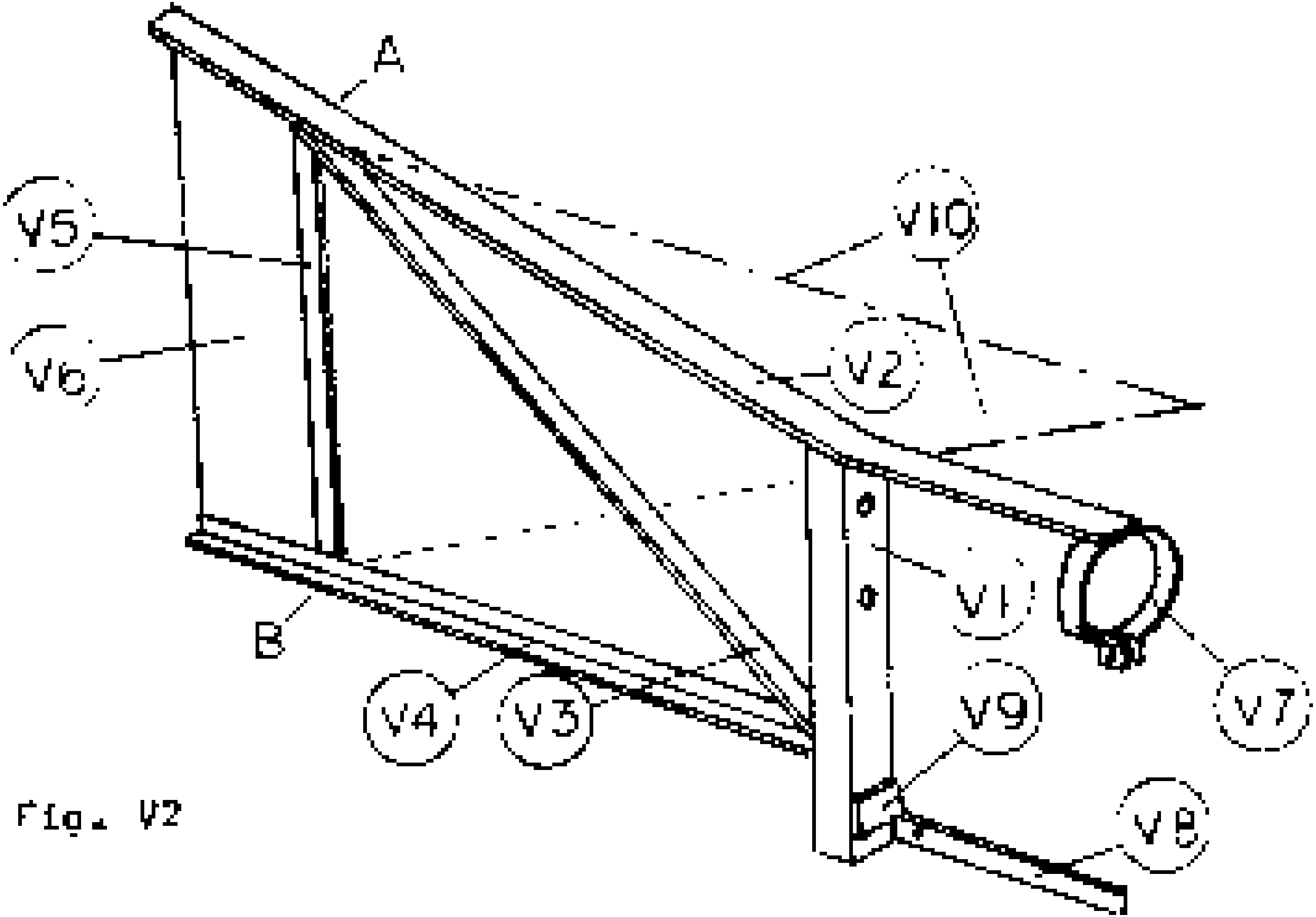


Fig. V2

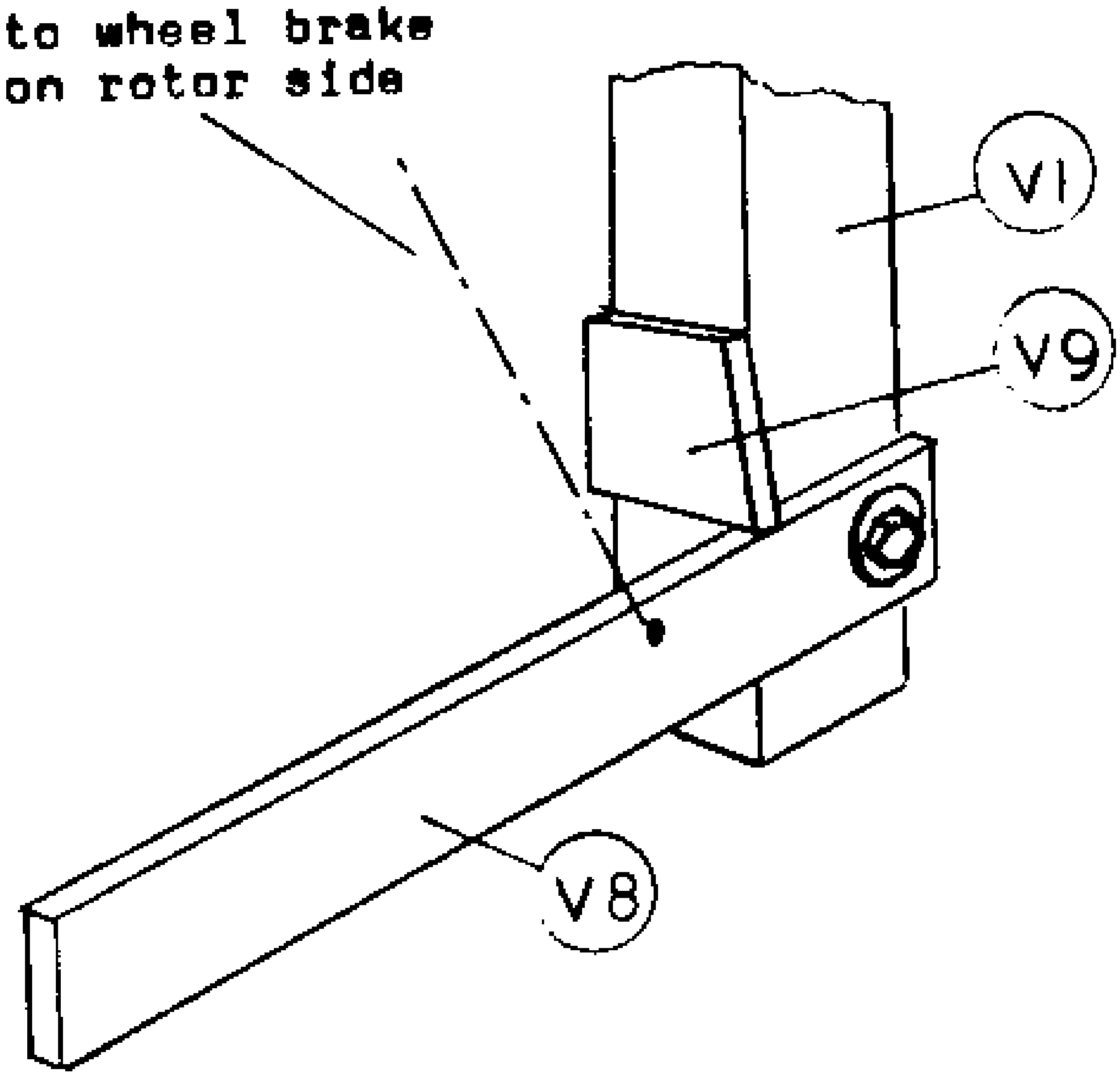


Fig. V3.

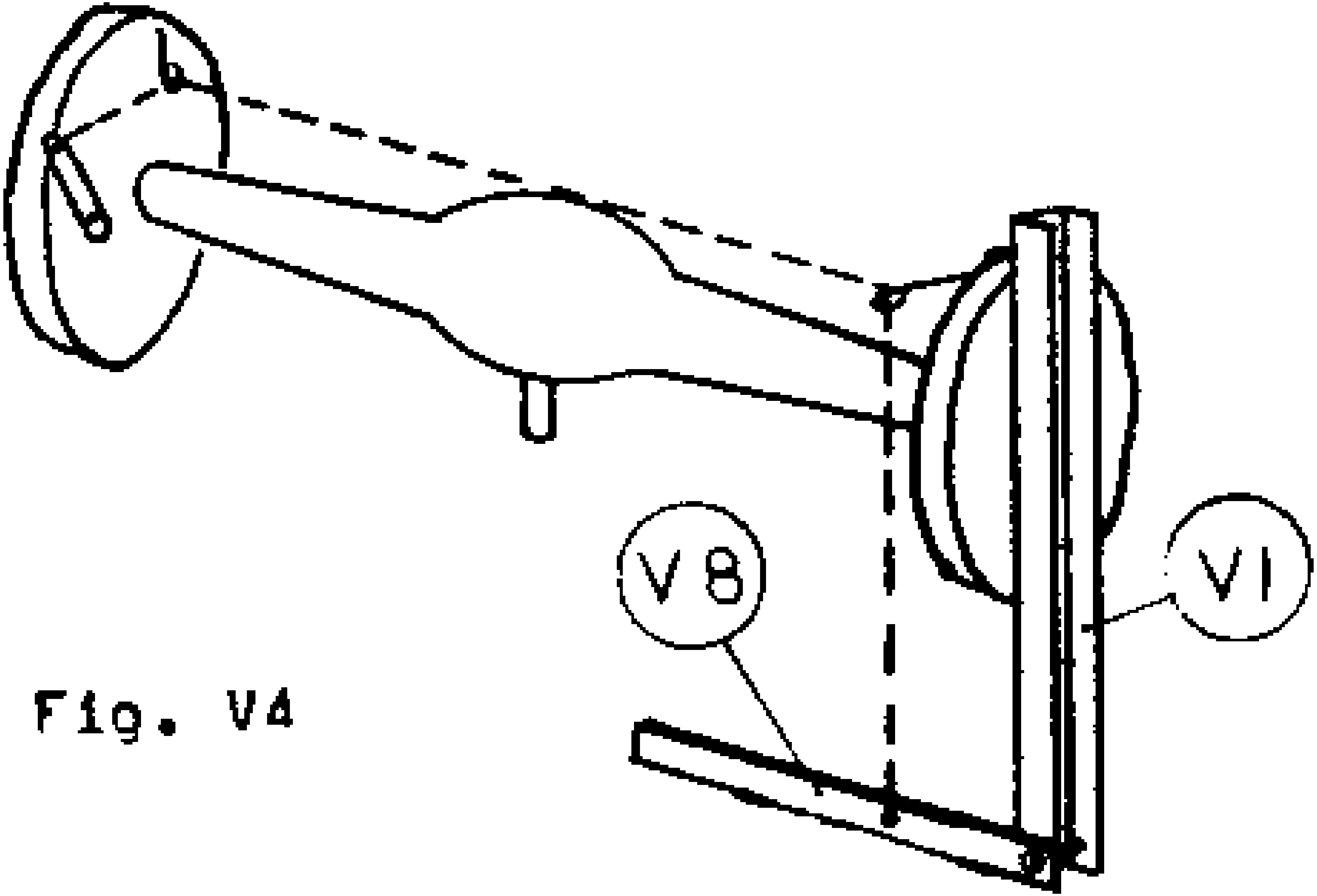


Fig. V4

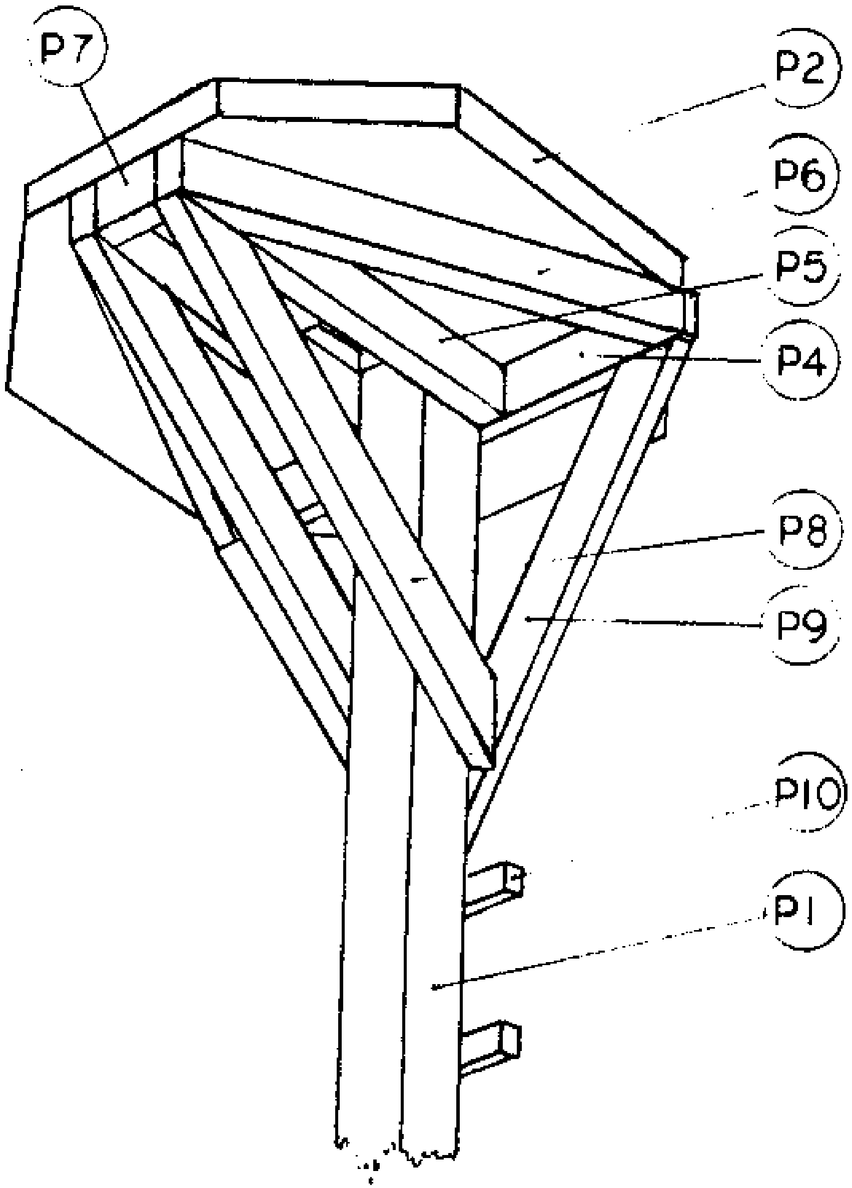
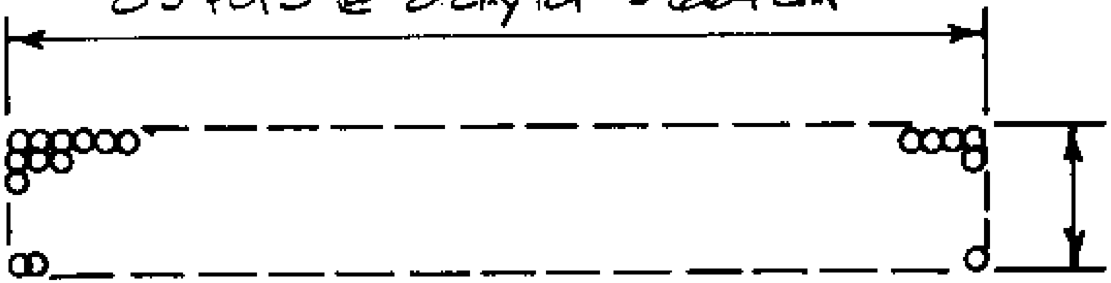


Fig. P2

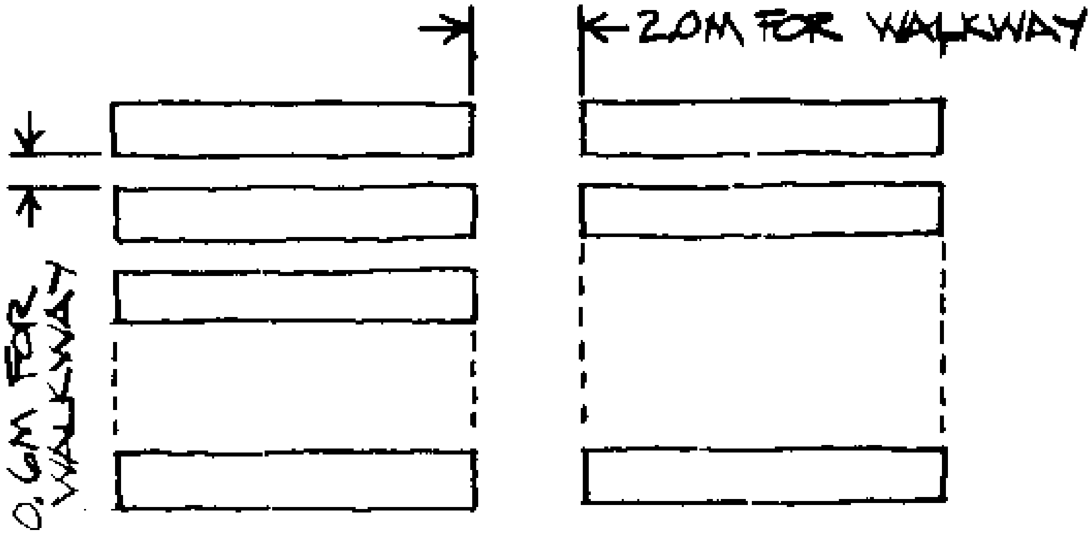
SPECIAL SUBJECT - NURSERIES

PLASTIC POTS



12 × 83 POTS = 996 POTS OR TREES

6.64 M × 0.96 M = 6.37 M^2



ONE BED REQUIRES:

$(0.96 + 0.6) \times (6.64 + 2.0) = 13.5 M^2$

13.5 M^2 BED AND WALKWAY
+ 1.3 M^2 10% WORK AREA AND FENCE

14.8 M^2 TOTAL AREA / BED

966 TREES ÷ 14.8 M^2 =
65 TREES / M^2

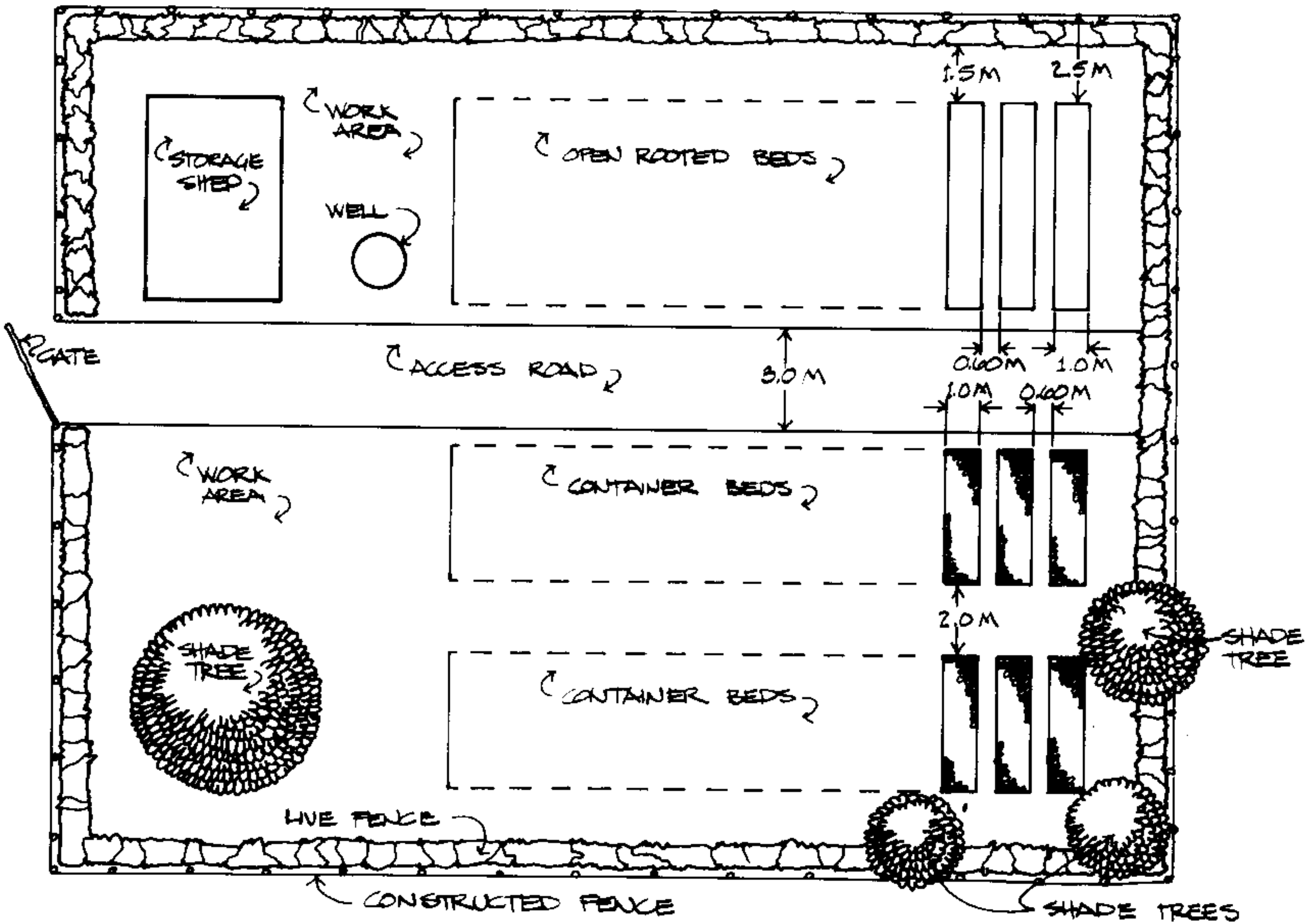
TOTAL SURFACE AREA REQUIRED m^2	ILLUSTRATIVE DIMENSIONS m	NUMBER OF TREES THAT CAN BE RAISED AS EITHER Plastic Pots (-10% LOSS OR REJECTS)	Open-Rooted
10	4 X 2.5	585	360
50	10 X 5	2,925	1,800
100	15 X 6.7	5,850	3,600
500	30 X 17	29,250	18,000
1,000	40 X 25	58,500	36,000
5,000	71 X 70	292,500	180,000
10,000	100 X 100	585,000	360,000

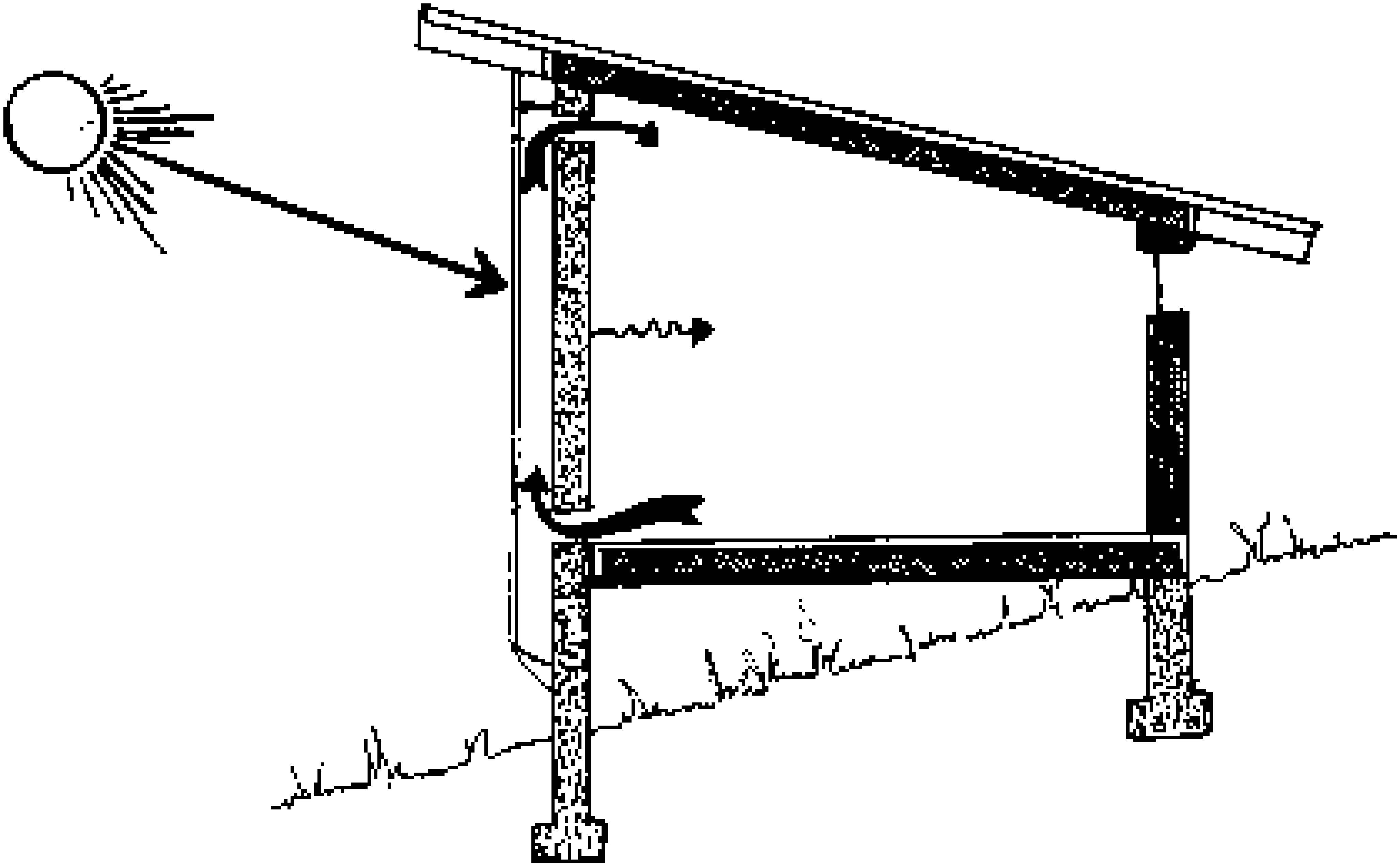
SPACE REQUIREMENTS CALCULATION

(Including walk space and work area)

ON THE BASIS OF :
PLASTIC POT STOCK = 65 TREES/m^2
OPEN-ROOTED STOCK = 40 TREES/m^2

TYPICAL LAYOUT FOR NURSERY PRODUCING APPROXIMATELY 20,000 SEEDLINGS PER YEAR (BOTH POTTED AND OPEN ROOTED STOCK)





trombe wall - winter

Terme **Références**

TAUX D'ABSORPTIVITE (sol) (mes). Rapport entre le RAYONNEMENT SOLAIRE absorbé par une surface et le rayonnement solaire total incident.

A - absorptance

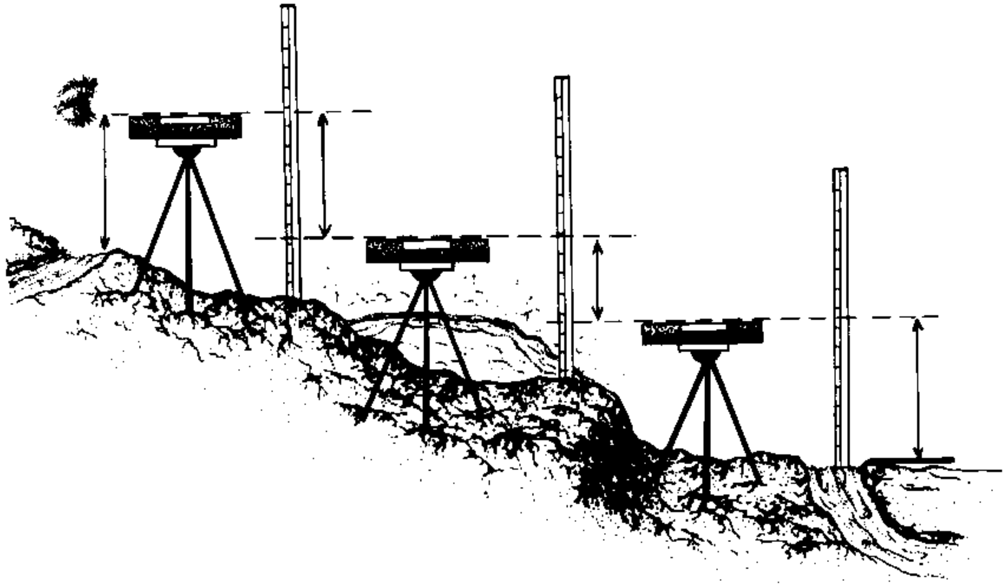
E - coeficiente de absorción

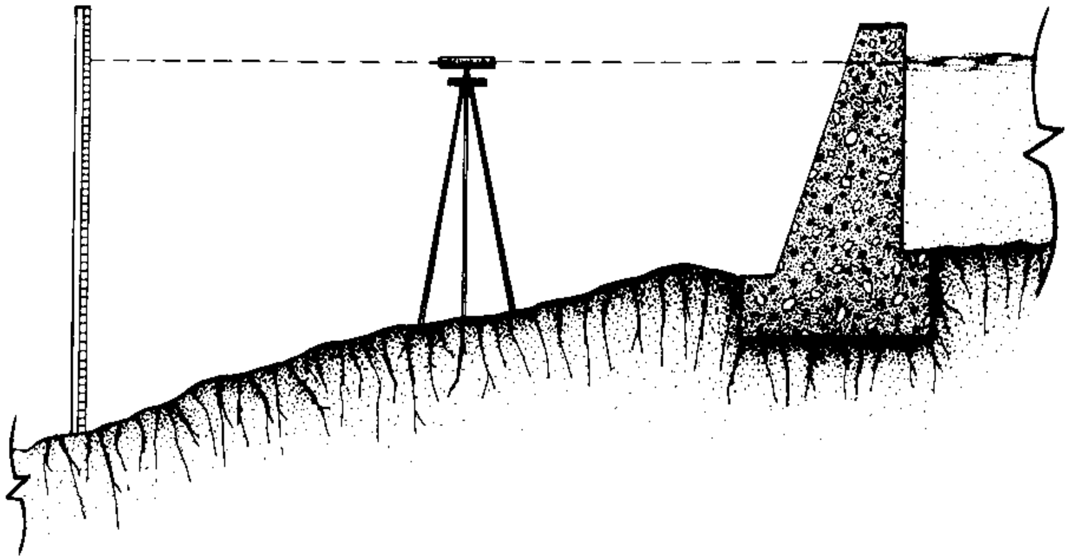
Anglais

Espagnol

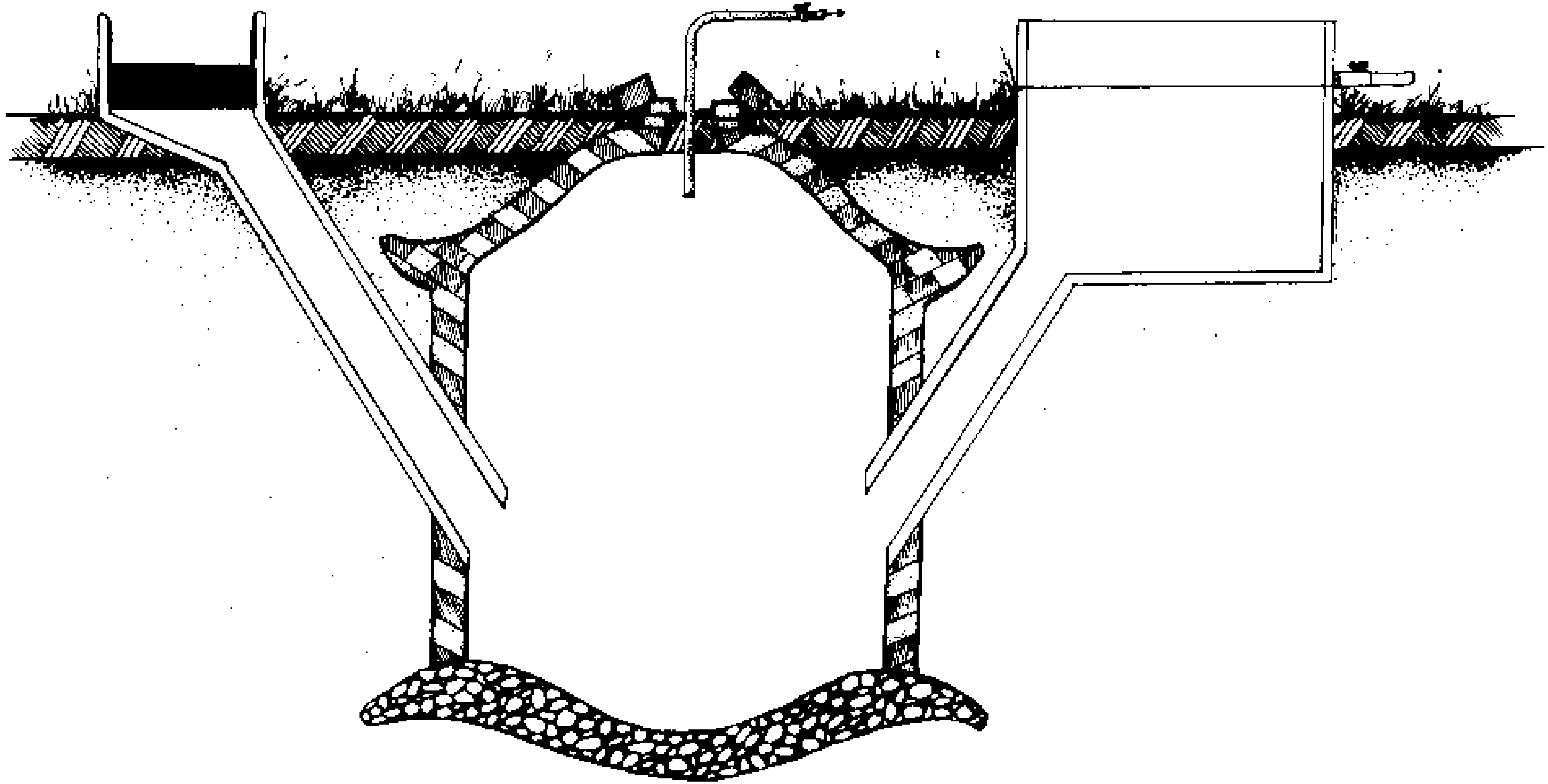
Seconde référence

Défini ailleurs

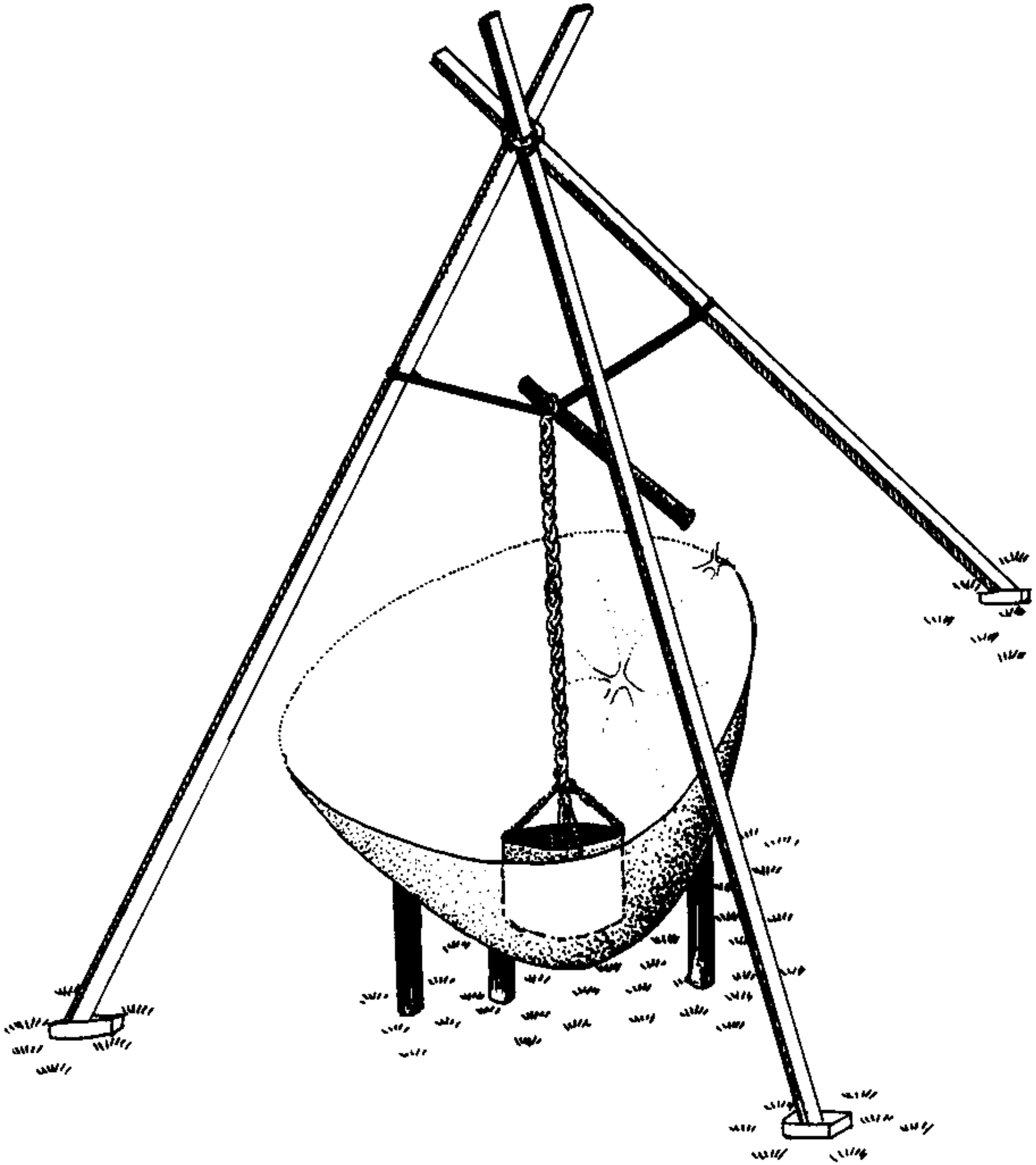




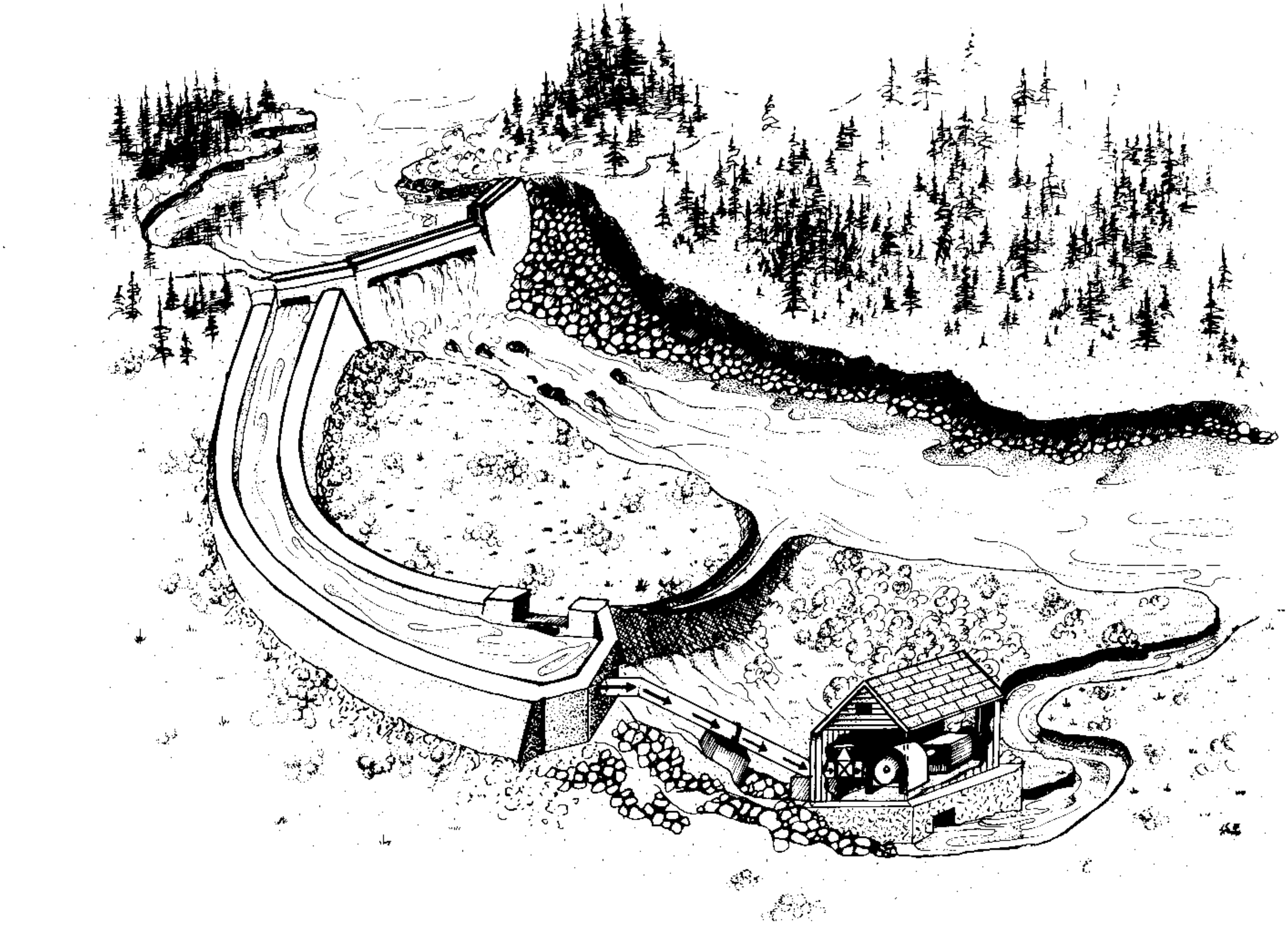
techniques pour la mésure de la chute d'eau



digesteur type chinois



panier solaire



système de puissance hydraulique

Definido en
esta sección

Término

referencias

COEFICIENTE DE ABSORCION (sol) (medic). La relación entre la RADIACION SOLAR absobida por una superficie y la cantidad total de radiación solar que recibe.

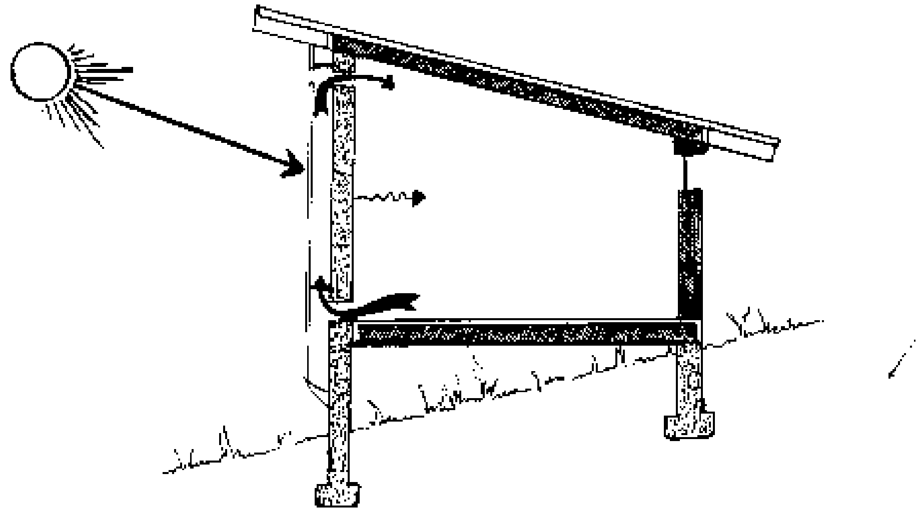
I - absorptance

F - absorptance; coefficient d'absorption

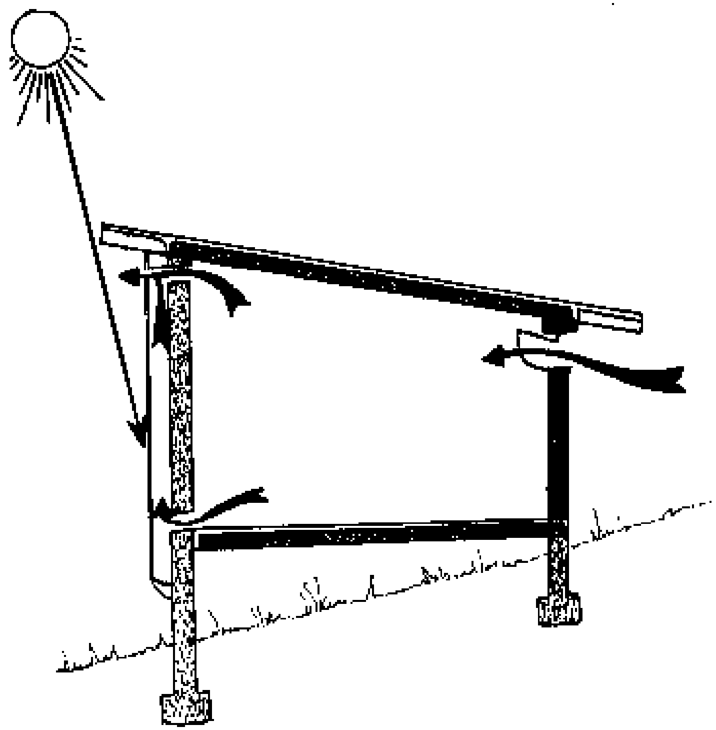
Francés (el más aceptado primero)

Inglés

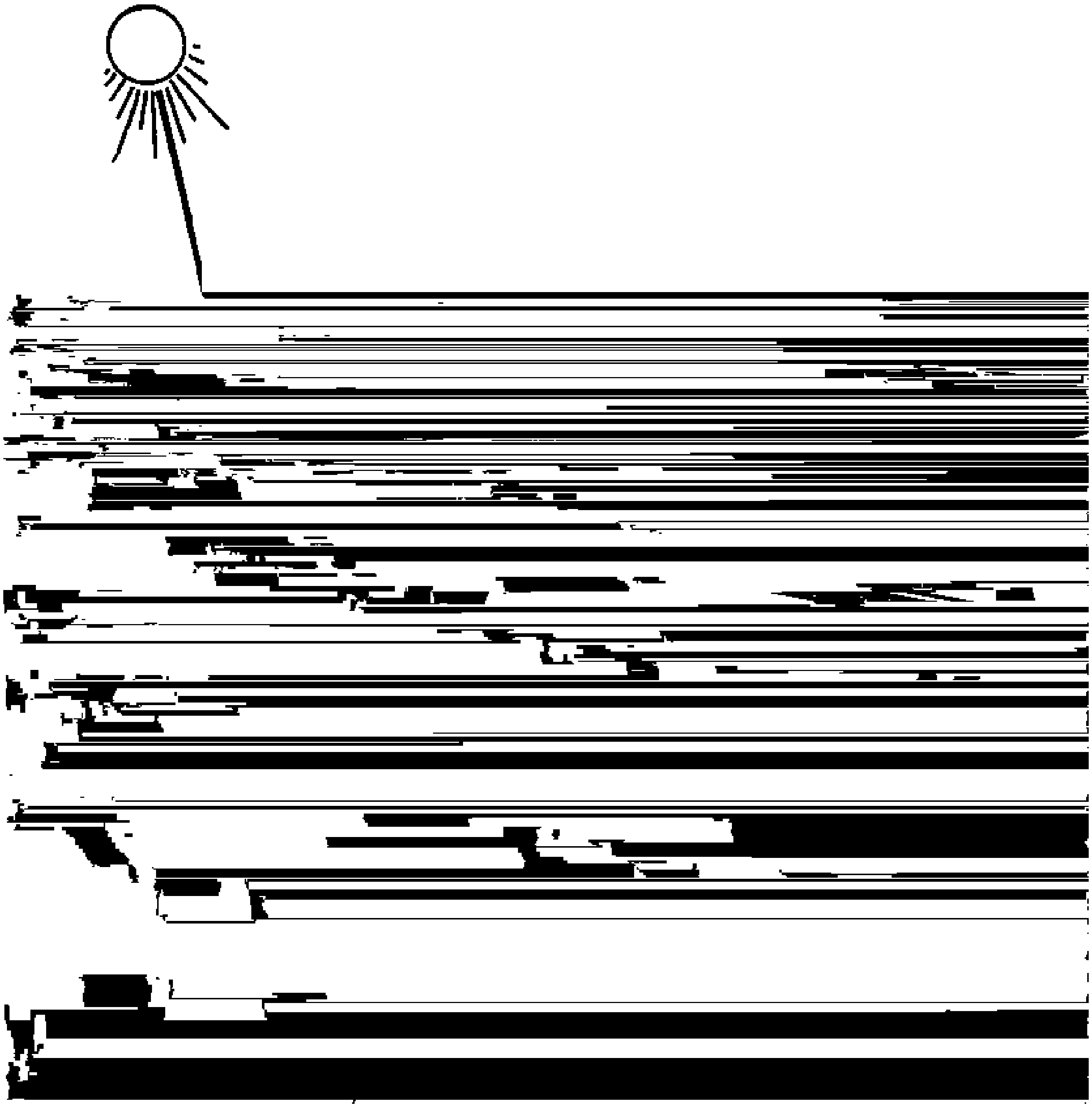
Segunda referencia



pared de trombe - invierno

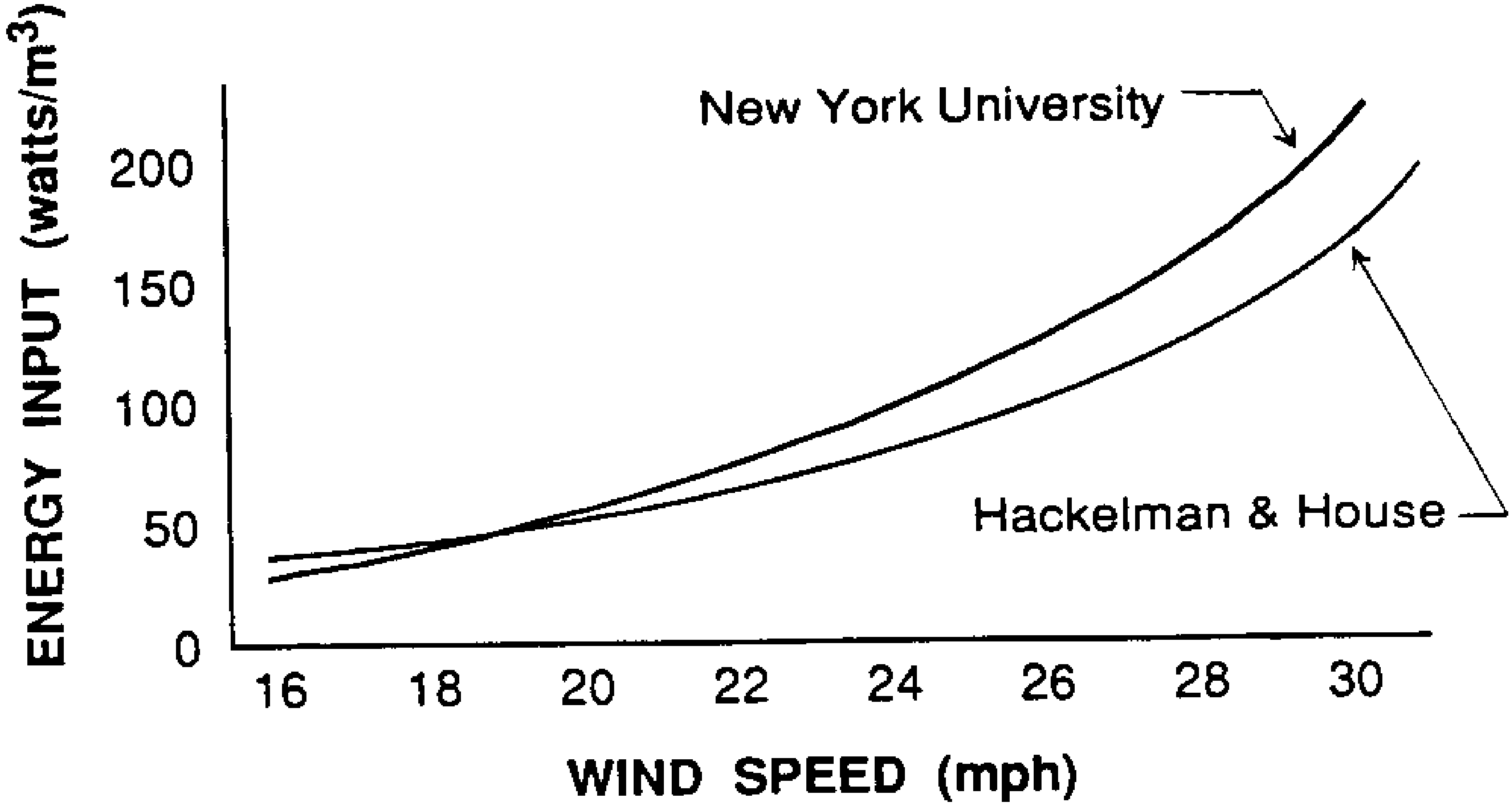


pared de trombe - verano



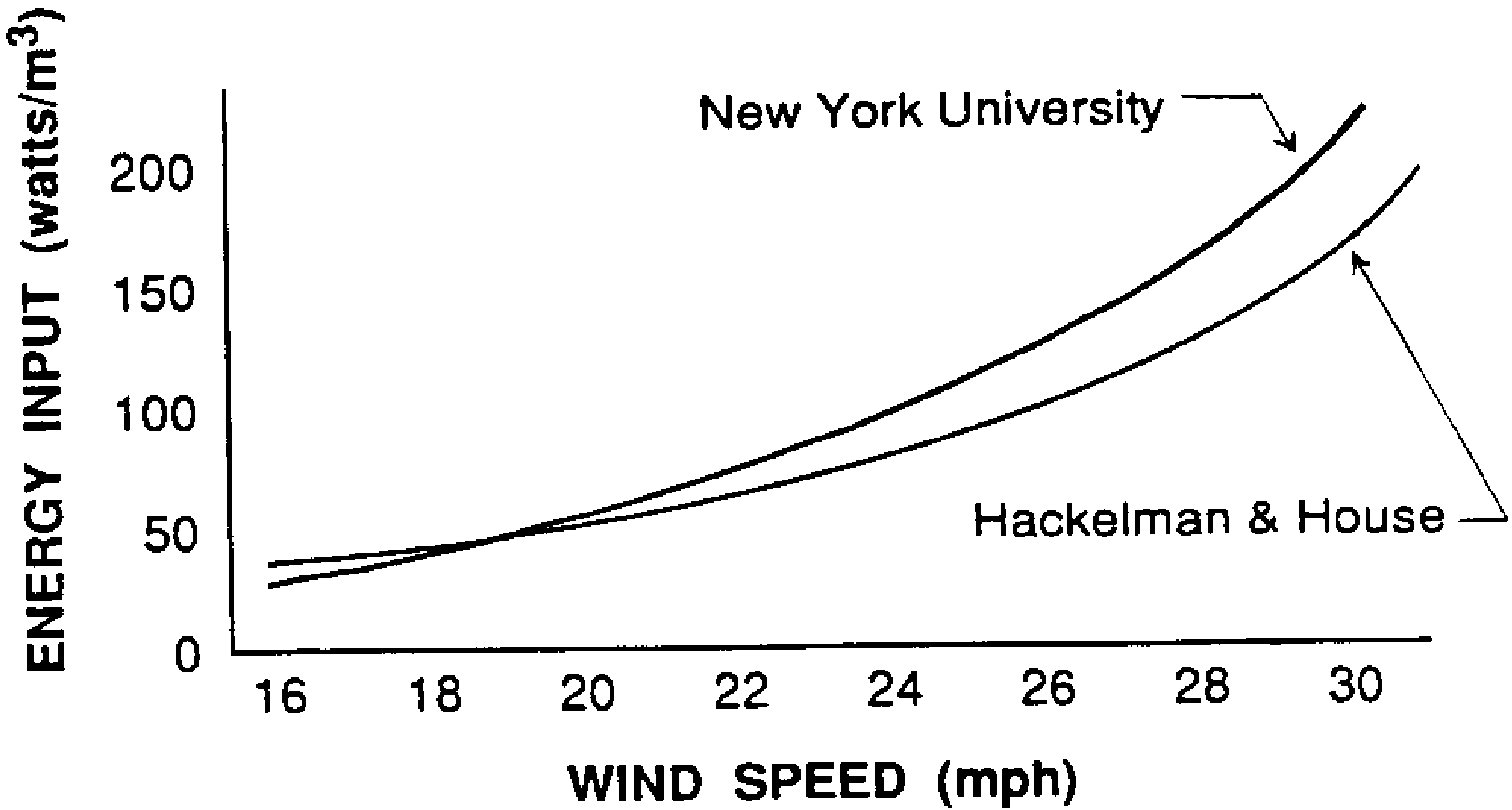
ENERGY INPUT (watts/m^2)

Graph 2

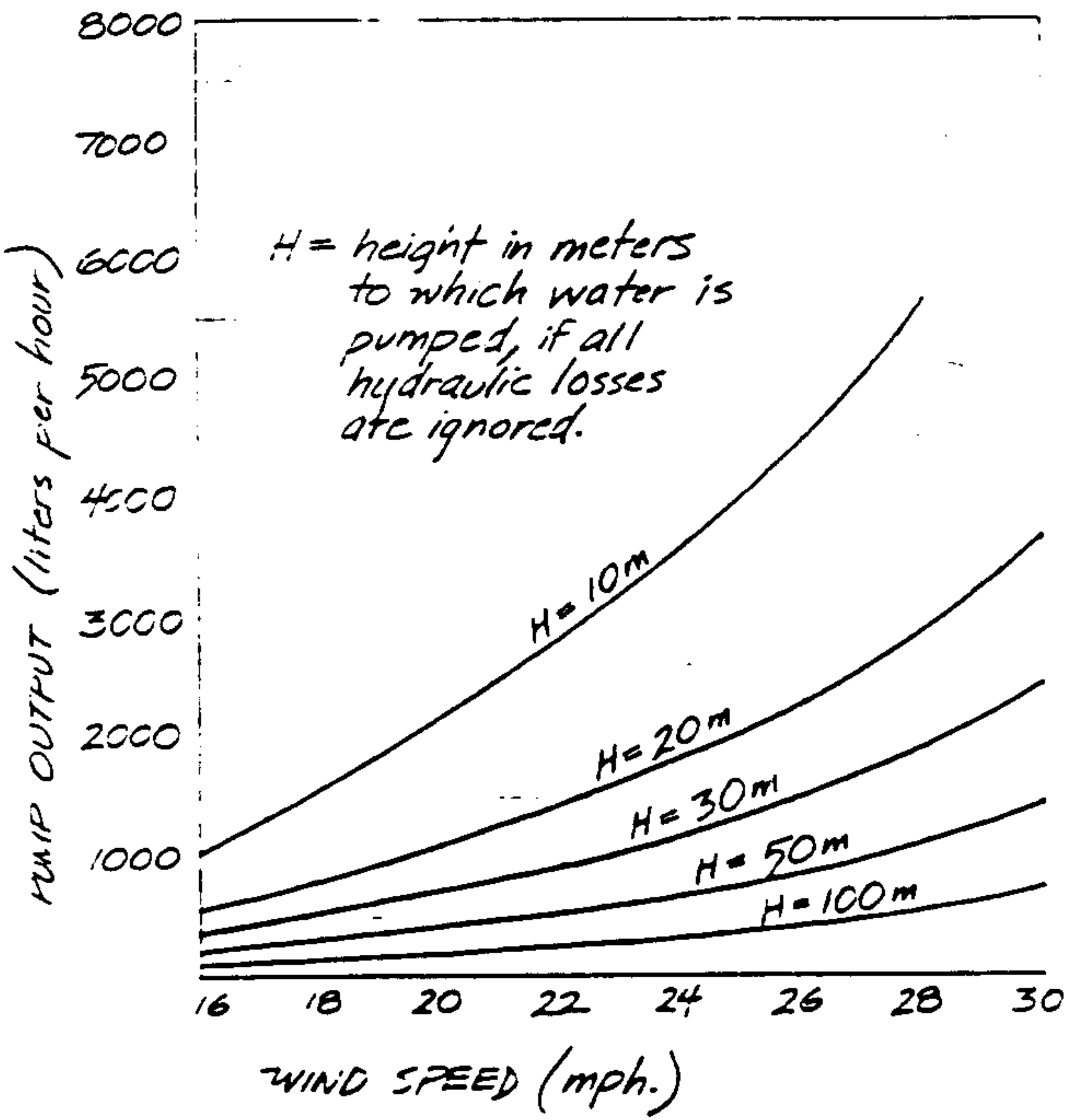


ENERGY INPUT (watts/m²)

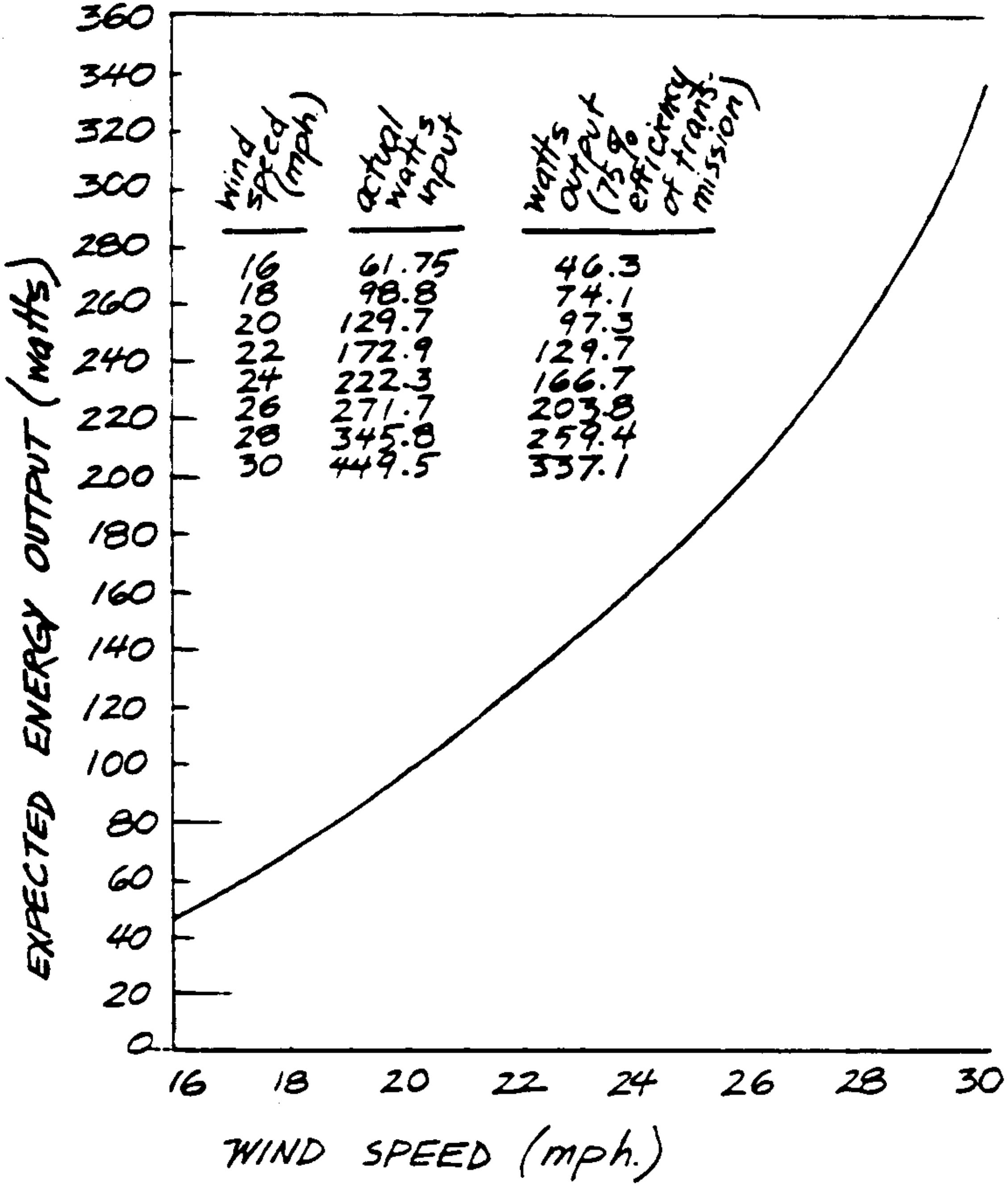
Graph 2



graph 4. EXPECTED PUMP OUTPUT (AT 60% EFFICIENCY) PER SQ. METER OF PROJECTED AREA OF S-ROTOR.

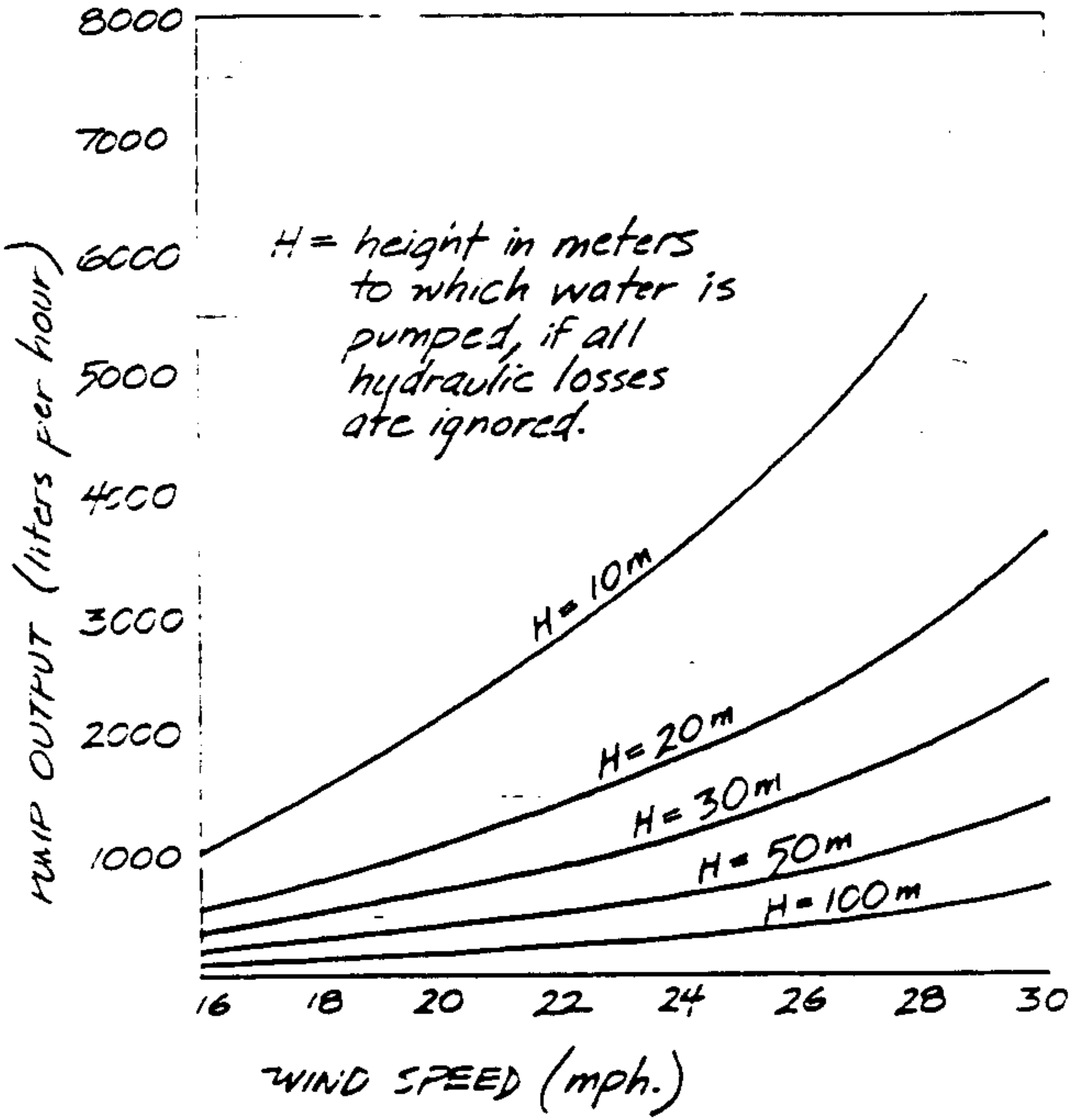


graph 3. EXPECTED ENERGY OUTPUT FROM TWO STAGE S-ROTOR



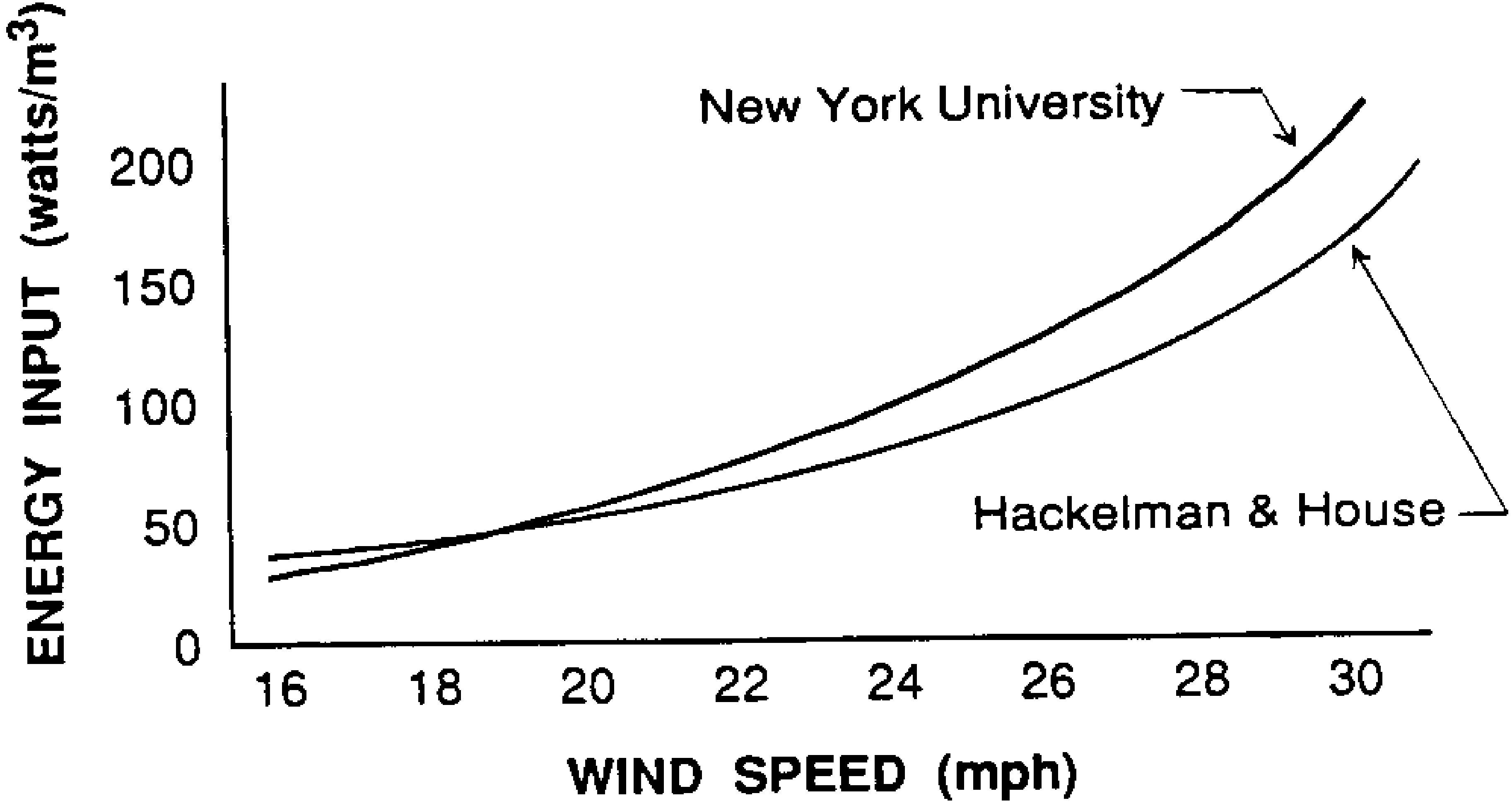
wind speed (mph)	actual watts input	watts output (75% efficiency of transmission)
16	61.75	46.3
18	98.8	74.1
20	129.7	97.3
22	172.9	129.7
24	222.3	166.7
26	271.7	203.8
28	345.8	259.4
30	449.5	337.1

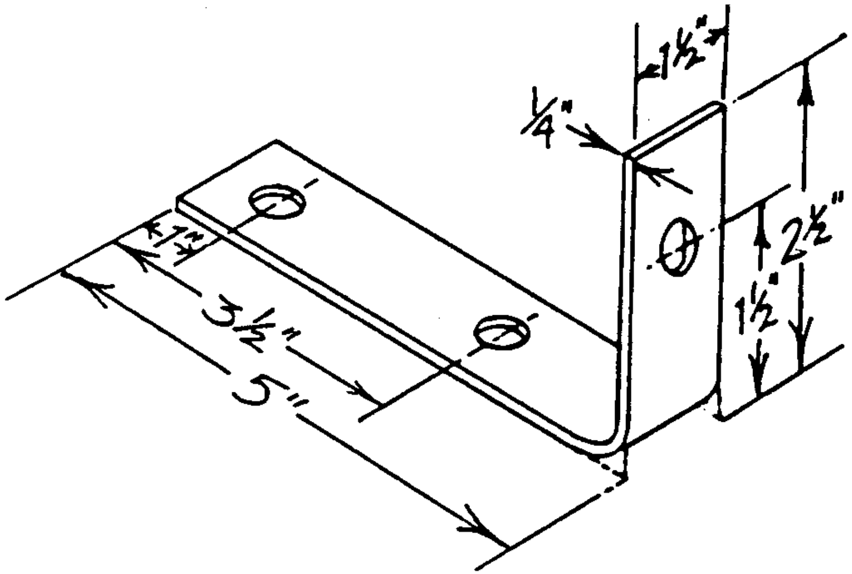
graph 4. EXPECTED PUMP OUTPUT (AT 60% EFFICIENCY) PER SQ. METER OF PROJECTED AREA OF S-ROTOR.



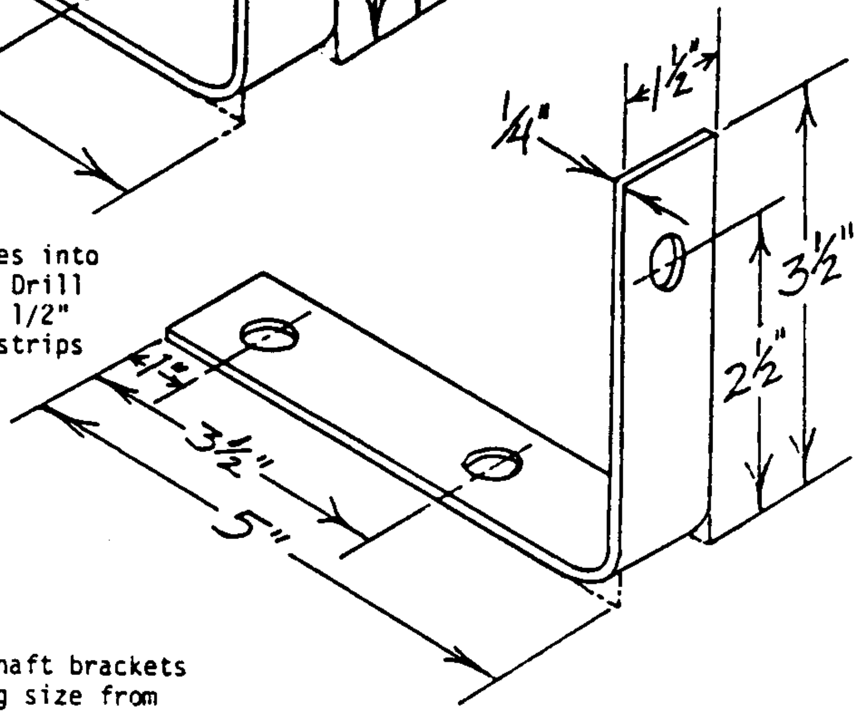
ENERGY INPUT (watts/m^2)

Graph 2

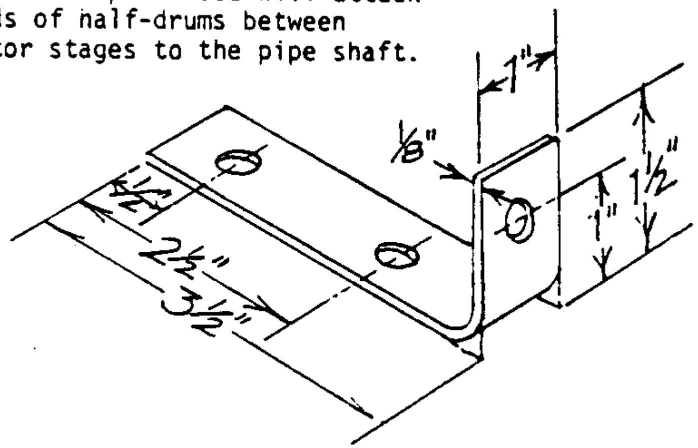




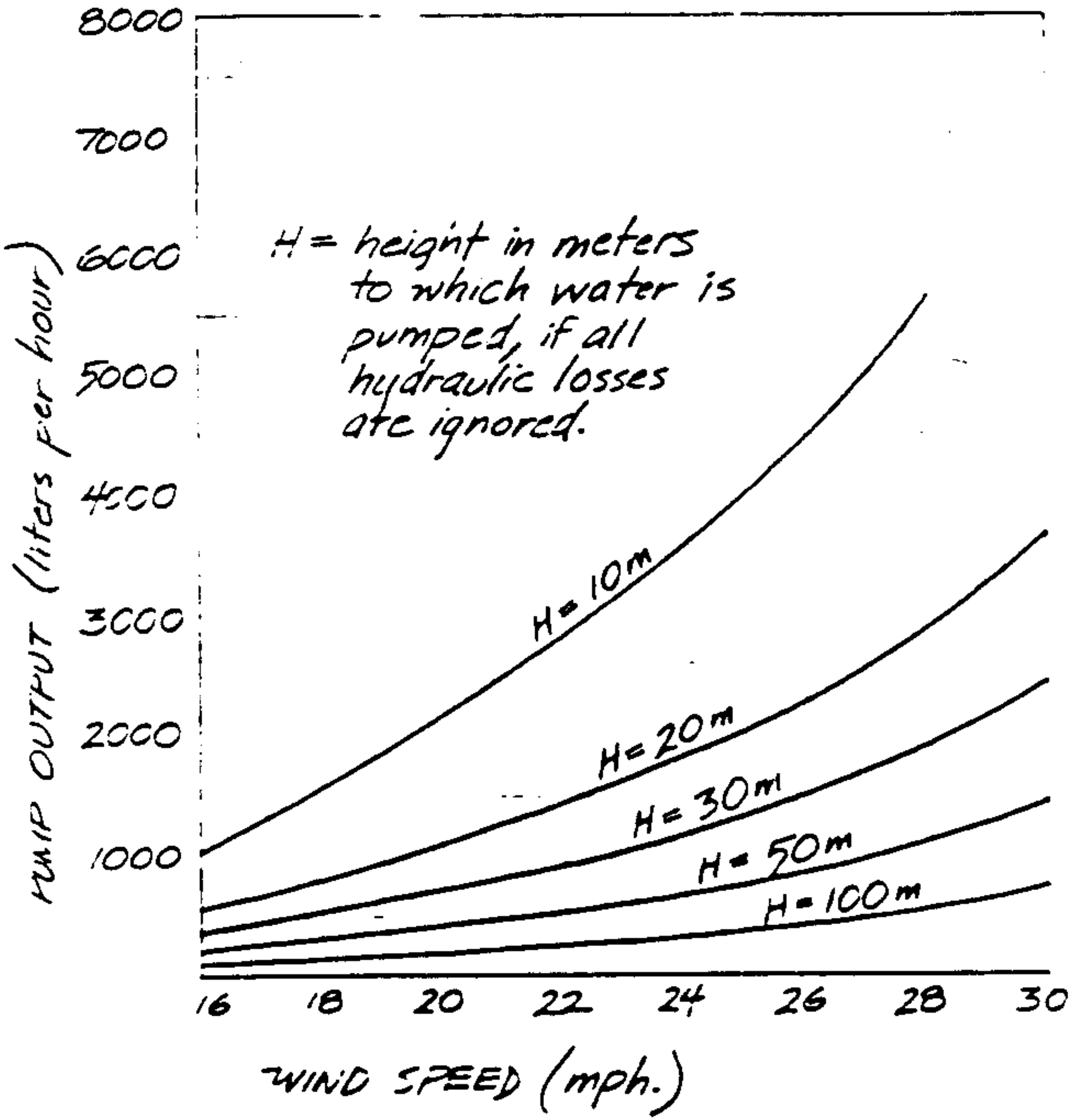
Bend right angles into red hot steel. Drill holes to accept 1/2" bolts when the strips are cool.



Make four lid/shaft brackets of the following size from steel strips. These will attach lids of half-drums between rotor stages to the pipe shaft.



graph 4. EXPECTED PUMP OUTPUT (AT 60% EFFICIENCY) PER SQ. METER OF PROJECTED AREA OF S-ROTOR.



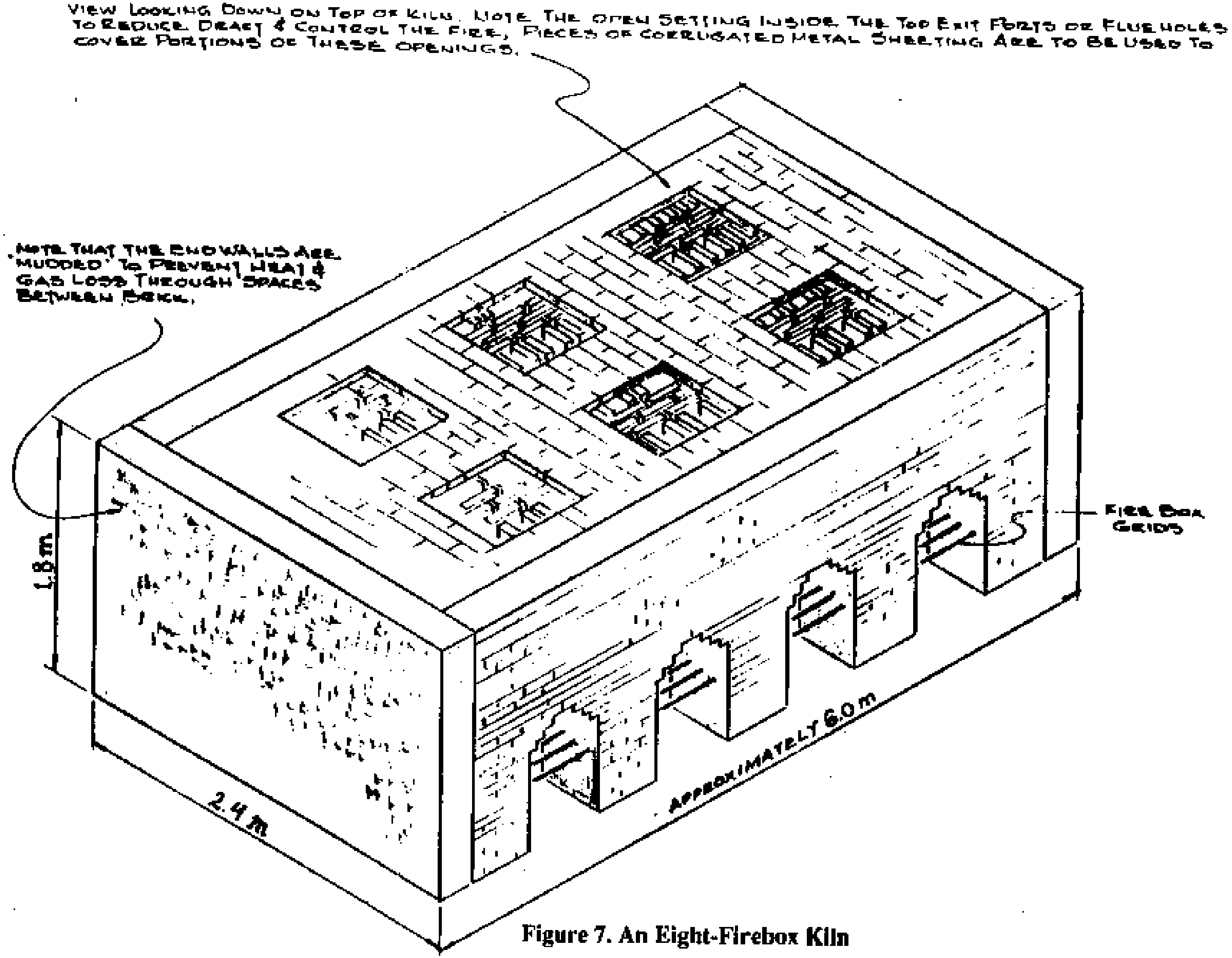
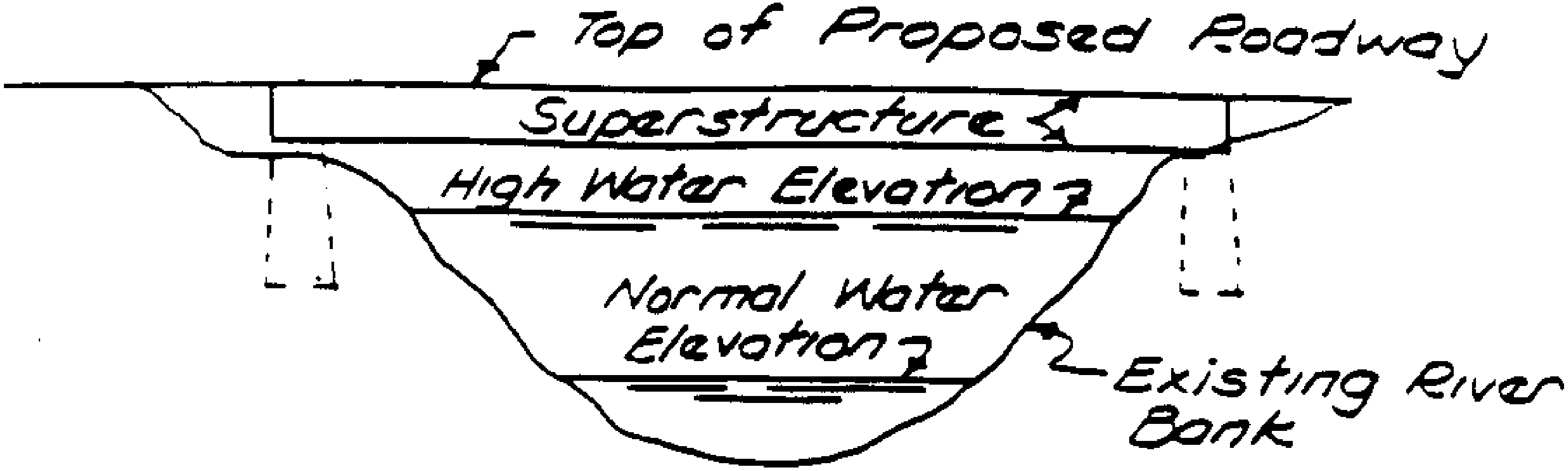
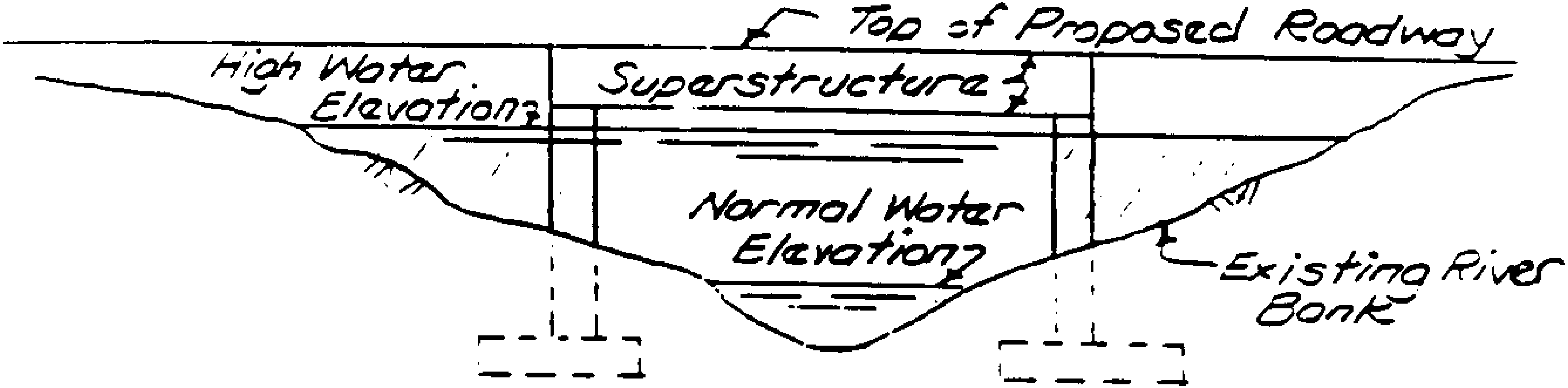


Figure 7. An Eight-Firebox Kiln

Larger kilns can be made just by making the kiln longer and increasing the number of fireboxes. All fireboxes regardless of length of kiln should be the same size.See Figure 5 for recommended dimensions of firebox. The end walls are plastered on the outside with mud to prevent loss of heat and gases through spaces between the bricks. In the top view, note the stacks of bricks below the top flue holes. These are partially or completely covered with metal sheet to control the fire. Dimensions are approximate.

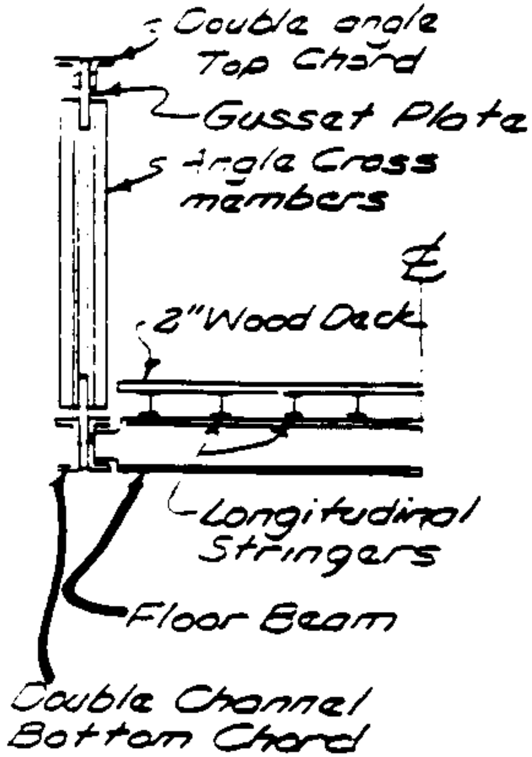


a. Typical River Crossing



b. Wide Flood Plain

Figure 3: Water ways



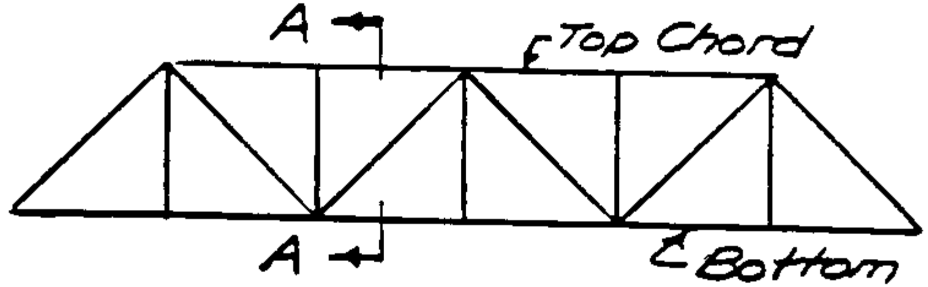


Figure 6: Truss

The truss type of structure requires smaller steel members but needs extensive fabrication by a local specialist. Because the needed skills are not common, truss construction may not be an available option.

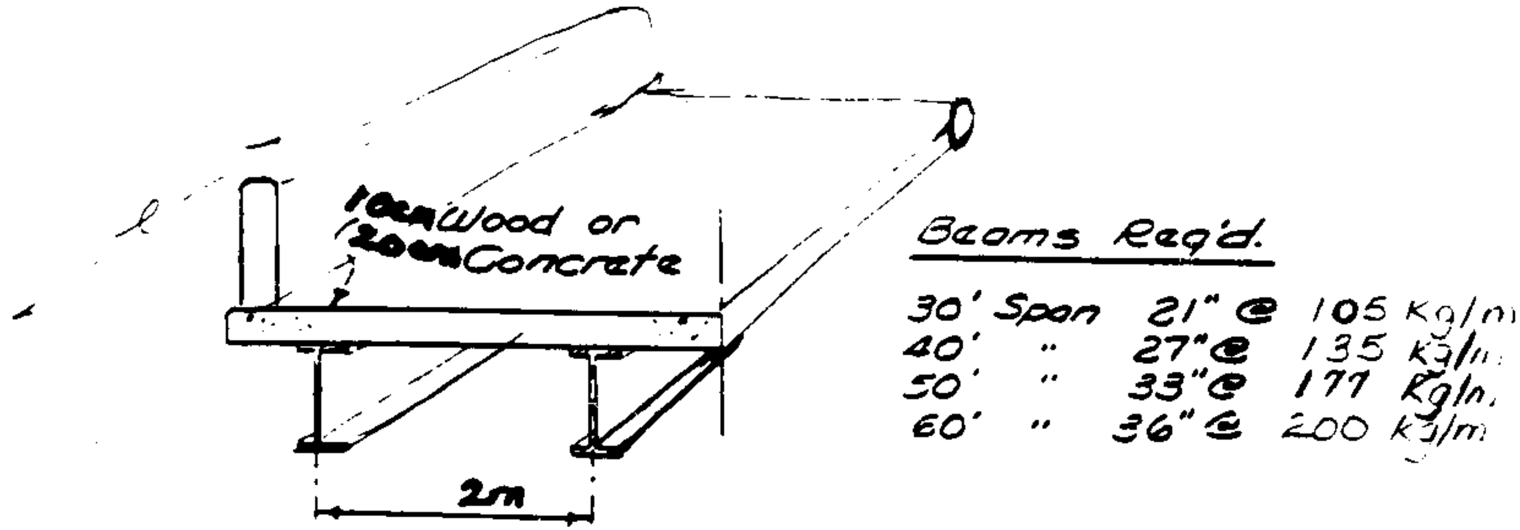
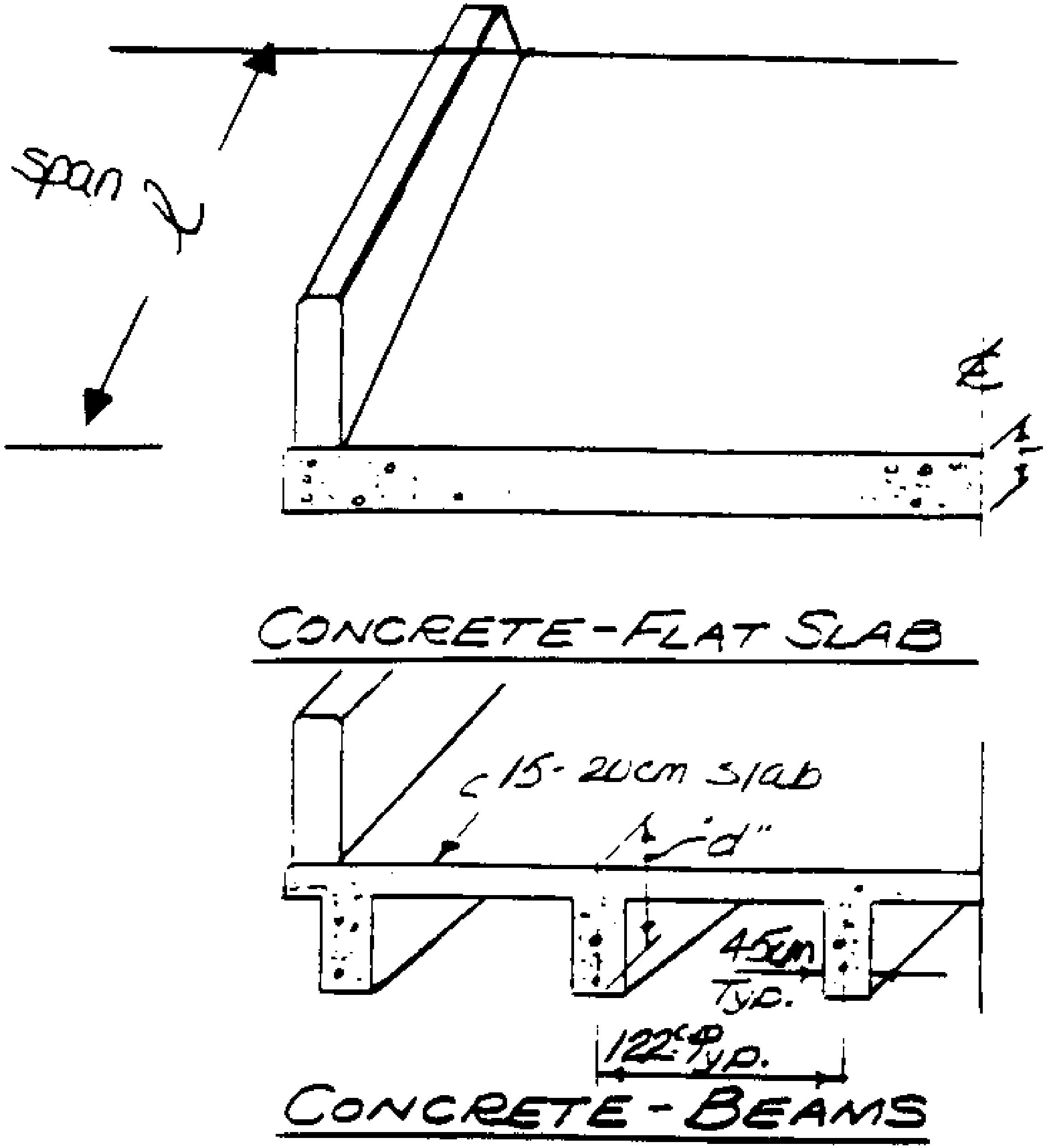


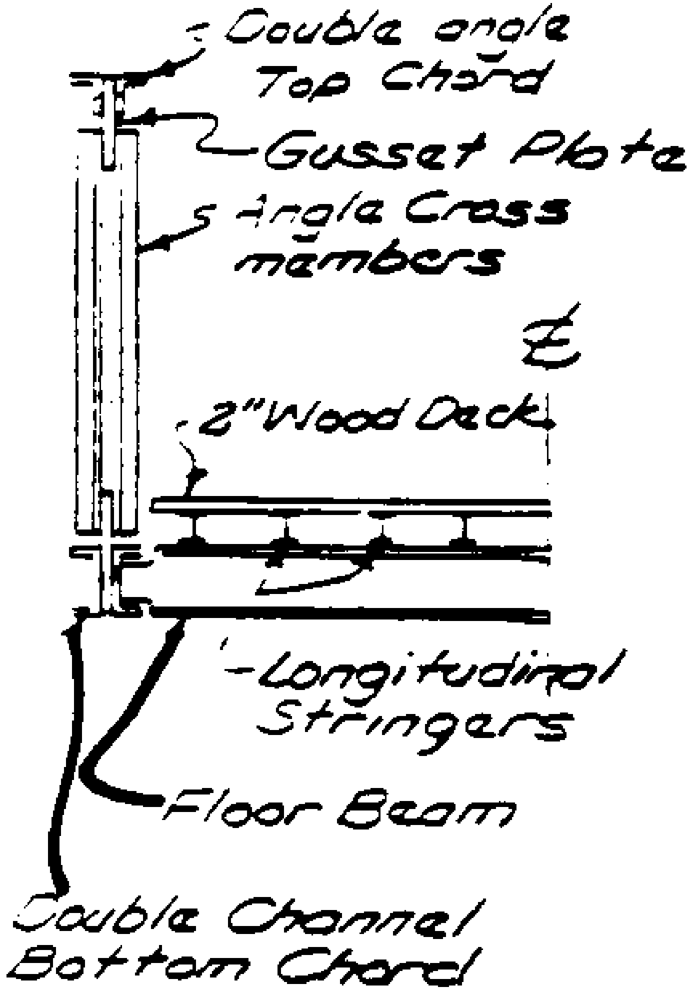
Figure 7: Steel Beams



20 cm slab/3 m spans
45 cm slab/9 m spans
Reinforced steel 90 kg/cu m

Reinforced steel 90 kg/cu m

Figure 5: Concrete Superstructures



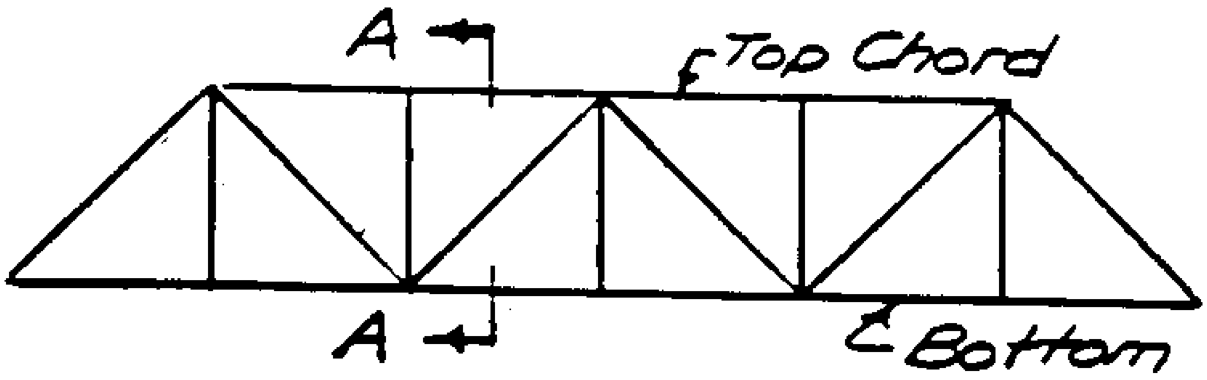
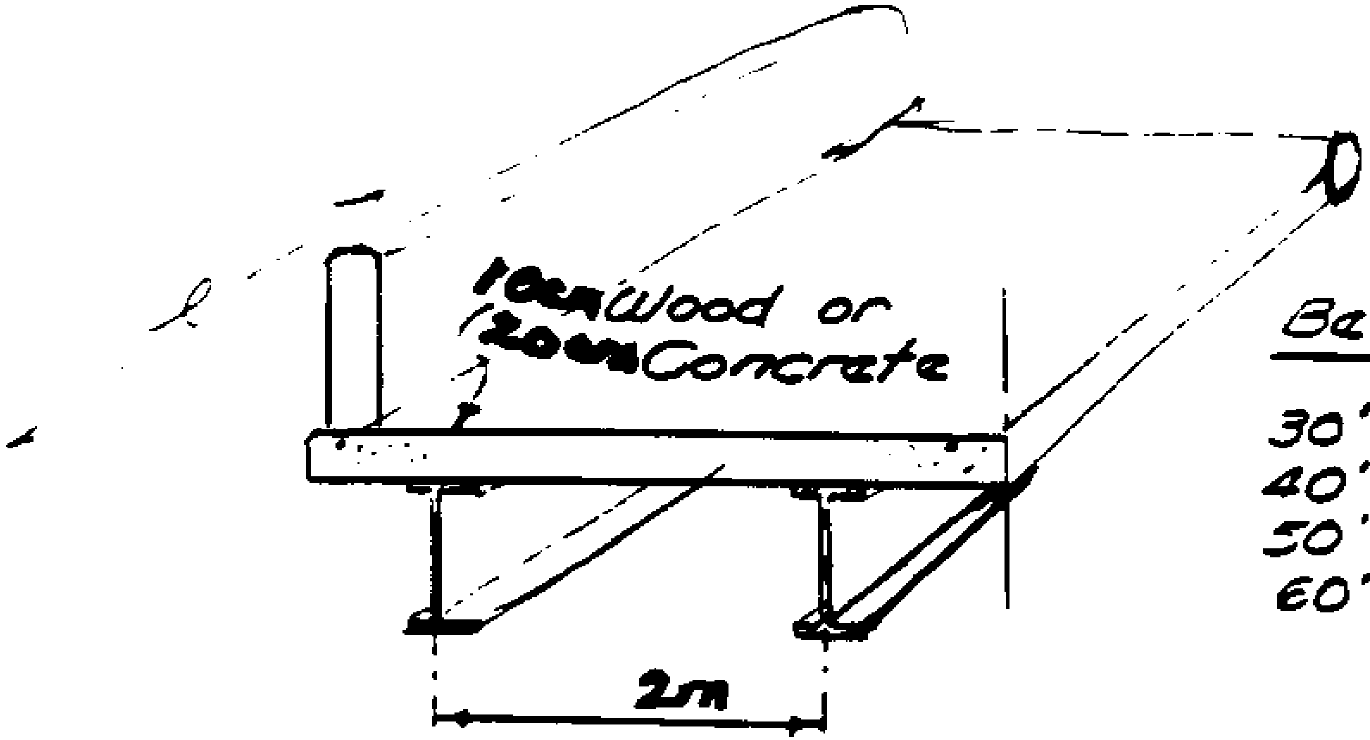


Figure 6: Truss



Beams Req'd.

30'	Span	21" @	105 Kg/m
40'	"	27" @	135 kg/m
50'	"	33" @	177 Kg/m
60'	"	36" @	200 kg/m

Figure 7: Steel Beams

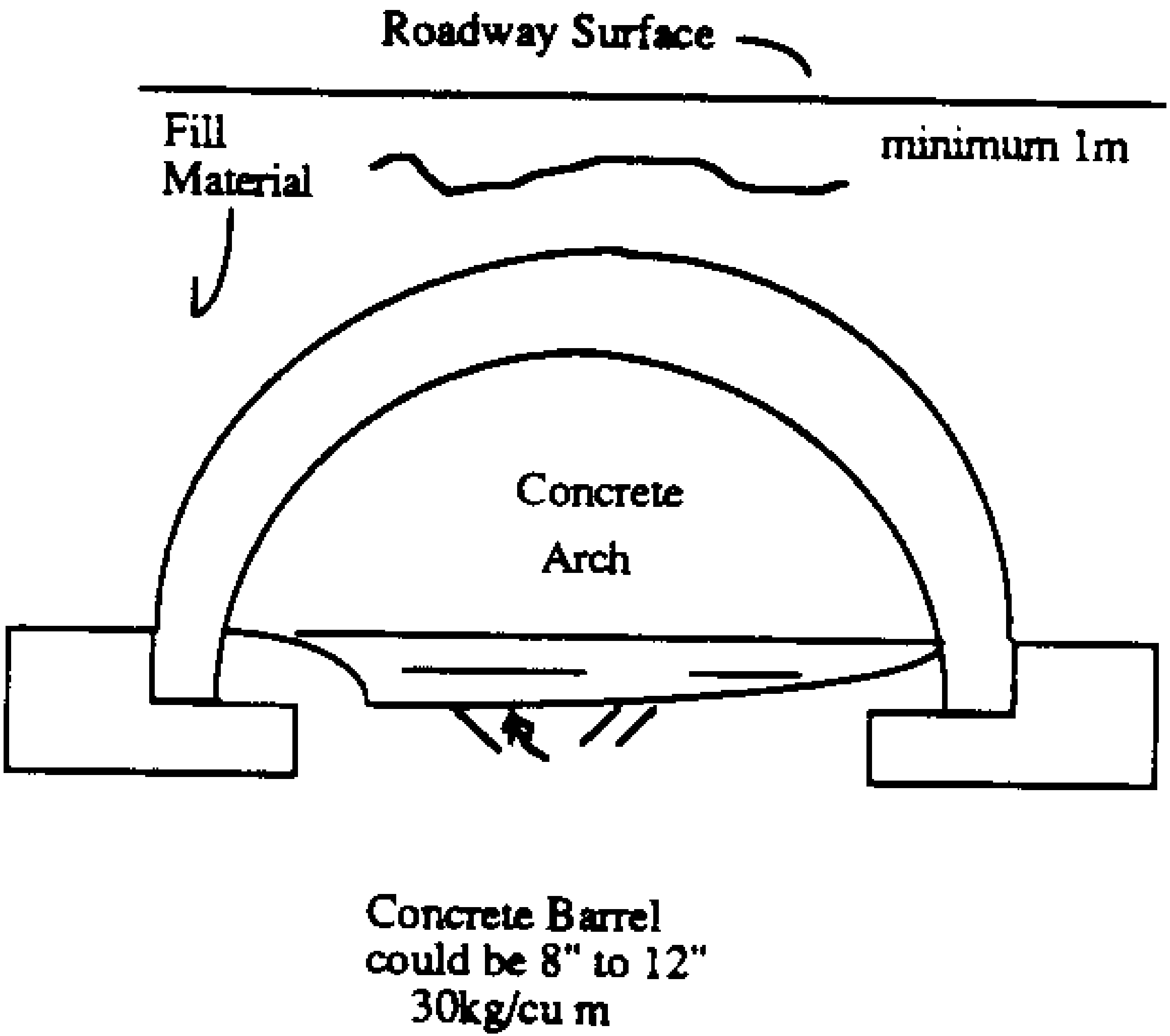
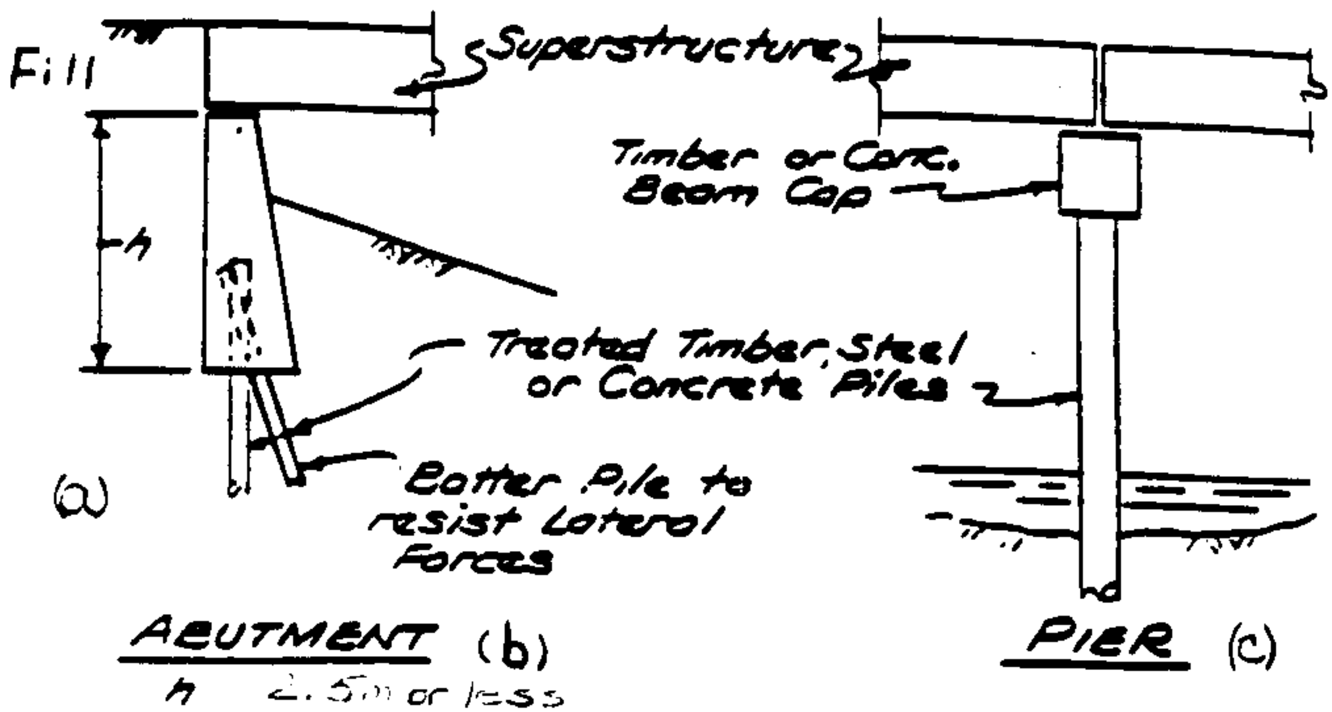


Figure 8: Concrete Arch



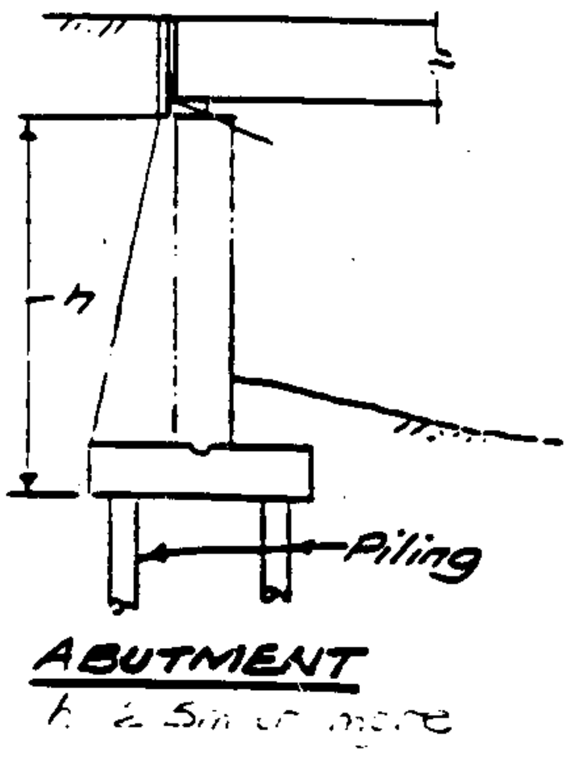


Figure 10: Abutments and Piers

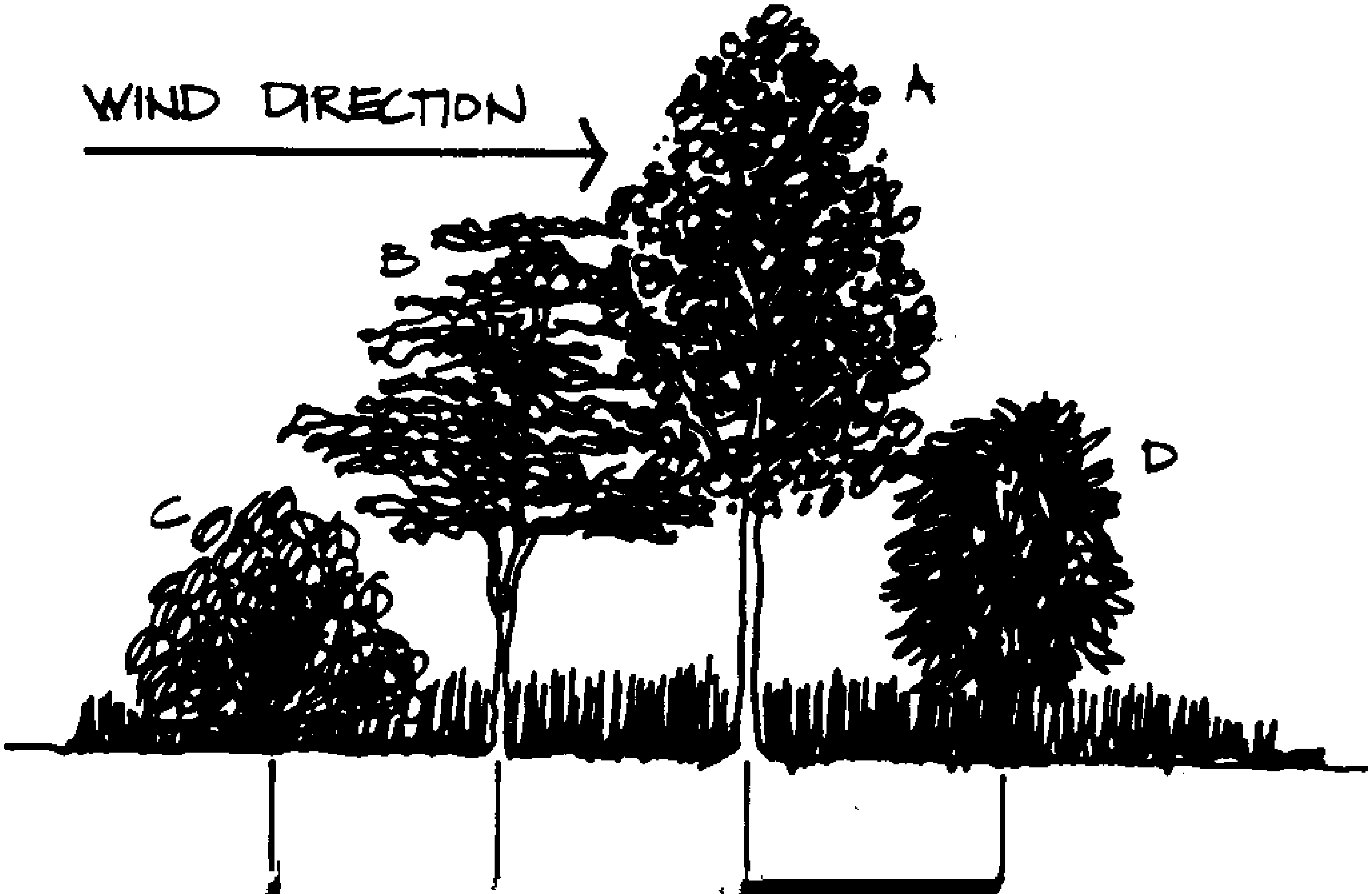

WIND DIRECTION
A
B
C
D

Table 1. Classification of Concentrators

Type of Concentrator	Type of Focus	Lens or Mirror	Sun's Concentration	Tracking (yes/no)	Tracking Receiver (yes/no)	Capability of Temperature (°C)	(°F)	Typical Applications	Comments
Parabolic dish	point	mirror	> 1000	yes two-axis	yes	>2638	>3000	electricity heat	Small-scale applications
Central receiver	point	mirror	> 1000	yes two-axis	no	>2638	>3000	electricity heat	Large-scale applications
Lens (round)	point	lens	> 1000	yes two-axis	yes	>2638	>3000	electricity heat	Utilized with photovoltaic cells
Parabolic trough	line	mirror	100	yes one-axis	no	538	1000	electricity heat	Can be used for both small and large systems
Fixed mirror moving focus	line	mirror	100	no	yes one-axis	538	1000	electricity heat	Can be used for both small and large systems; not economic in U.S. experience
Lens (linear)	line	lens	100	yes one-axis	yes	538	1000	electricity heat	Little U.S. experience
Sphere	line	mirror	80	no	yes two-axis	538	1000	electricity	Awkward in large size
Cylinder	line	mirror	2	no	no	121	250	heat	
Cusp	line	mirror	1.5-2.5	no	no	121	250	heat	
Winston	line	mirror	3 - 6	no	no	121	250	heat	Concentration decreases as acceptance angle increases
Flat plate with booster	area	mirror booster	> 1 and < 2	no	no	121	250	heat	

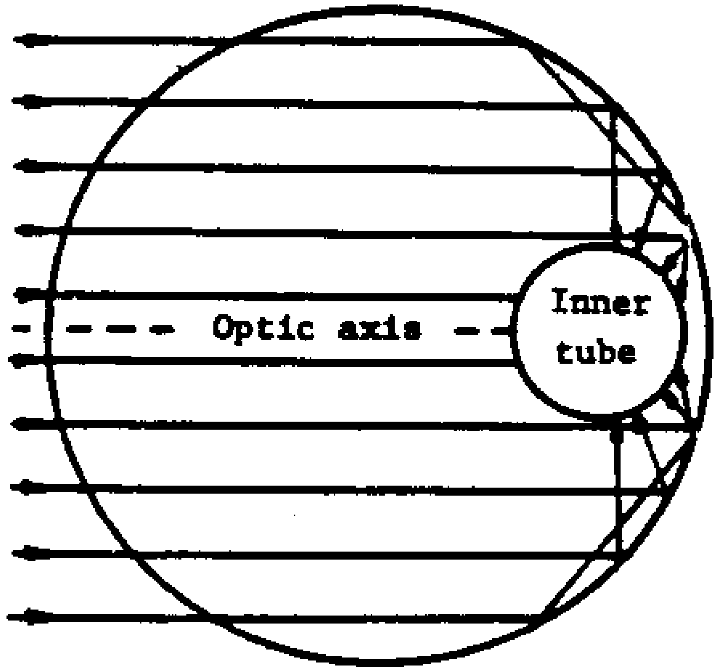


Figure 28. Cross Section Drawing of Once Through Configuration

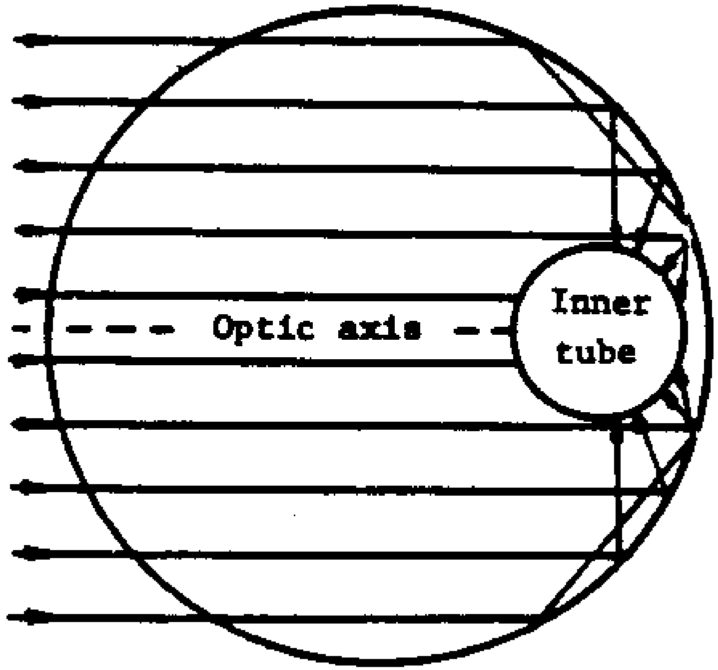


Figure 28. Cross Section Drawing of Once Through Configuration

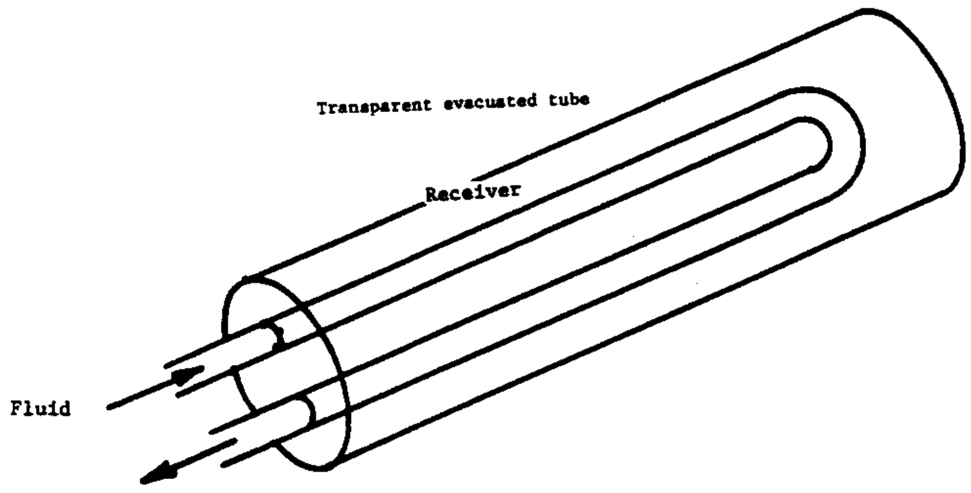
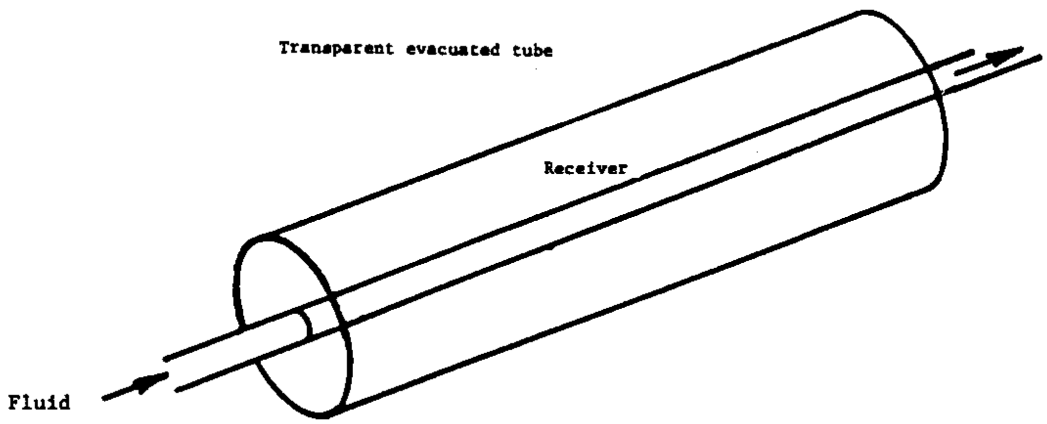


Figure 29. Bayonet Configuration



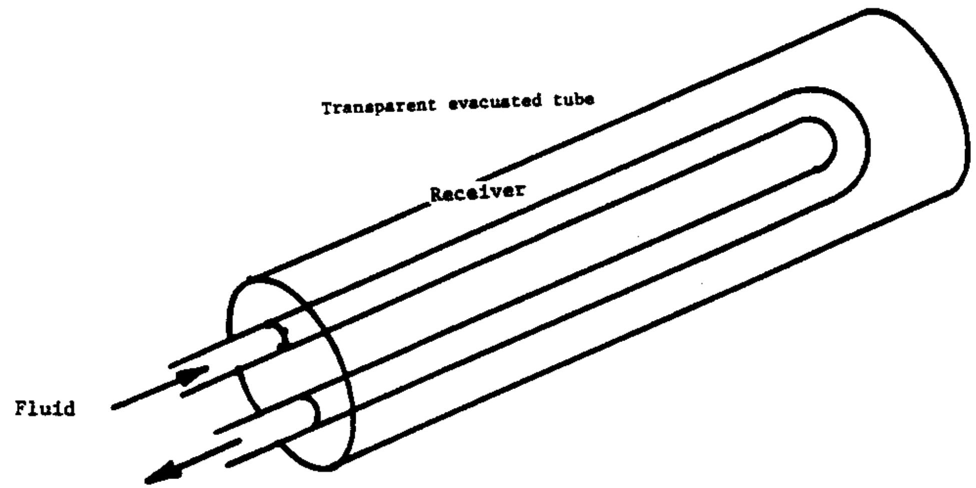
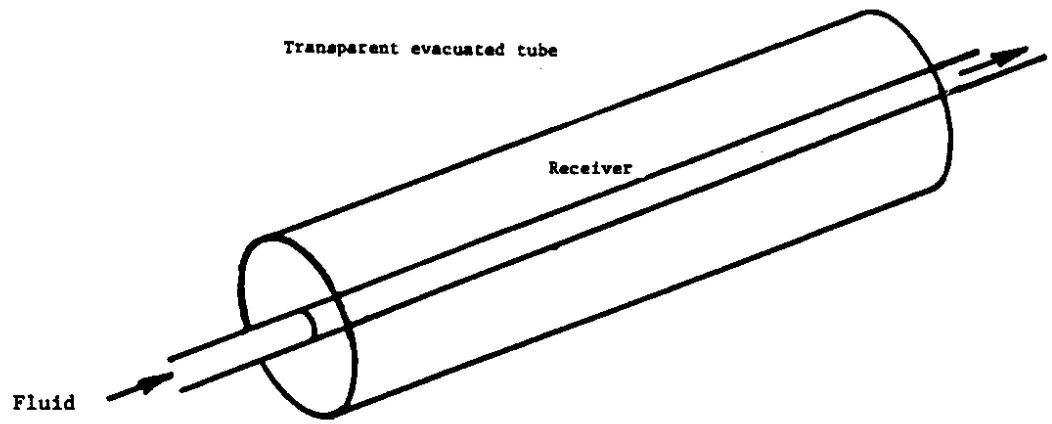


Figure 29. Bayonet Configuration



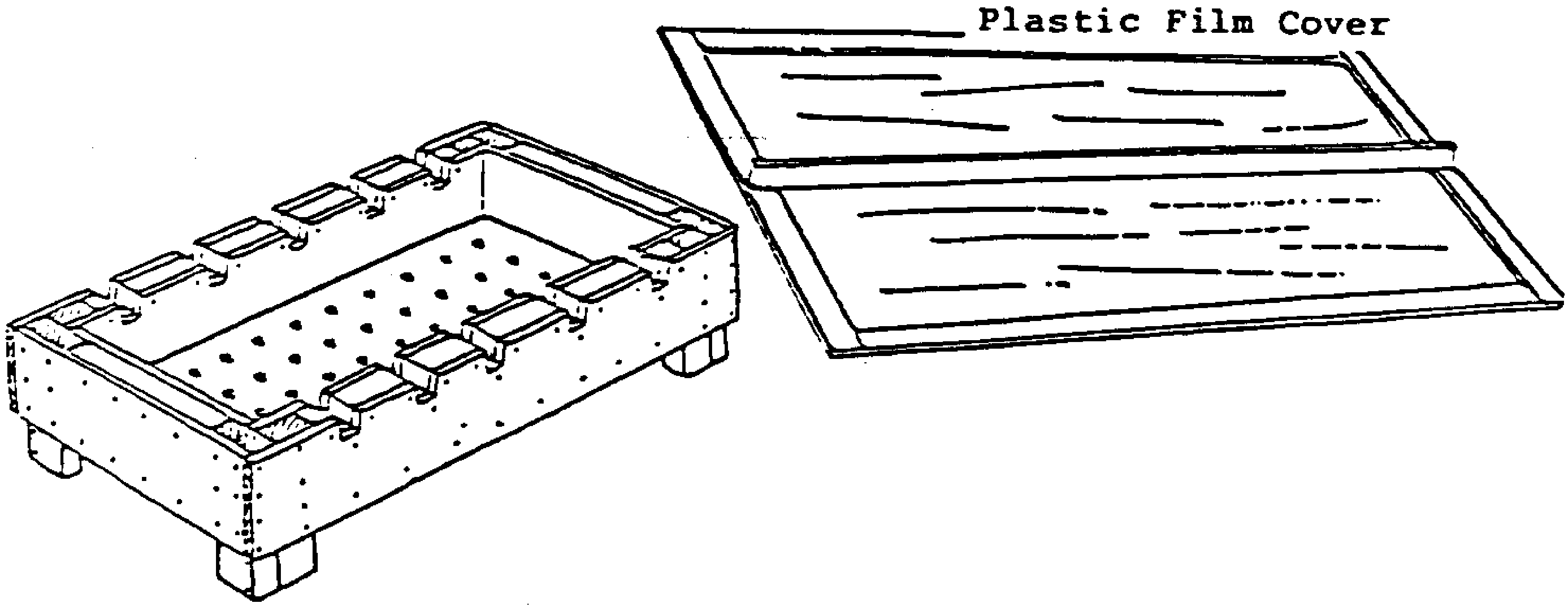


Figure 6. VITA Solar Crop Dryer

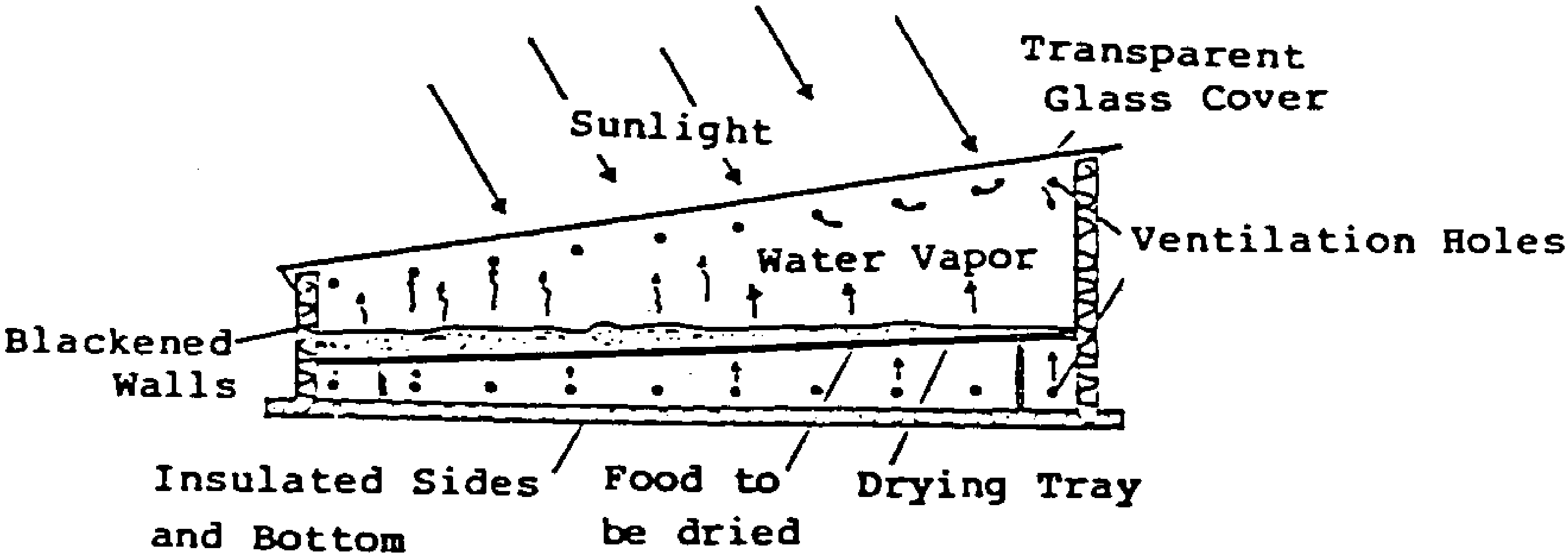


Figure 7. Brace Research Institute's Hot Box Dryer

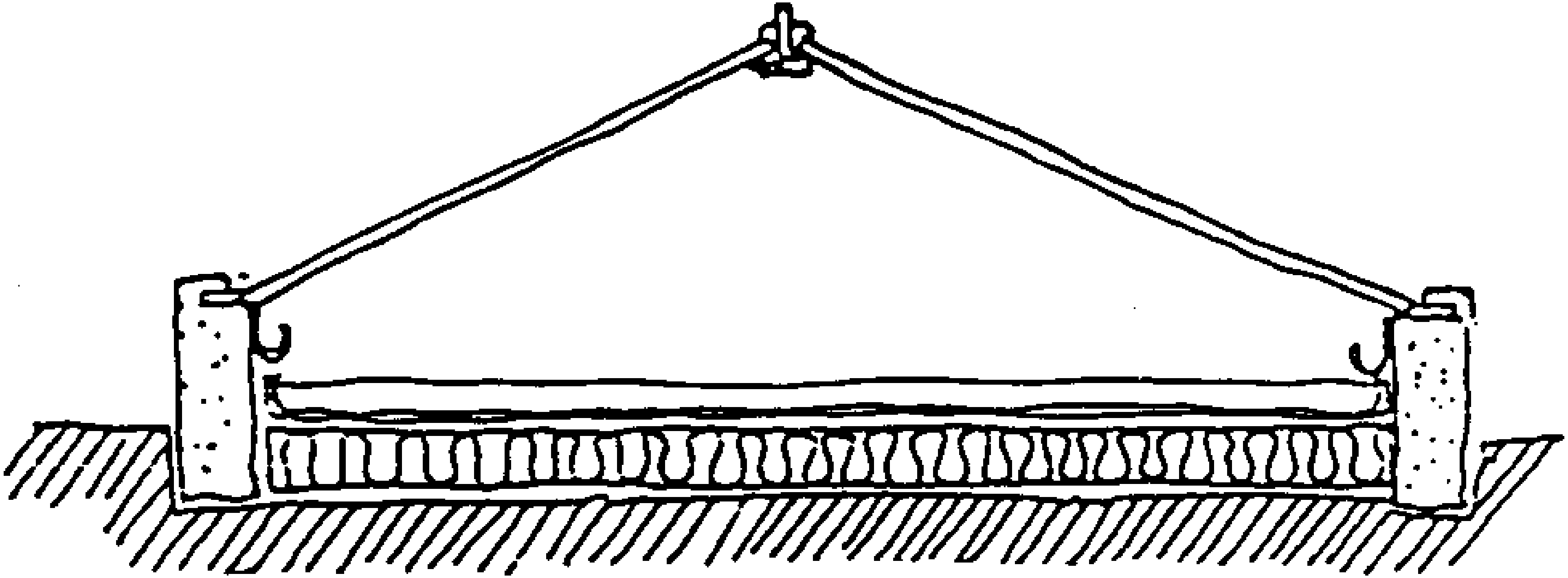


Figure 7. Double-Slope Still

Source: U.S. Agency for International Development, <u>Fresh Water from the Sun</u>, by Daniel C. Dunham (Washington, D.C., August 1978), p. 89.

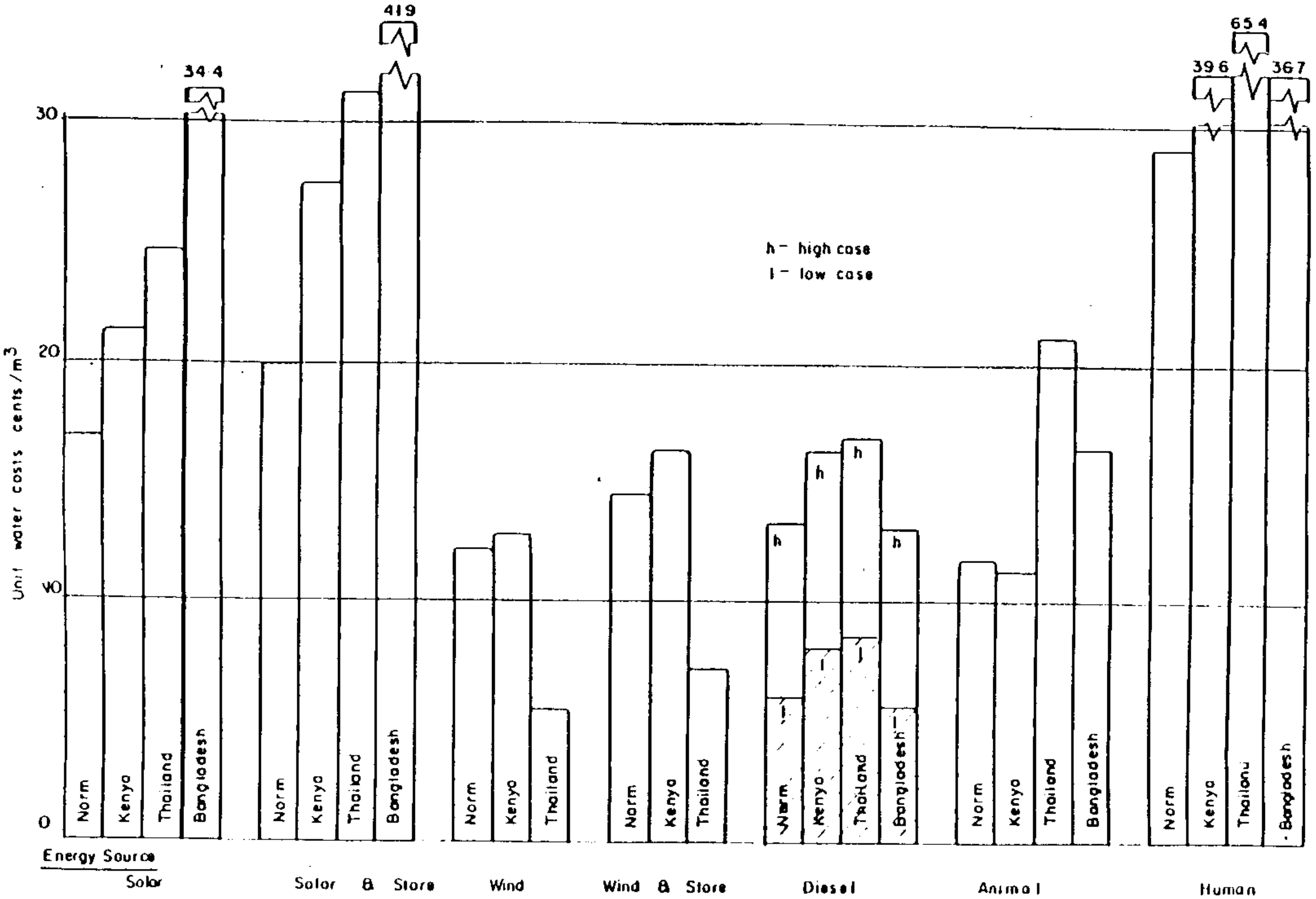


Figure 6. **Histogram Showing Optimum Irrigation Water Costs for Alternative Pumping Methods to Supply 2 Hectares at a 7 Meter Lift with Peak Water Requirements of 60 Cubic Meters/Day**

Source: Willam Halcrow and Partners, and Intermediate Technology Power, Ltd., June 1983.

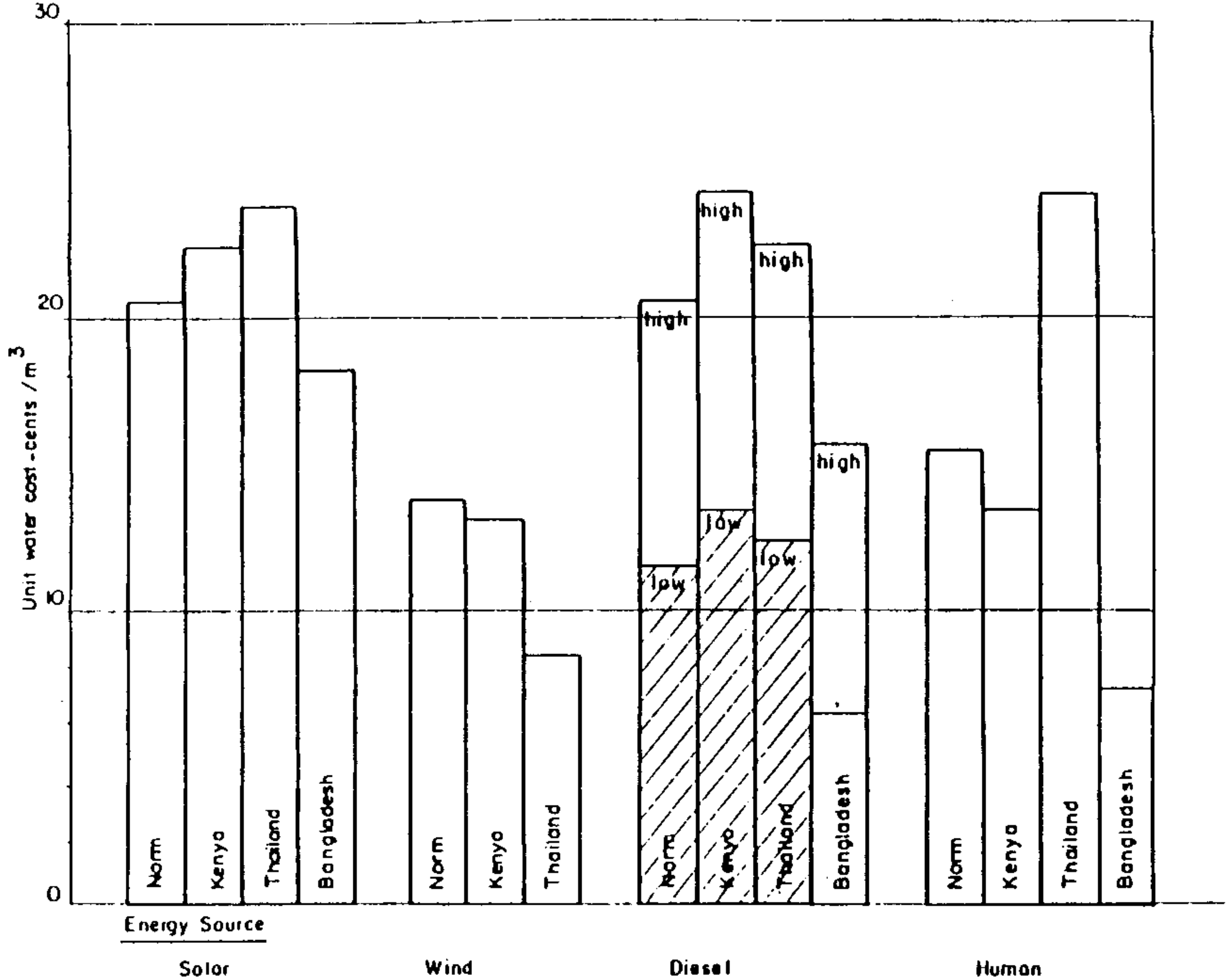


Figure 7. Histogram Showing Village Water Costs for Alternative Pumping Methods For Village Population 750, Per Capita Consumption 40 Liters/Day, 20 Meter Lift

Source: Willam Halcrow and Partners, and Intermediate Technology Power, Ltd., June 1983.

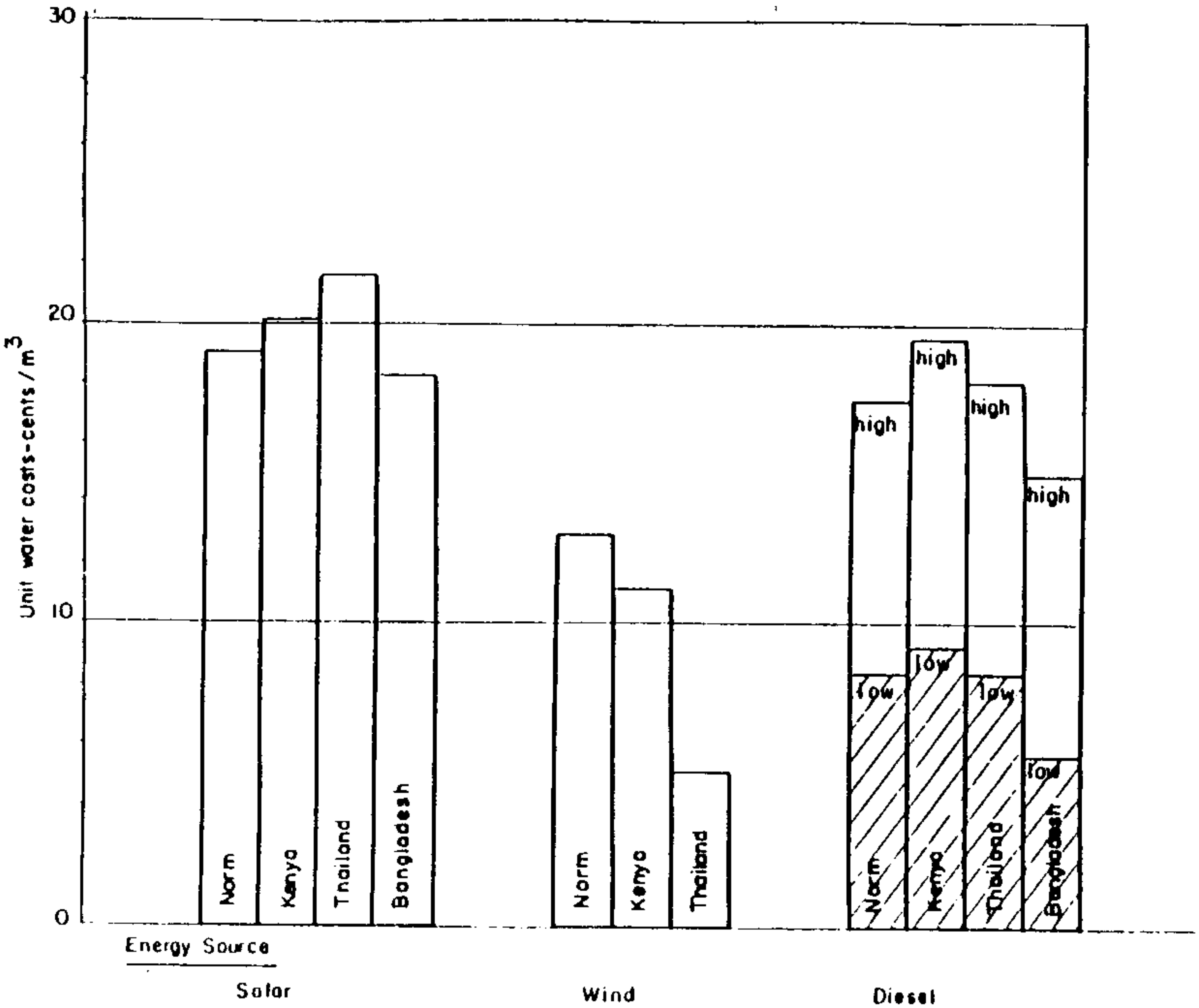


Figure 8. Histogram Showing Livestock Water Costs for Alternative Pumping Methods for 2,000 Head of Cattle, Consumption 40 Liters/Head/Day, 20 Meter Lift

Source: Willam Halcrow and Partners, and Intermediate Technology Power, Ltd., June 1983.

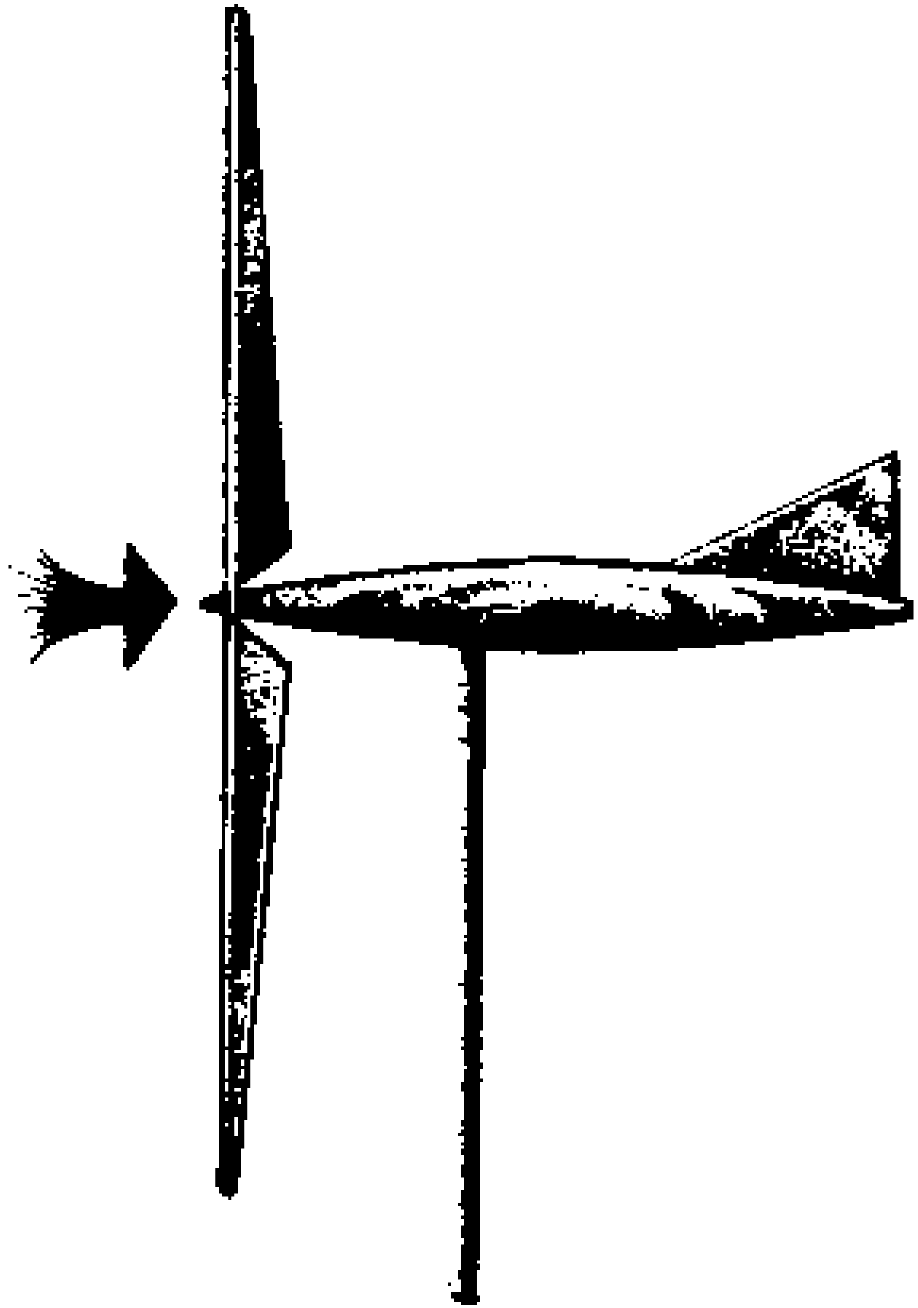


Figure 10. Rotor Placed Upwind

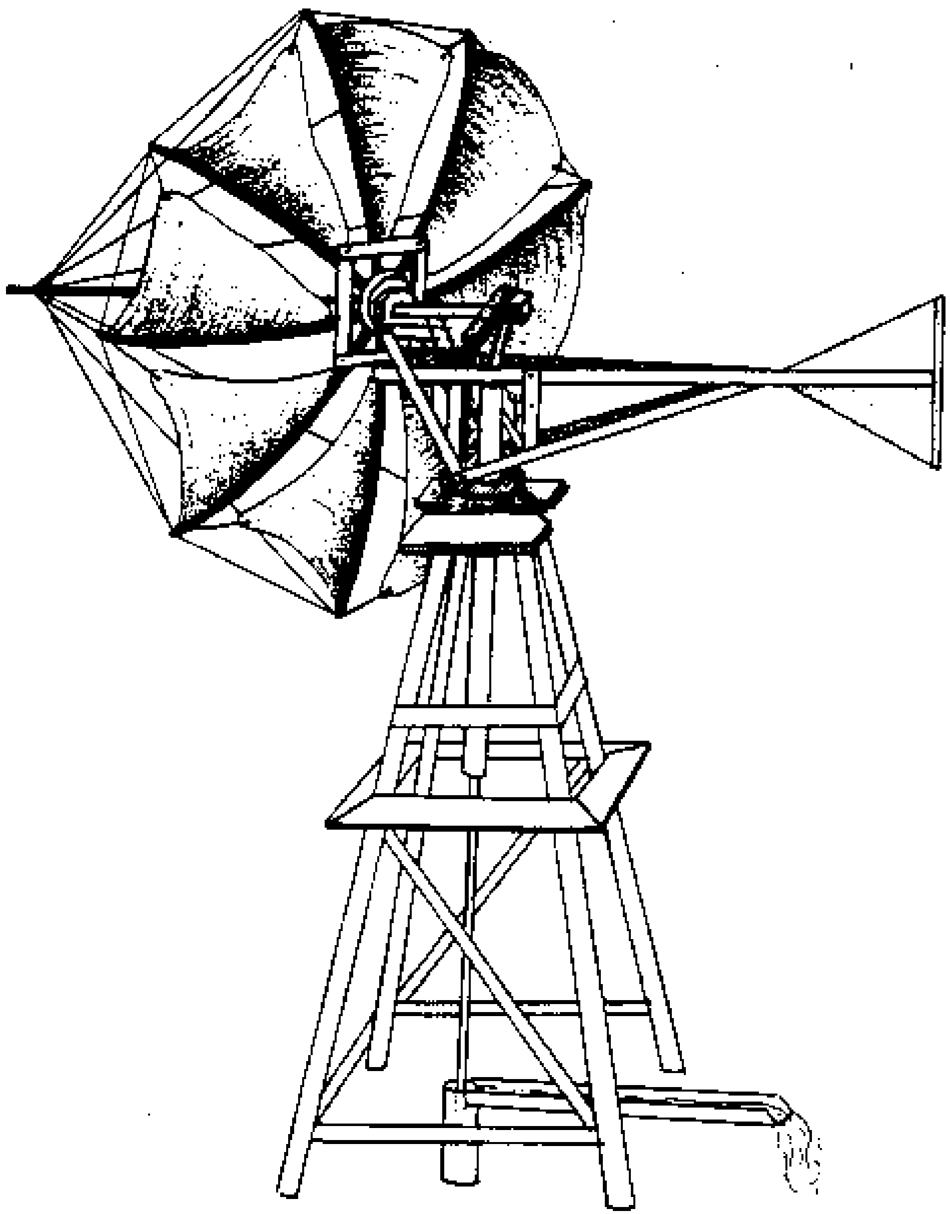
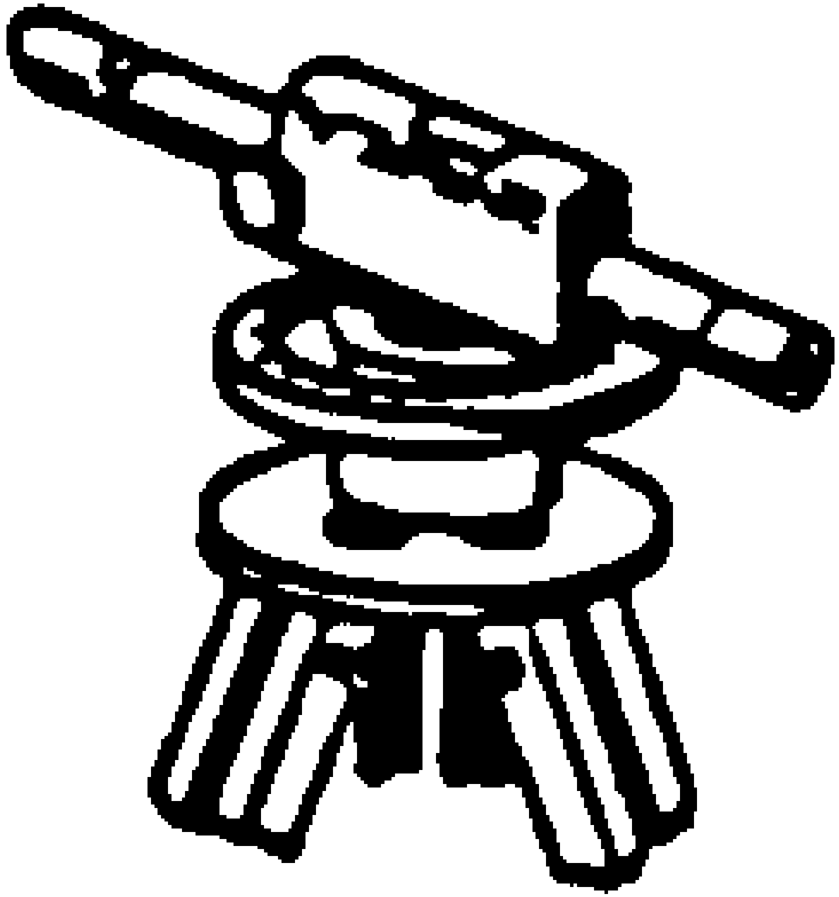
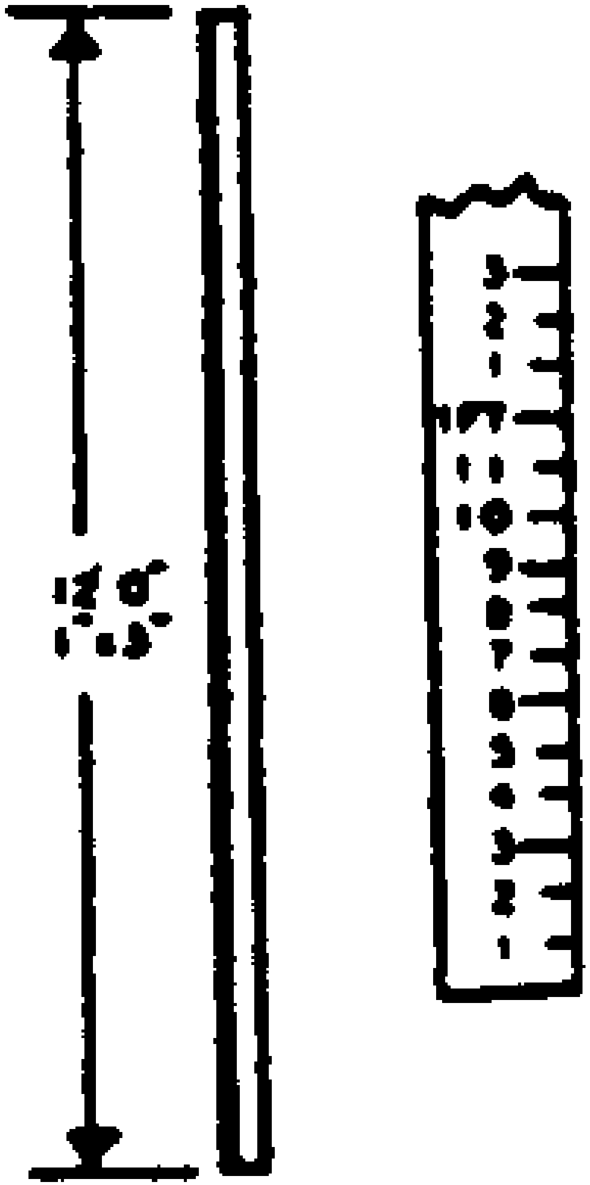


Figure 11. A Cretan Sail Windmill



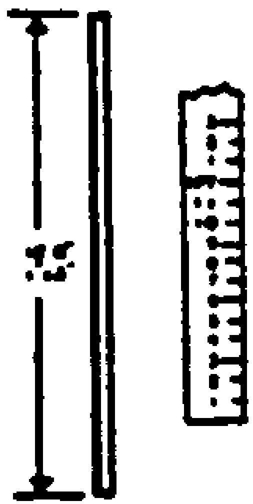
SURVEYOR'S LEVEL



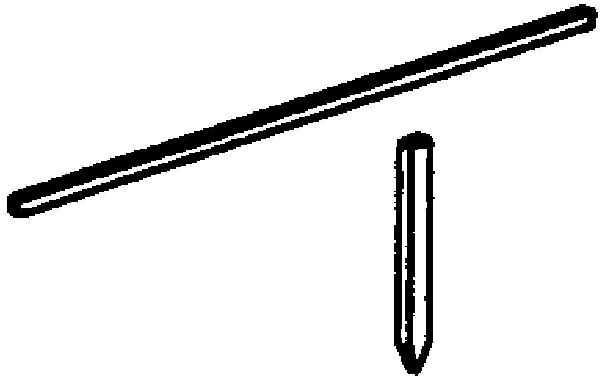
SCALE AND DETAIL OF SCALE

1. Equipment

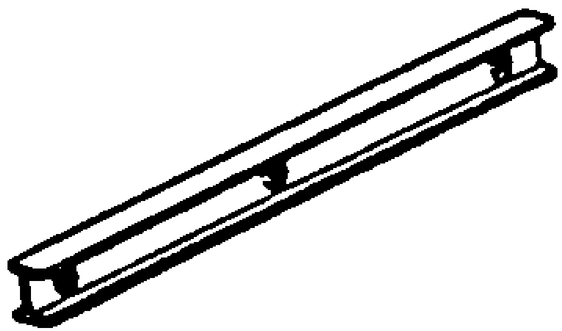
   a. Scale
   b. Board and wooden plug
   c. Ordinary carpenter's level



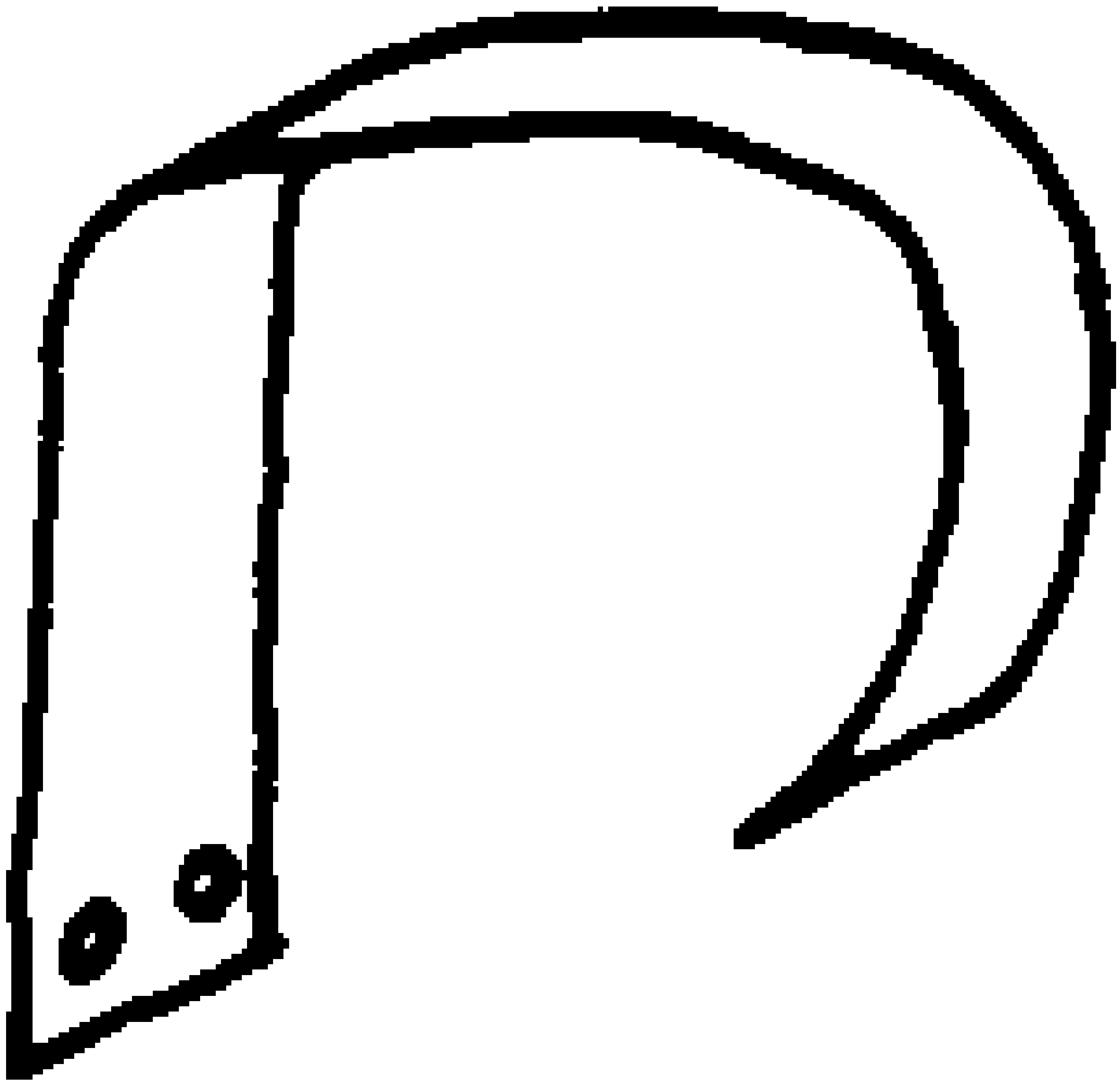
SCALE AND DETAIL OF SCALE

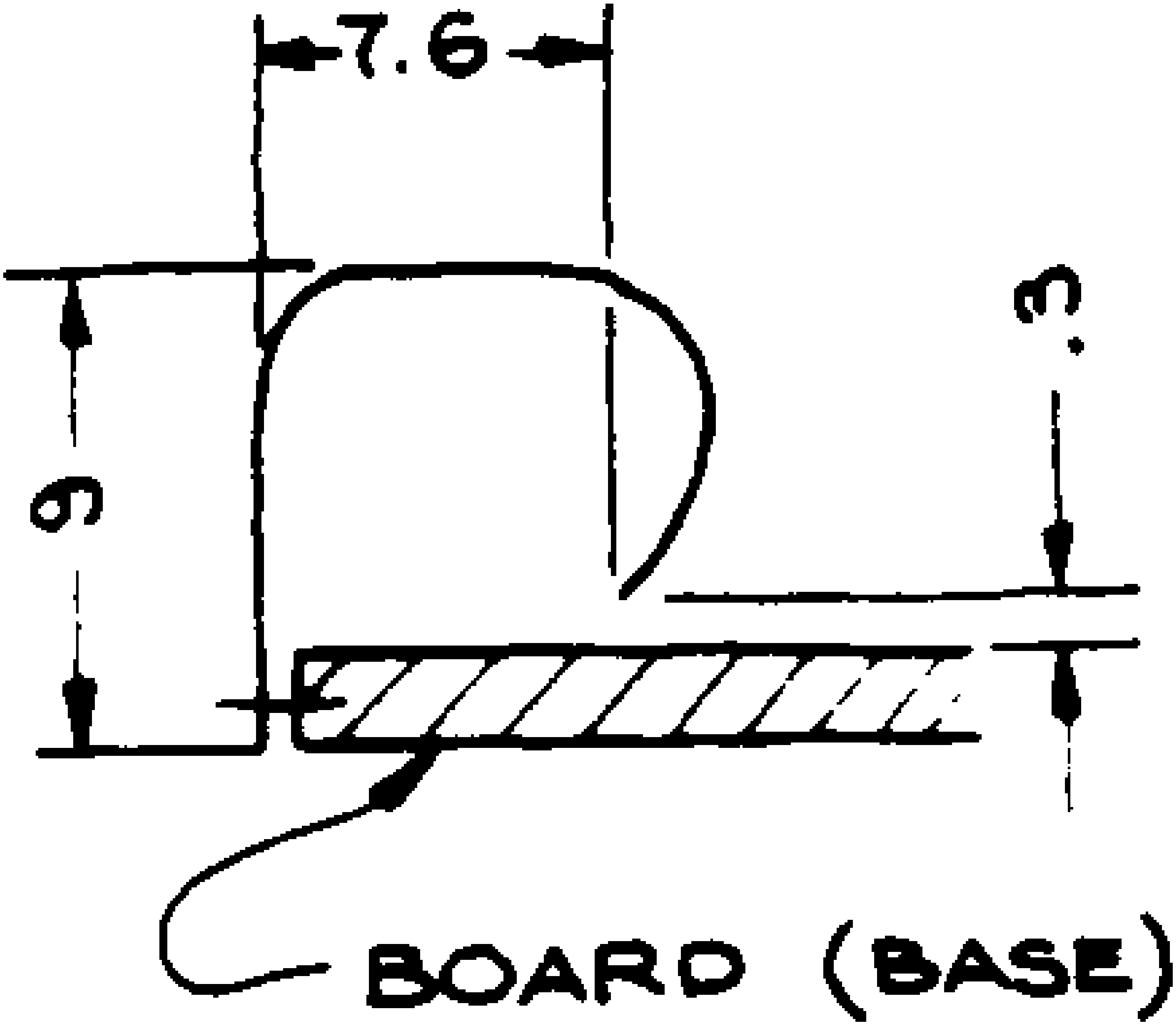


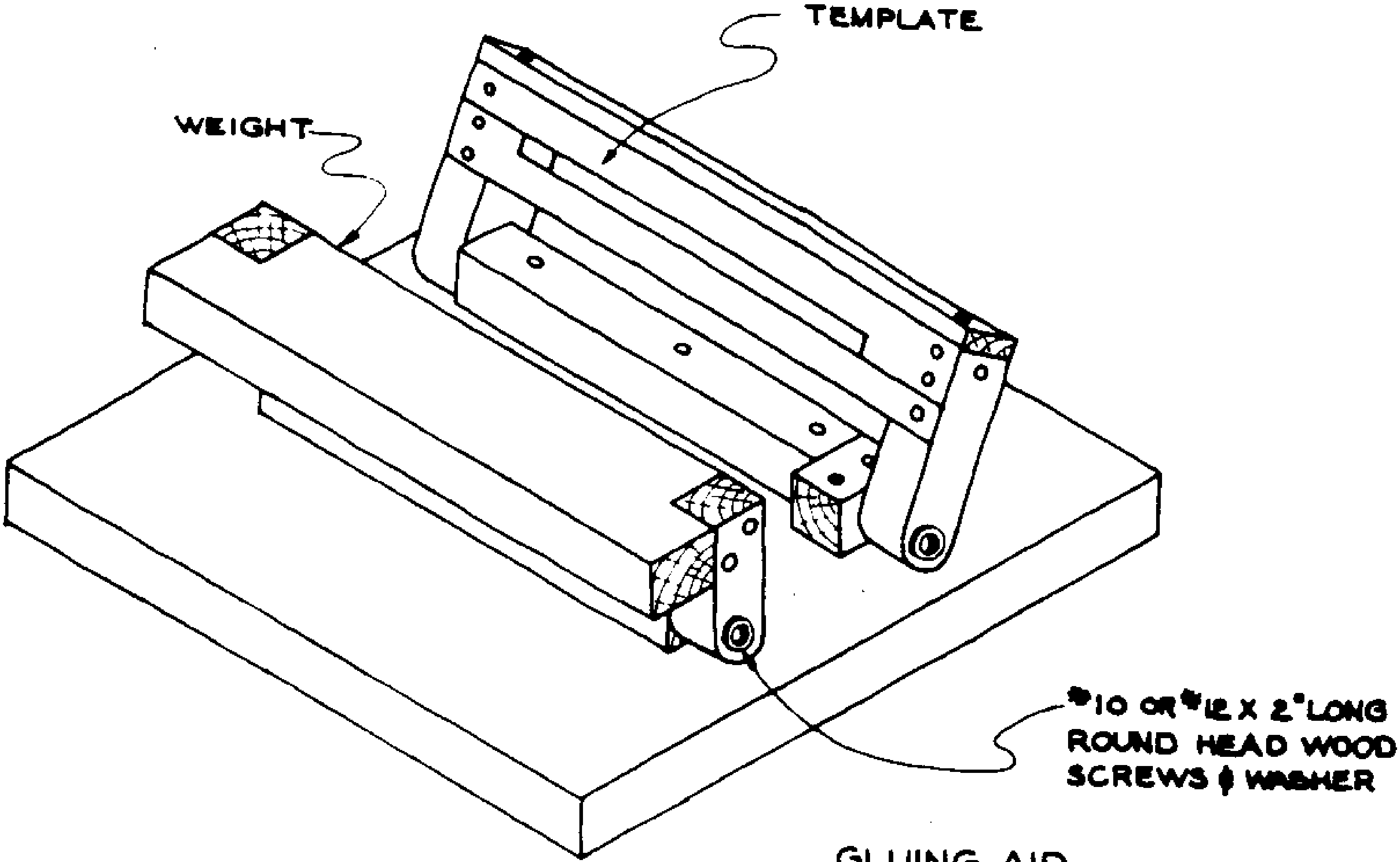
LEVELING BOARD AND PLUGS IN STAKES



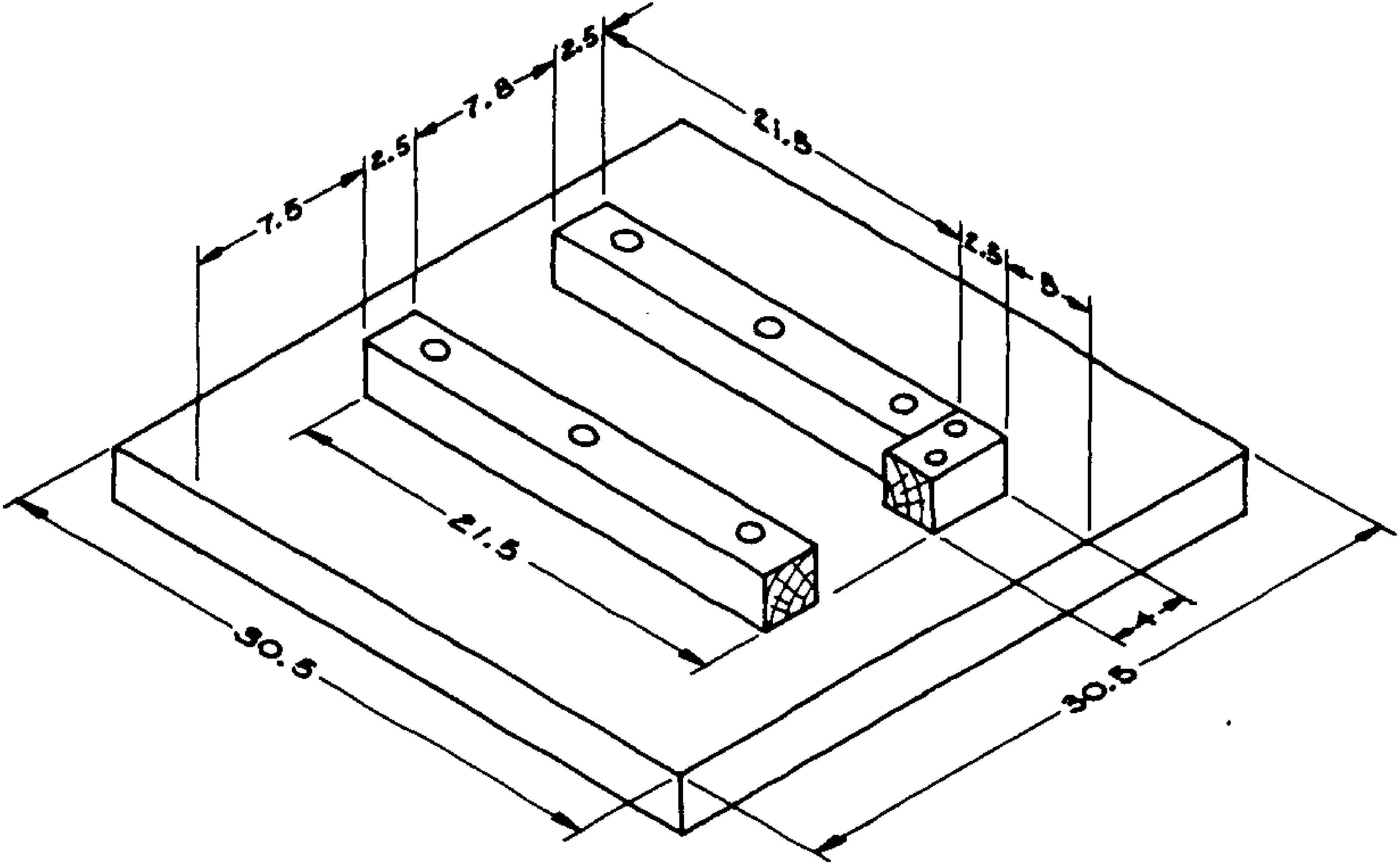
CARPENTER'S LEVEL



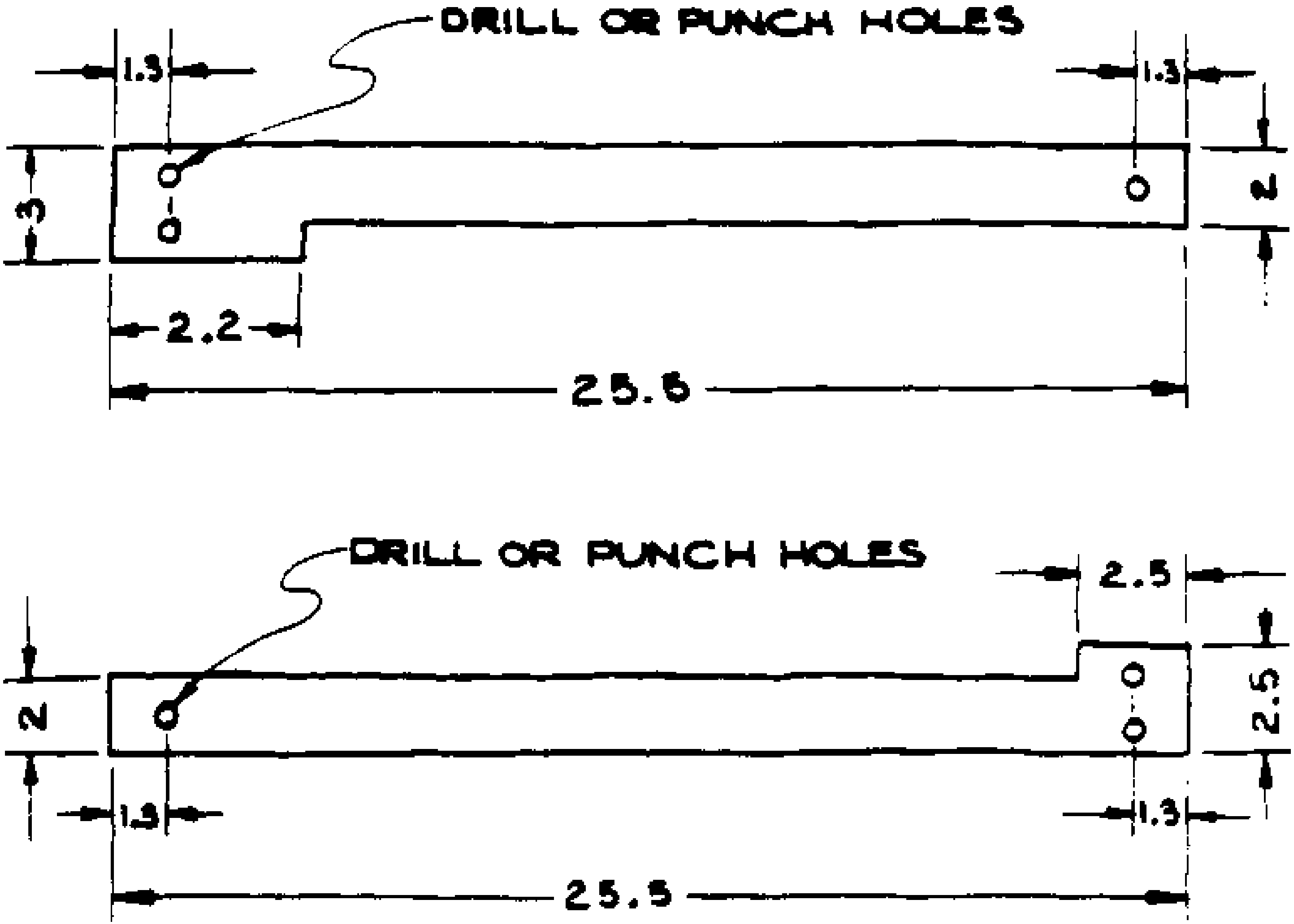

7.6
9
.3
BOARD (BASE)


TEMPLATE
WEIGHT
#10 OR #12 X 2" LONG
ROUND HEAD WOOD
SCREWS & WASHER

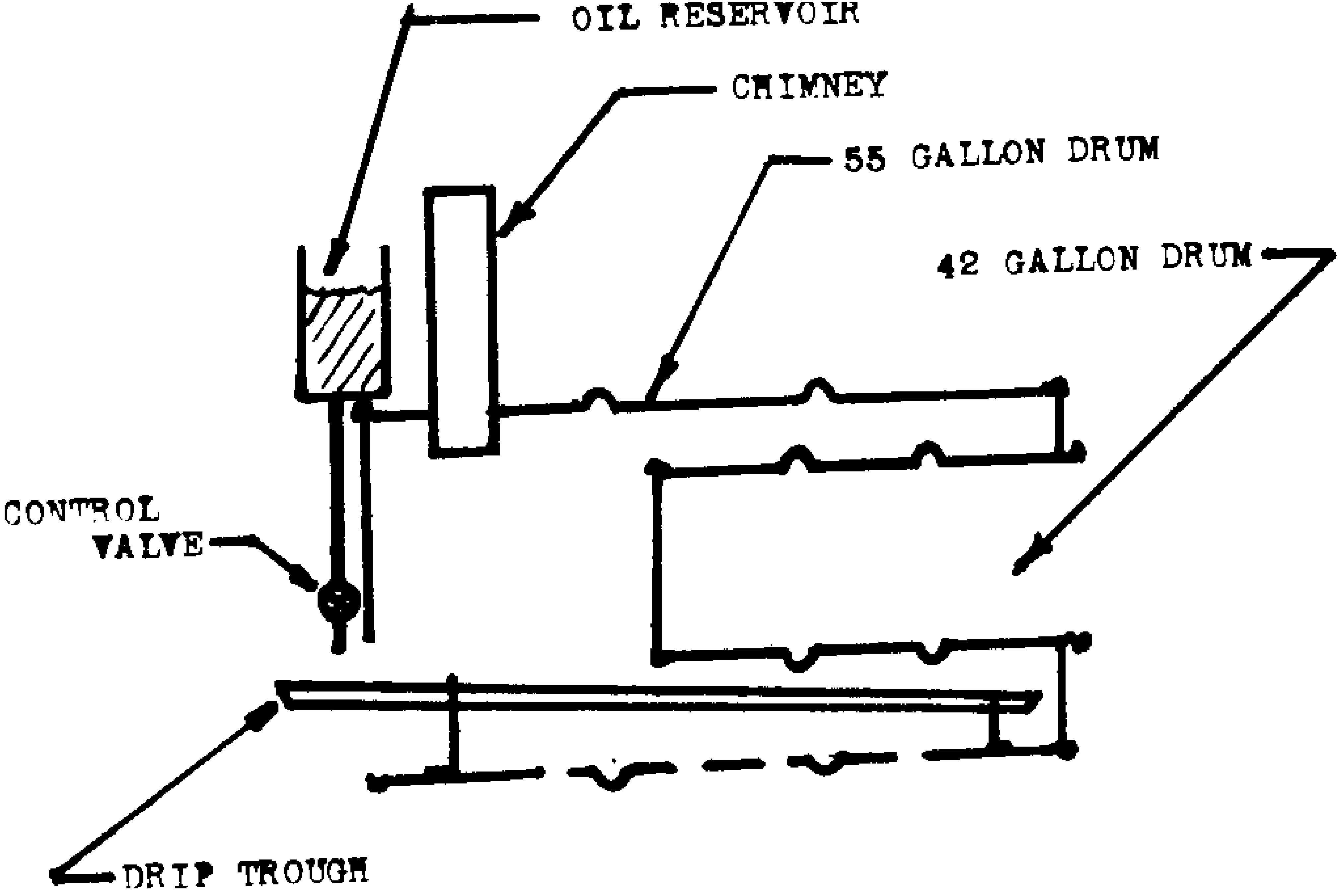
. GLUING AID



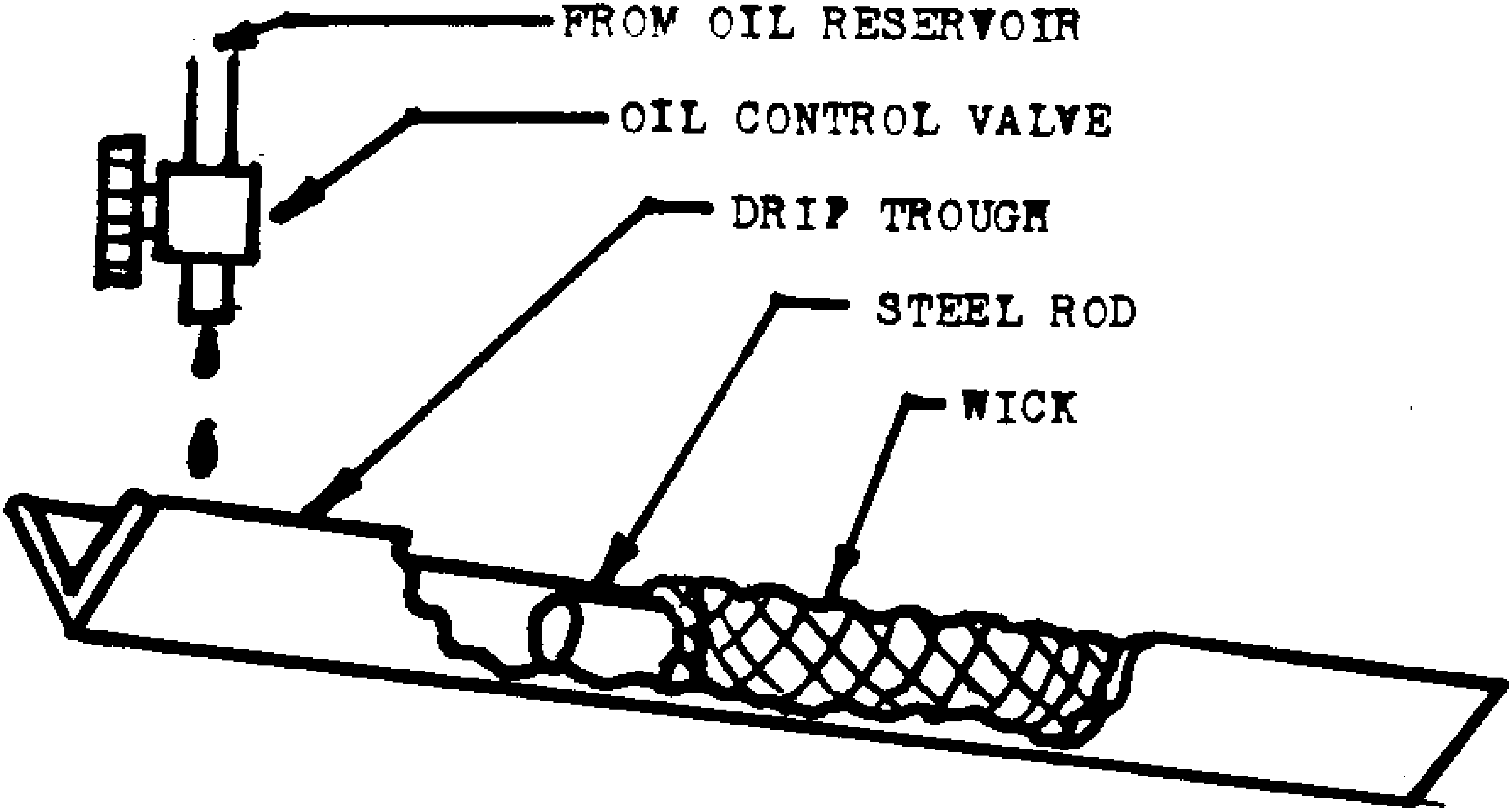
GLUING AID BASE



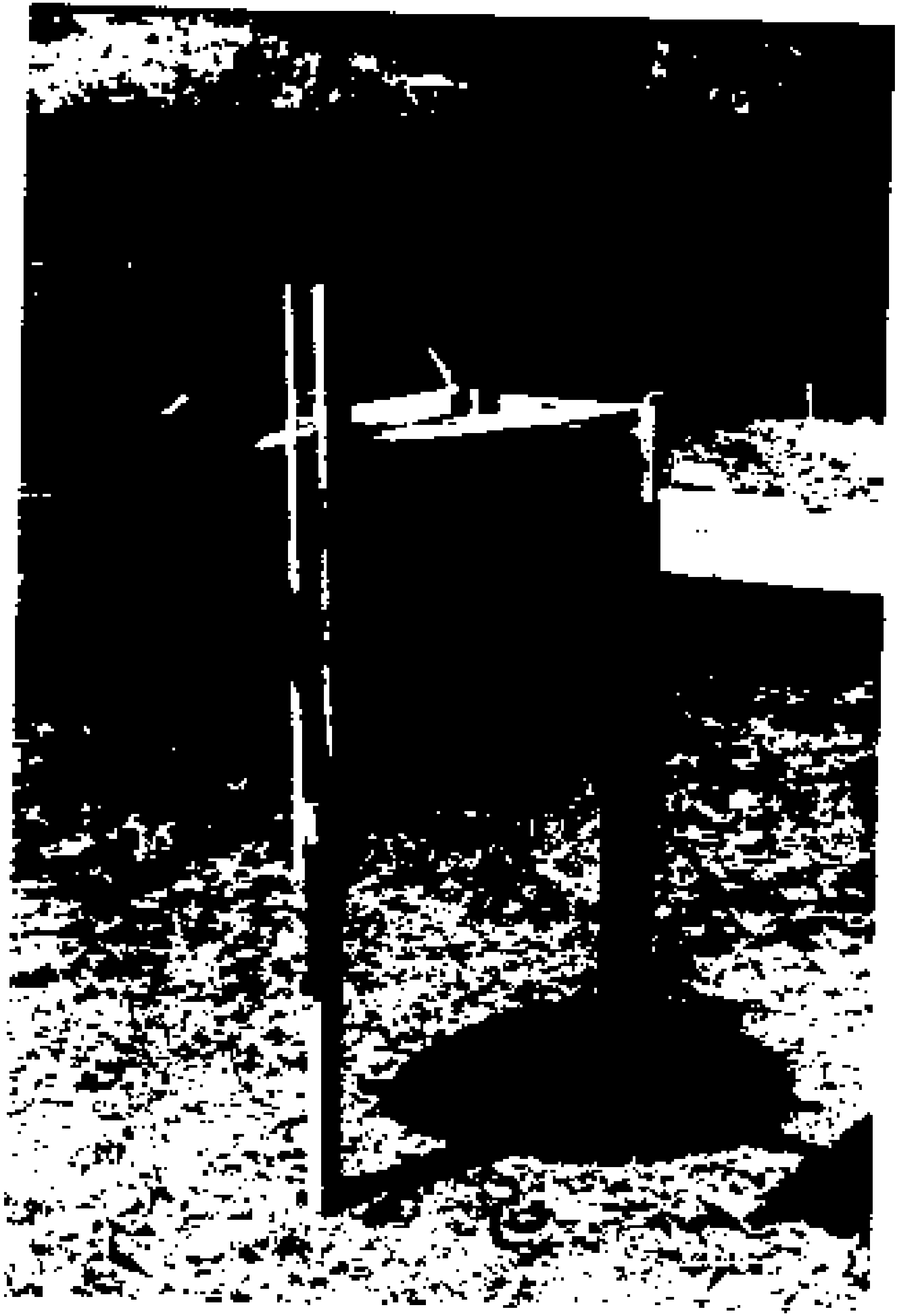
MATERIAL: SHEET METAL

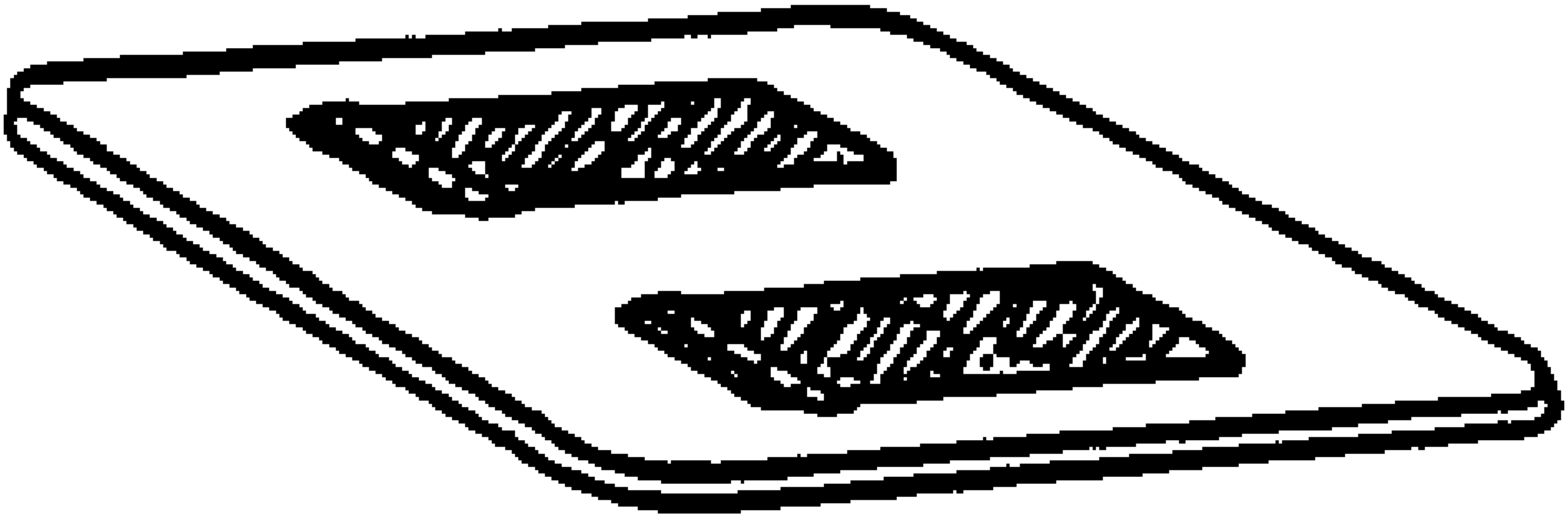


OVEN COMPONENTS

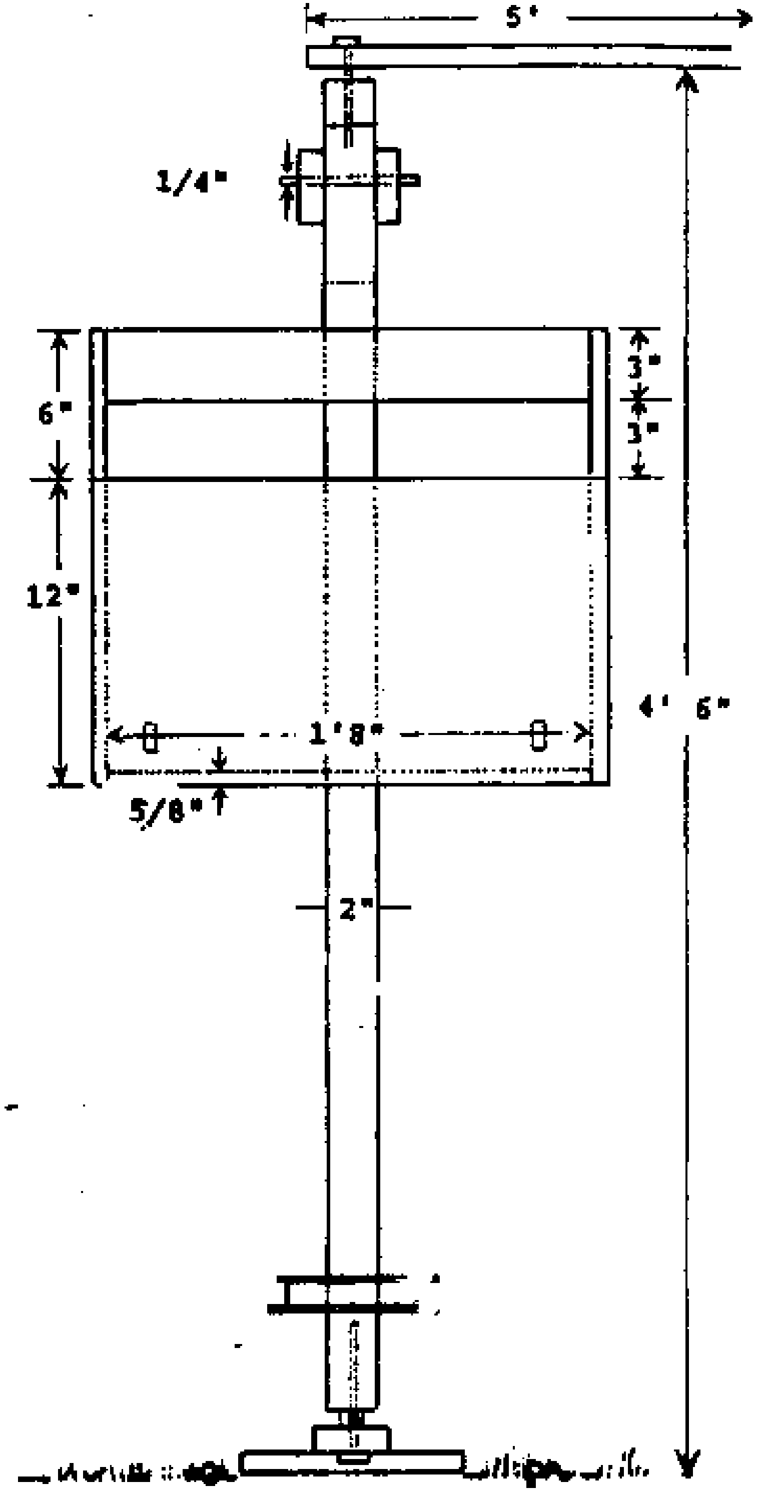


THE DRIP FEED SYSTEM



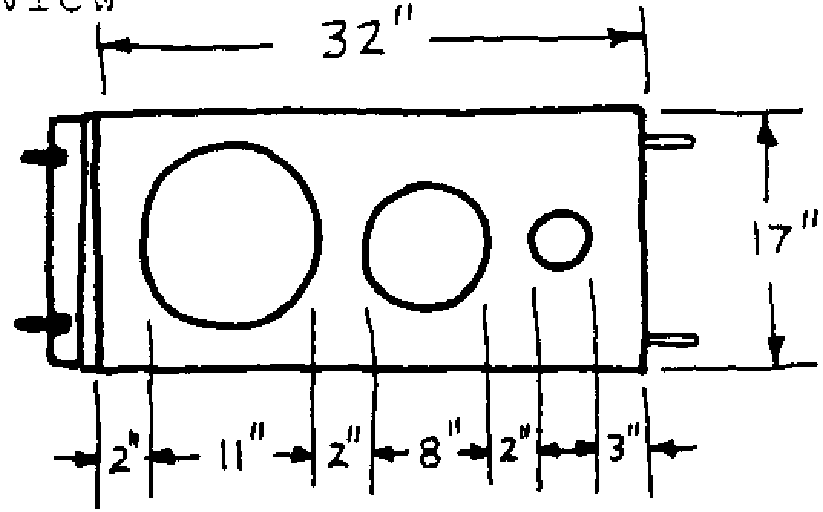


The results of Step 6
should look like this.

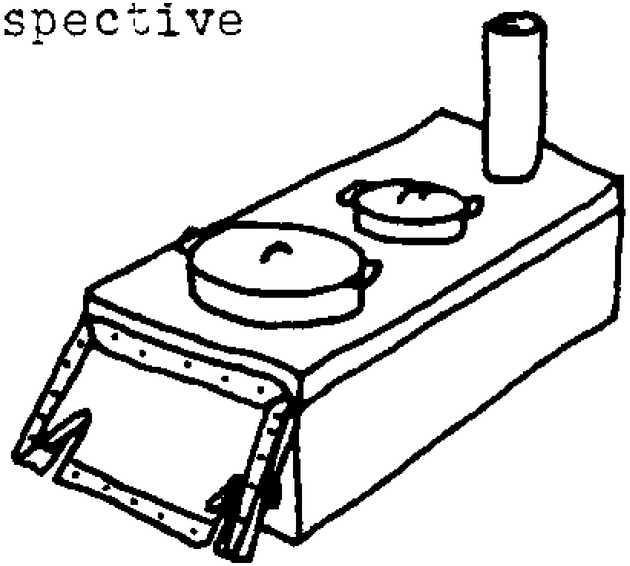


5'
1/4"
6"
3"
3"
12"
4' 6"
1'8"
5/8"
2"

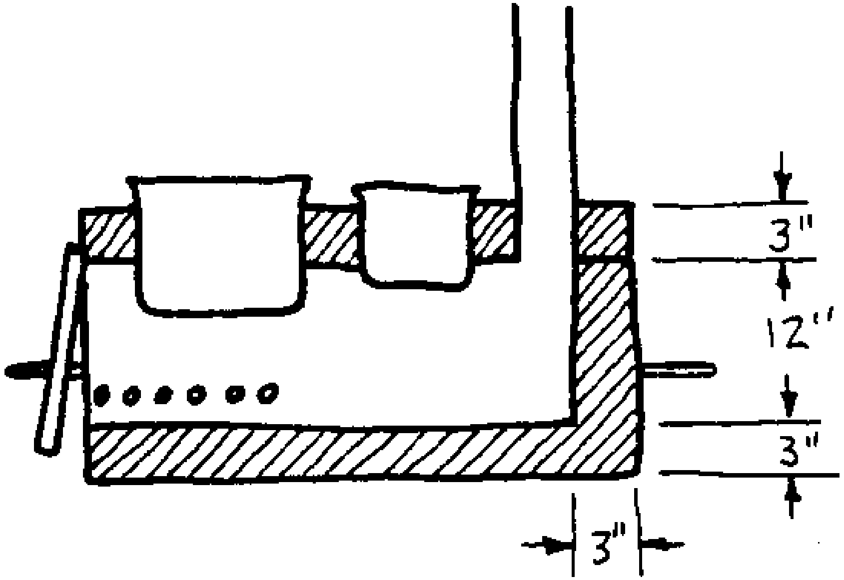
Top view



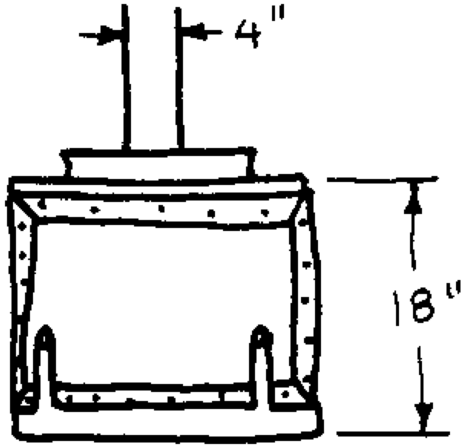
Perspective



Cutaway view with pot(s)



Front view



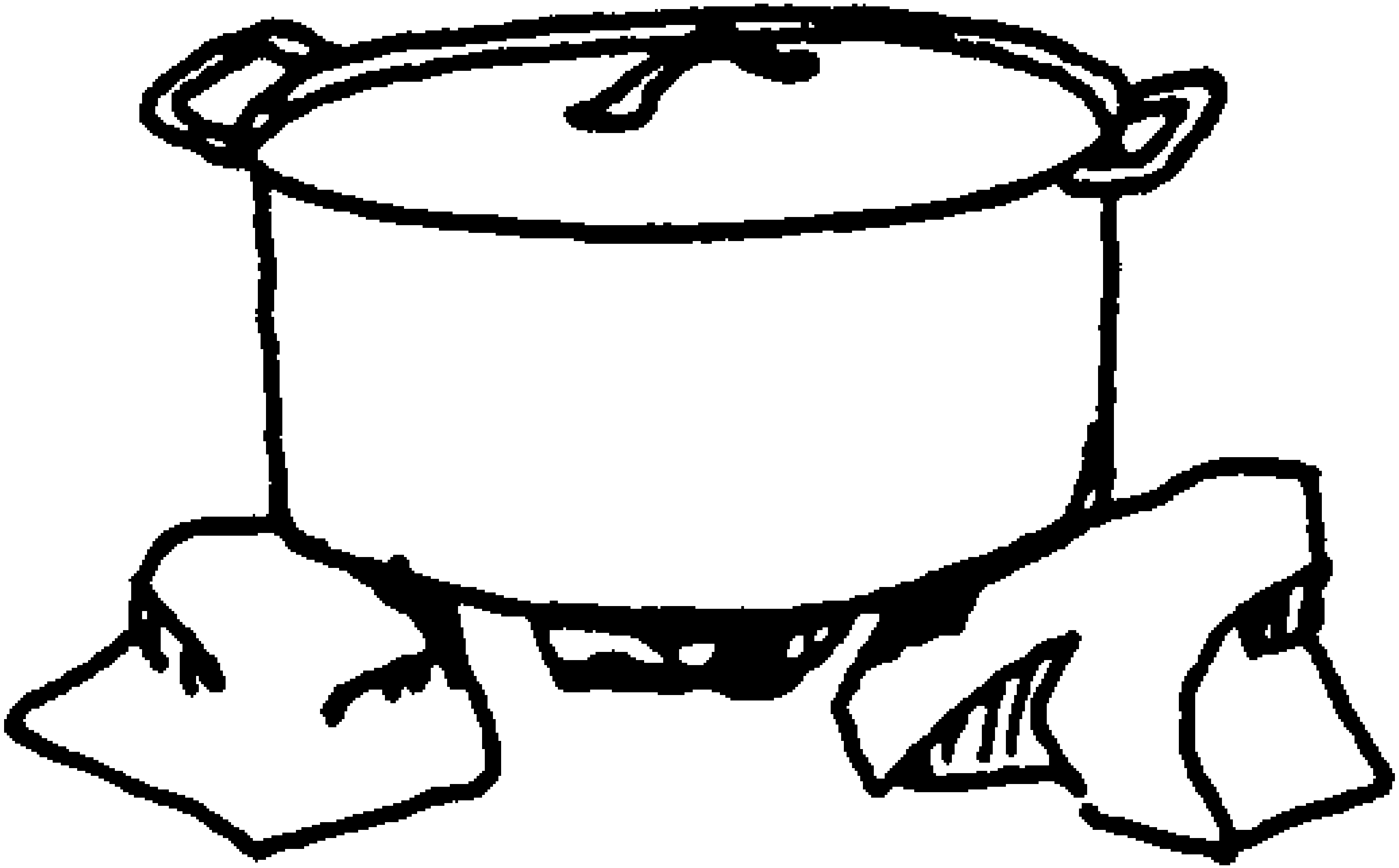


Figure 1. Three-Stone Fireplace--Universal

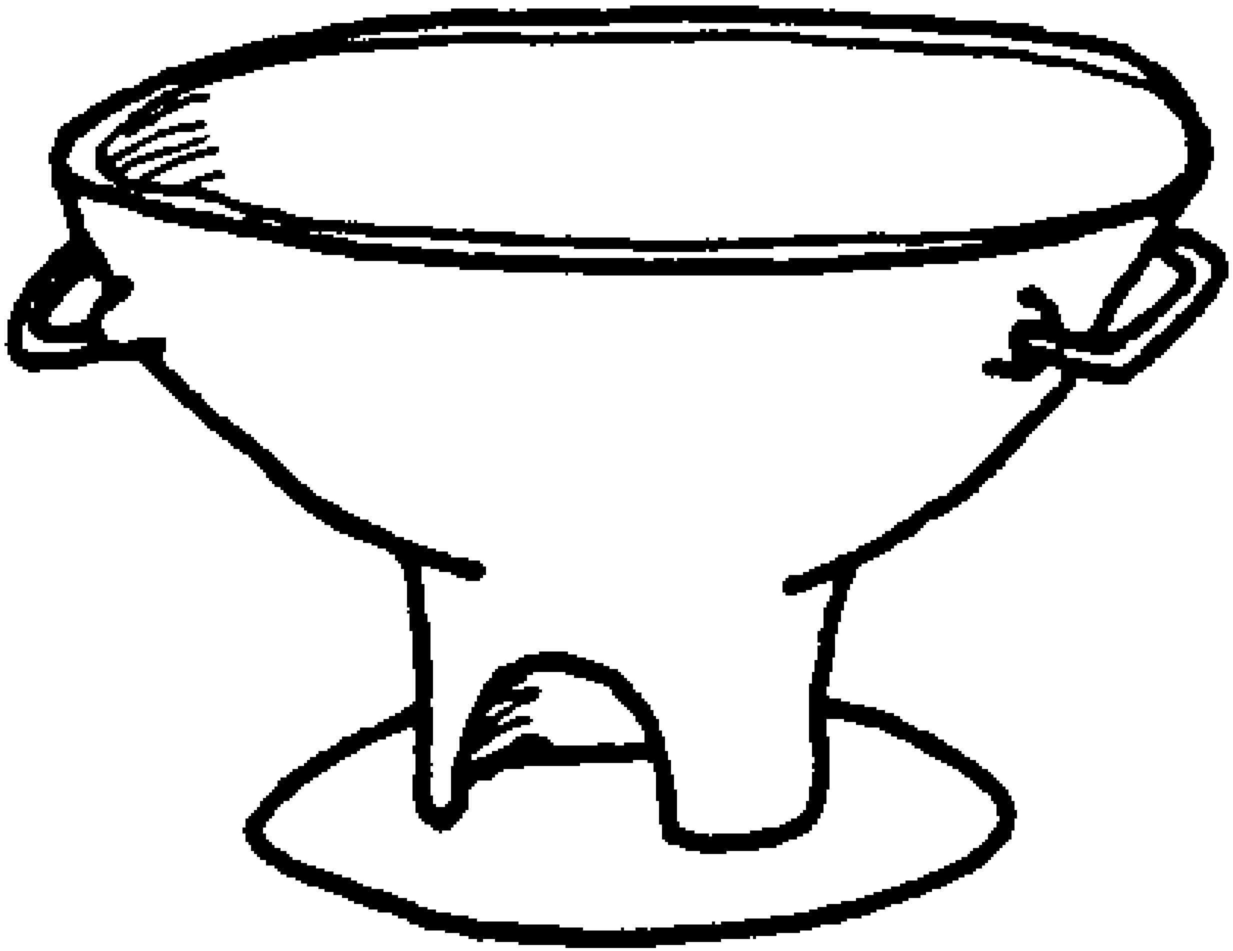
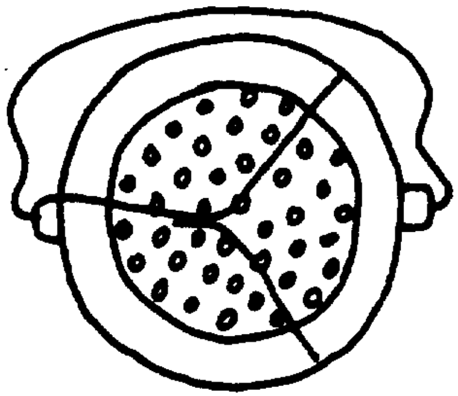
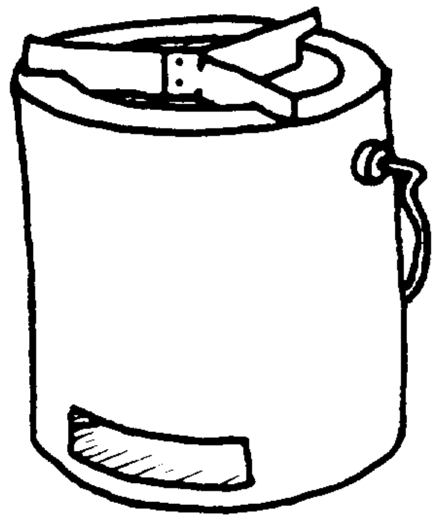


Figure 2. Traditional
Coal Pot--Caribbean

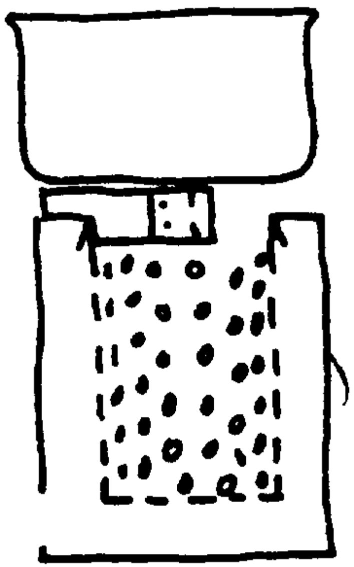
Top view



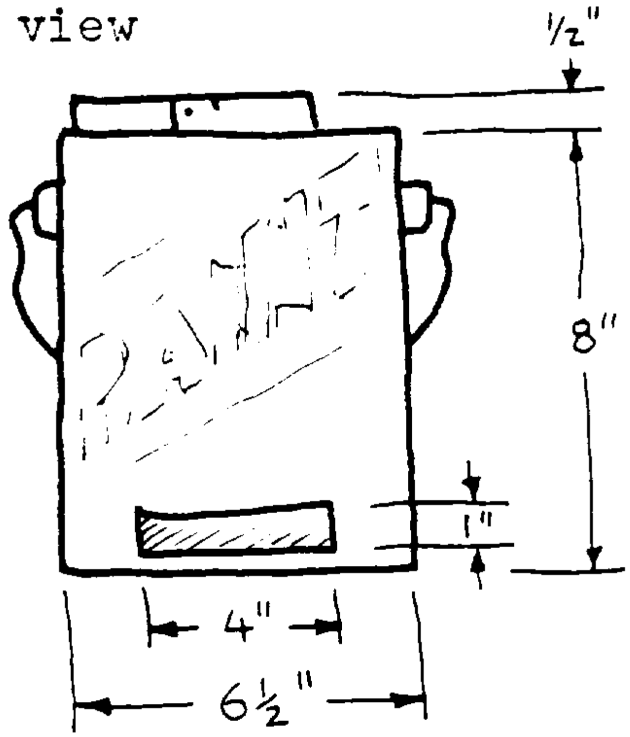
Perspective

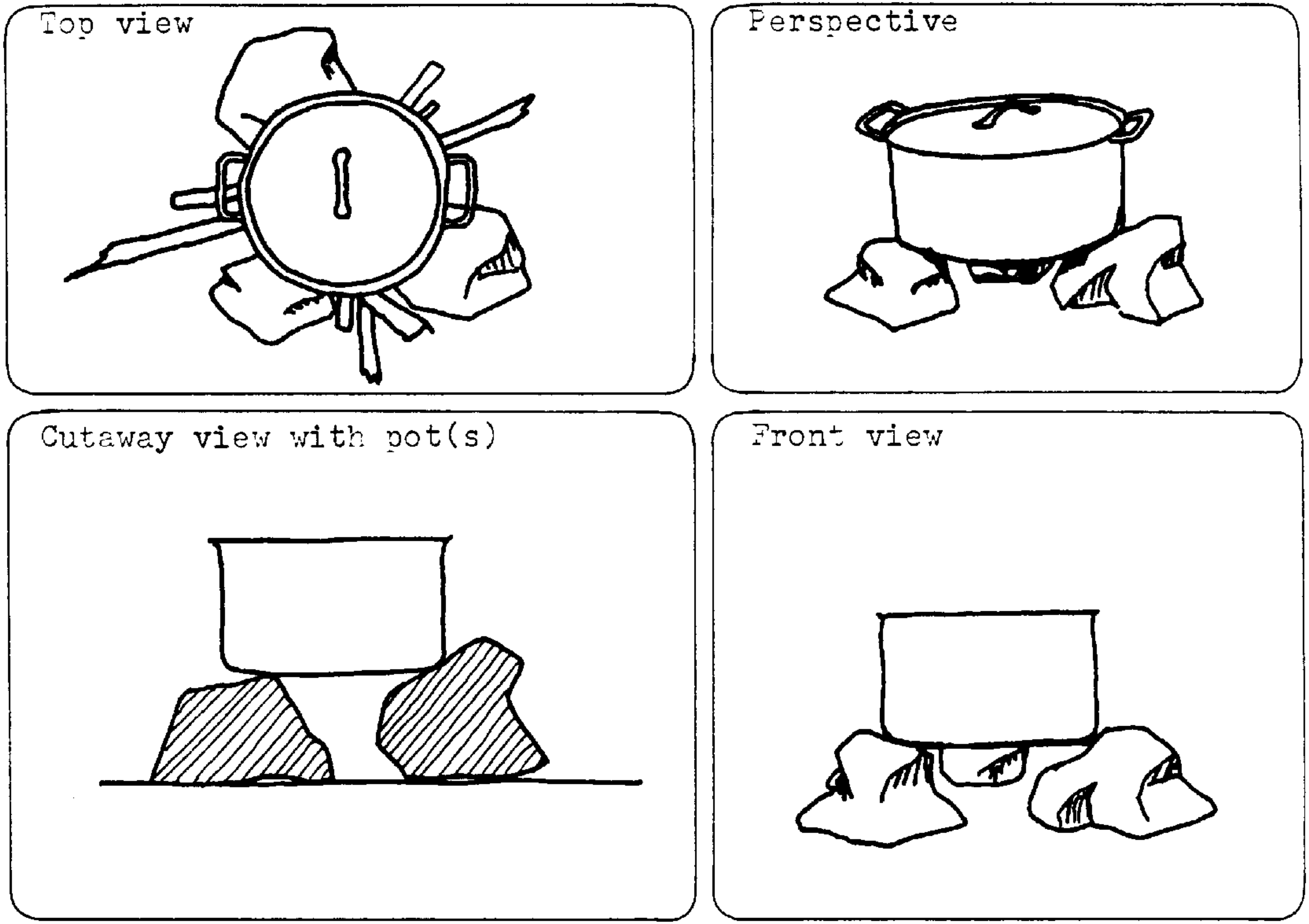


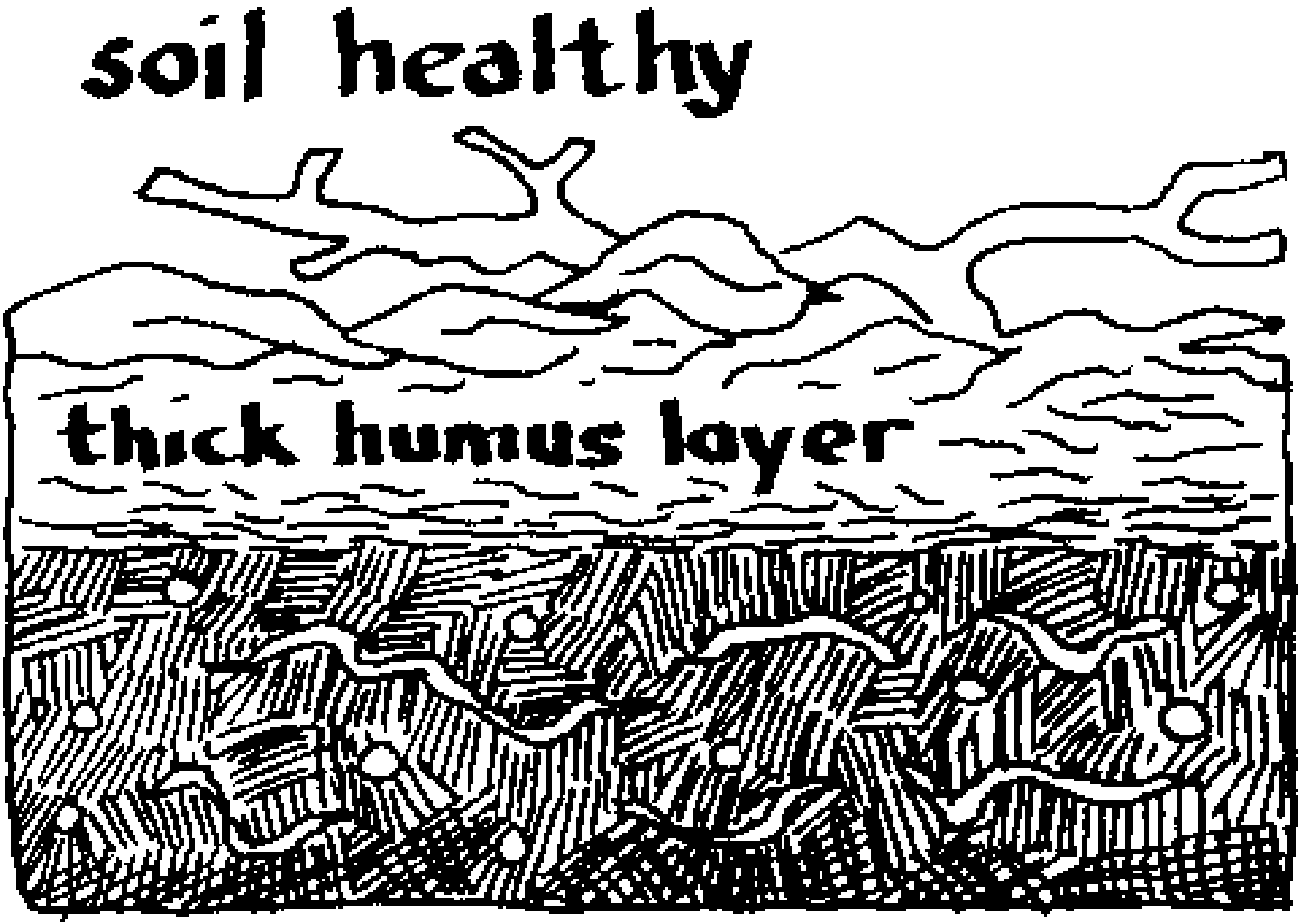
Cutaway view with pot(s)



Front view

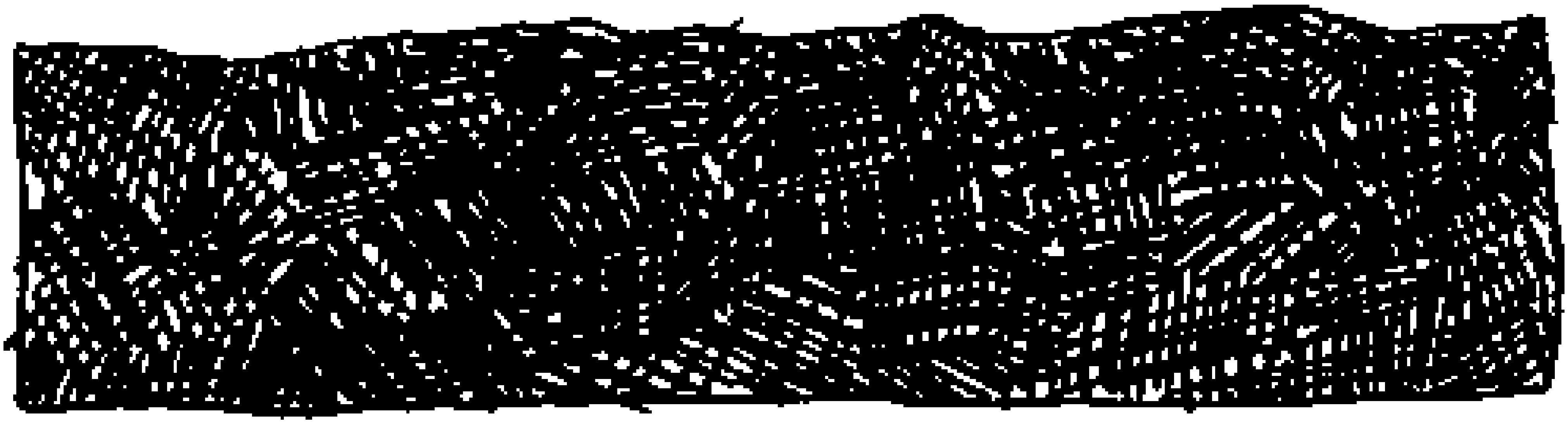


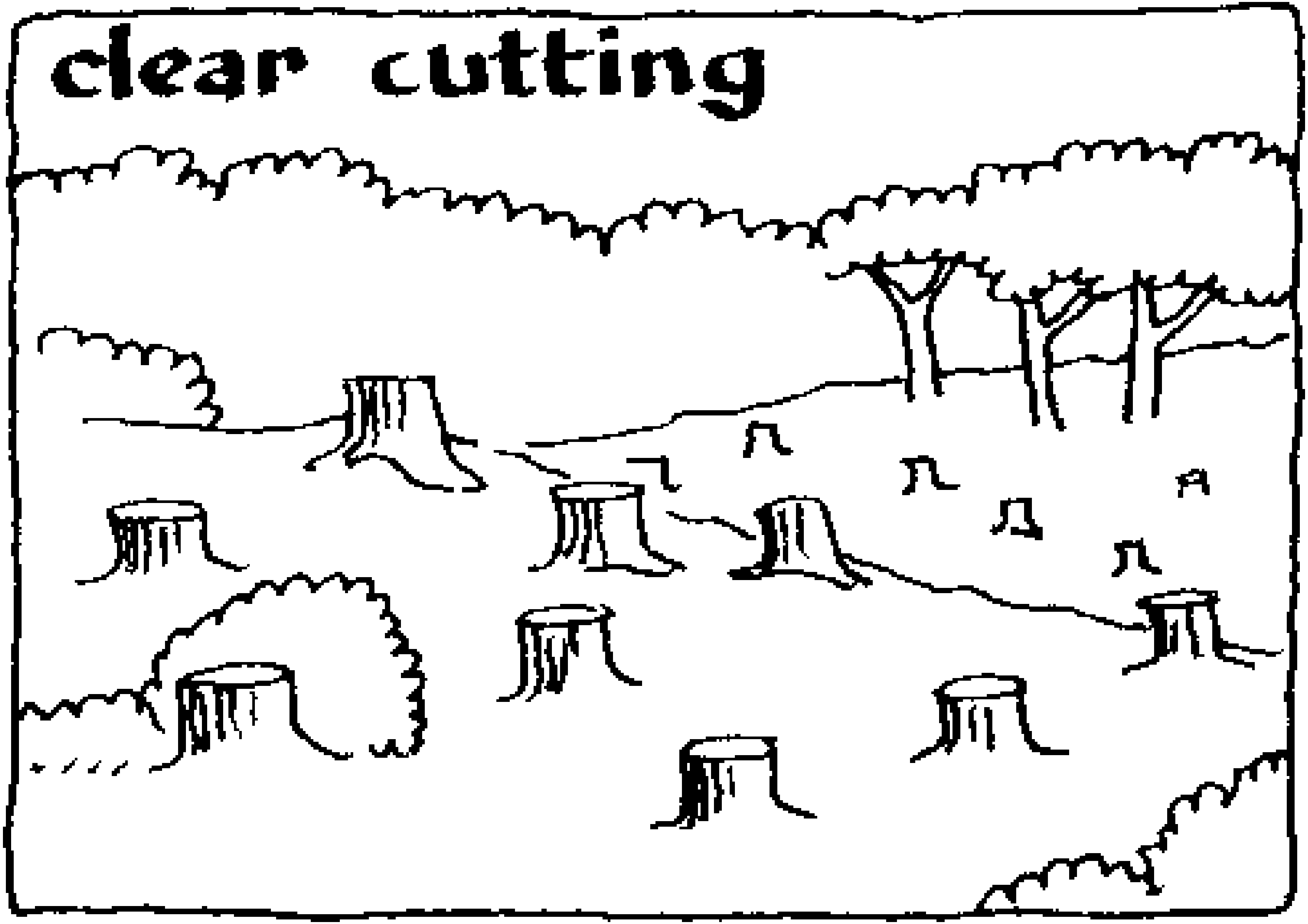

Top view
Perspective
Cutaway view with pot(s)
Front view

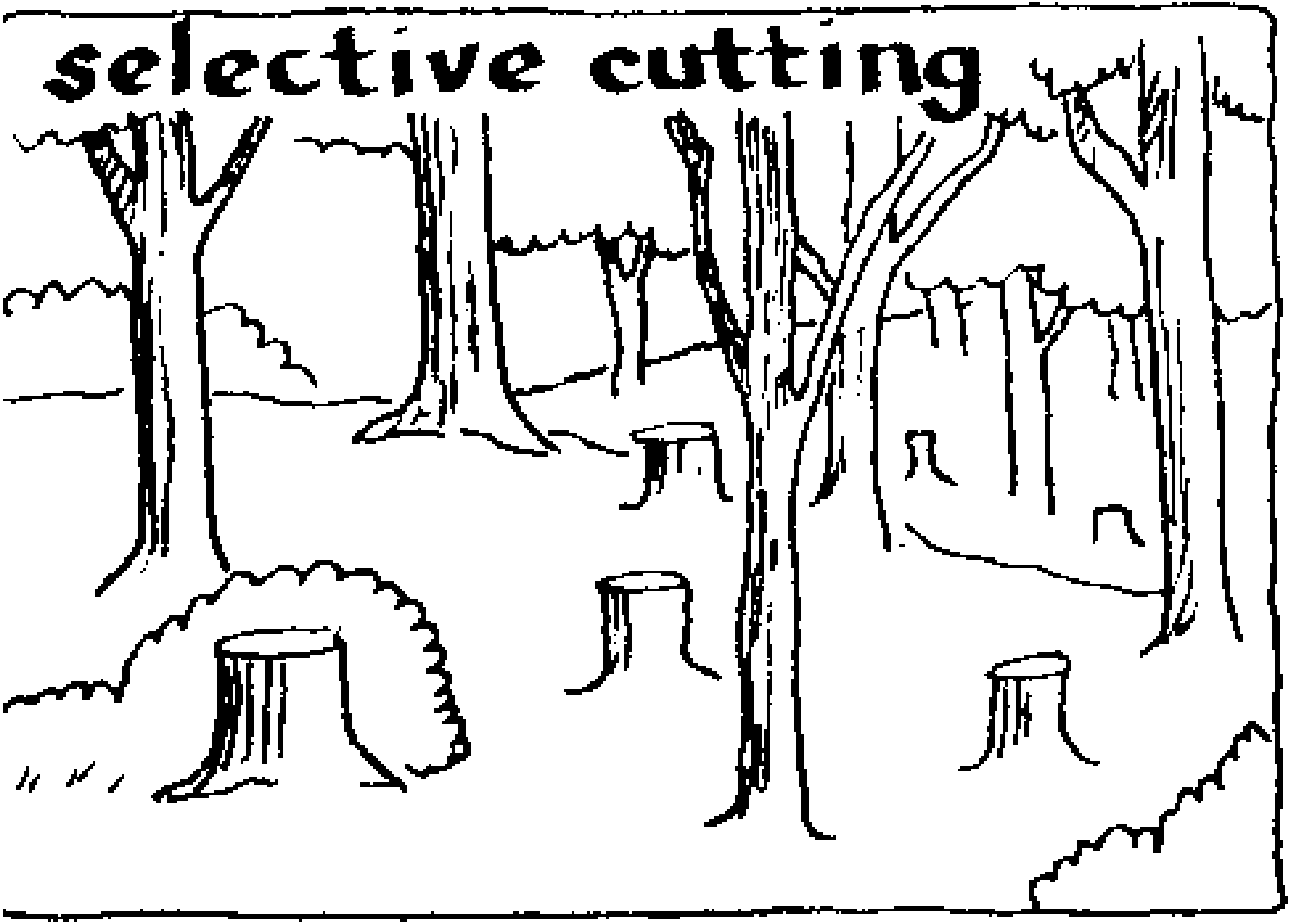

soil healthy
thick humus layer

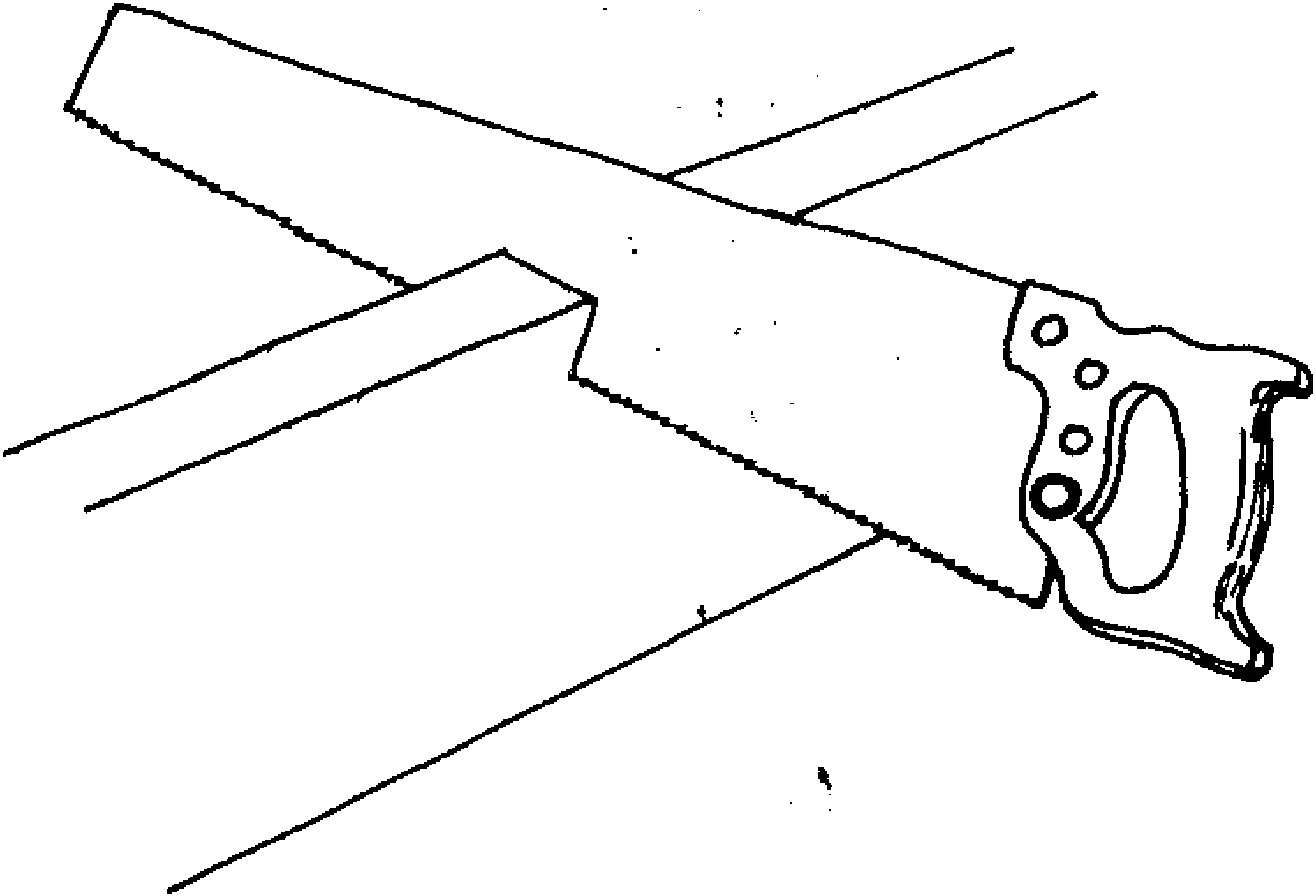
soil compacted

humus gone

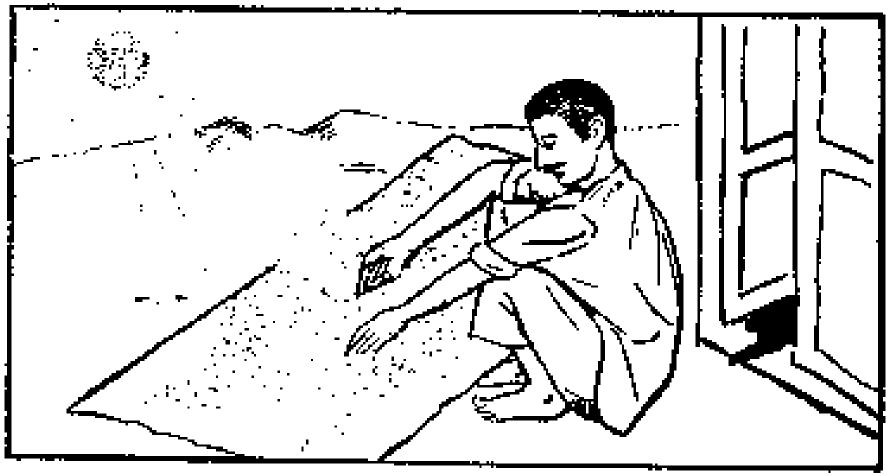



clear cutting

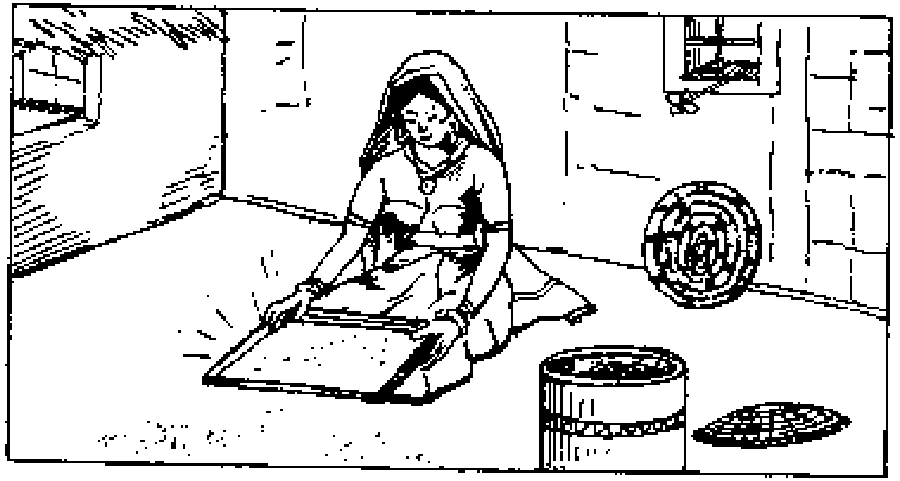

selective cutting



1. Dry and clean your grain before storing.

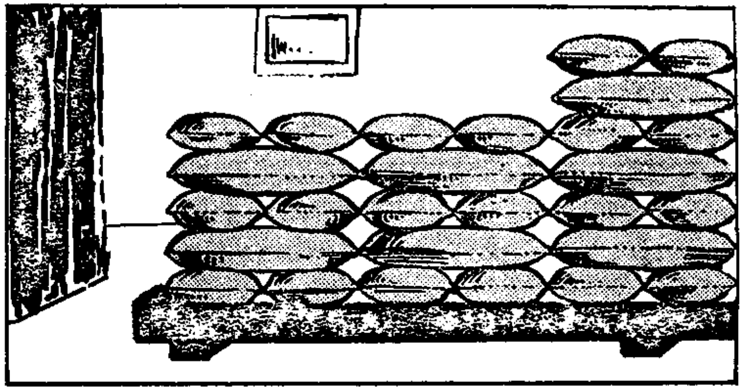


Dry grain stores longer



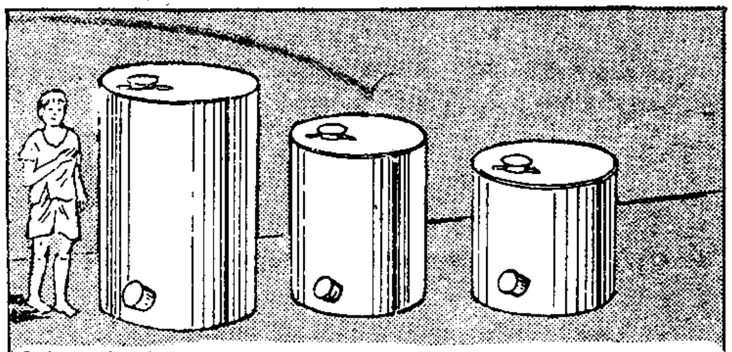
Clean grain stores better

2. Use dunnage to avoid moisture damage to grain stored in bags.



Wooden crate and bamboo mat prevent moisture pick up from ground.

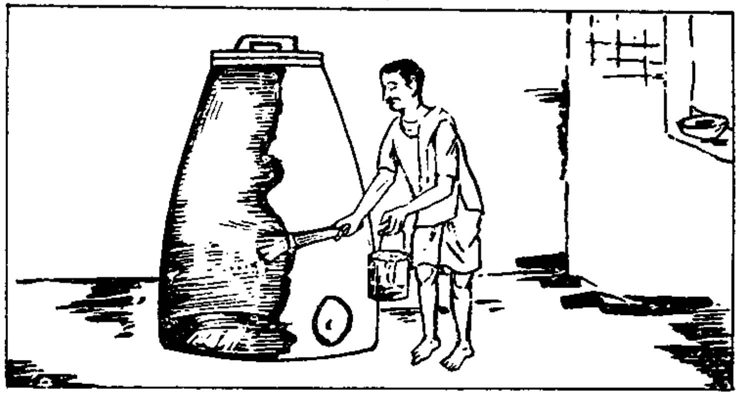
3. Use domestic metal bins.



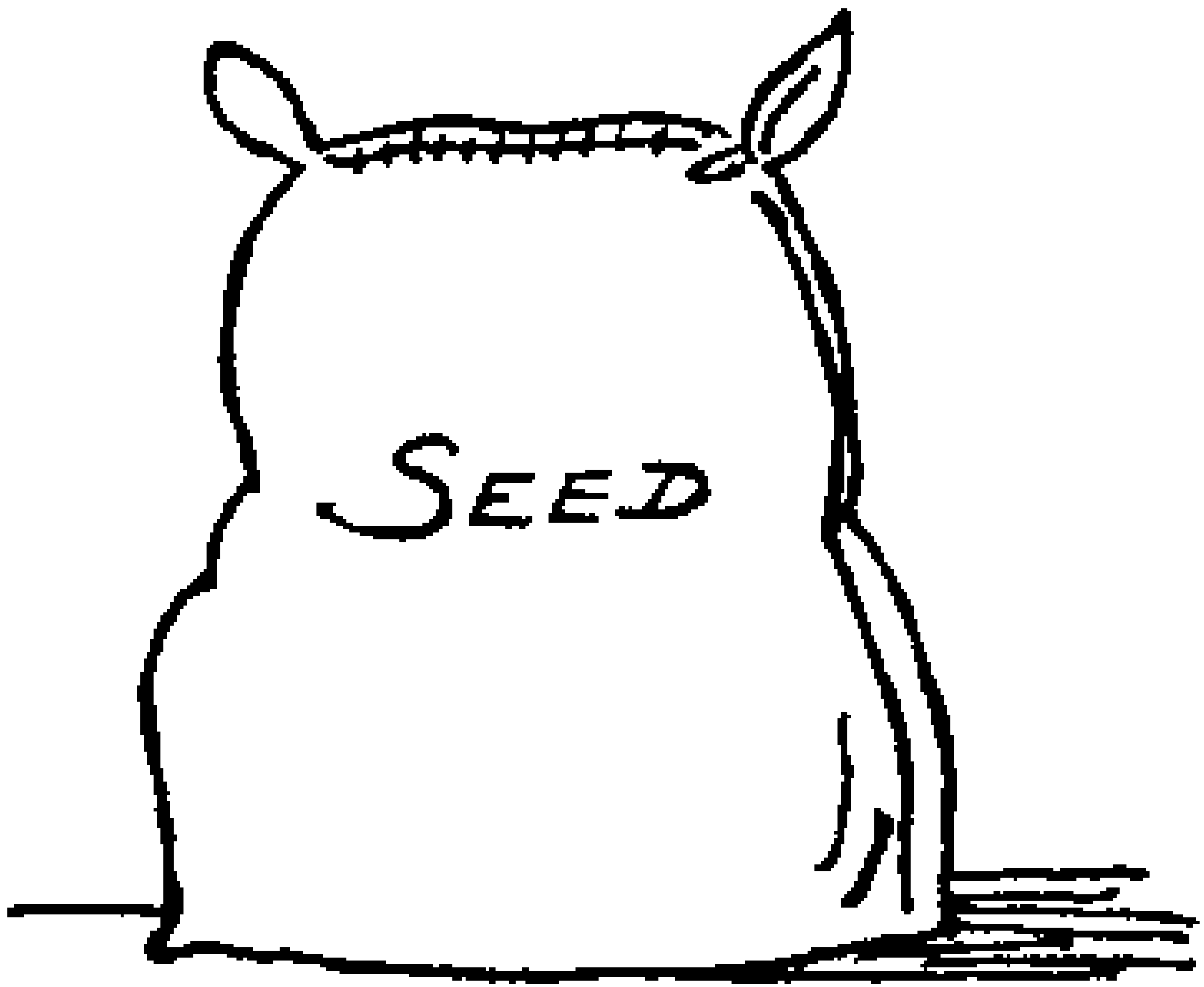
Select the bins to suit your needs. Improved bins are moisture proof and rat proof. It is easier to fumigate grain in them for insect control.

OR

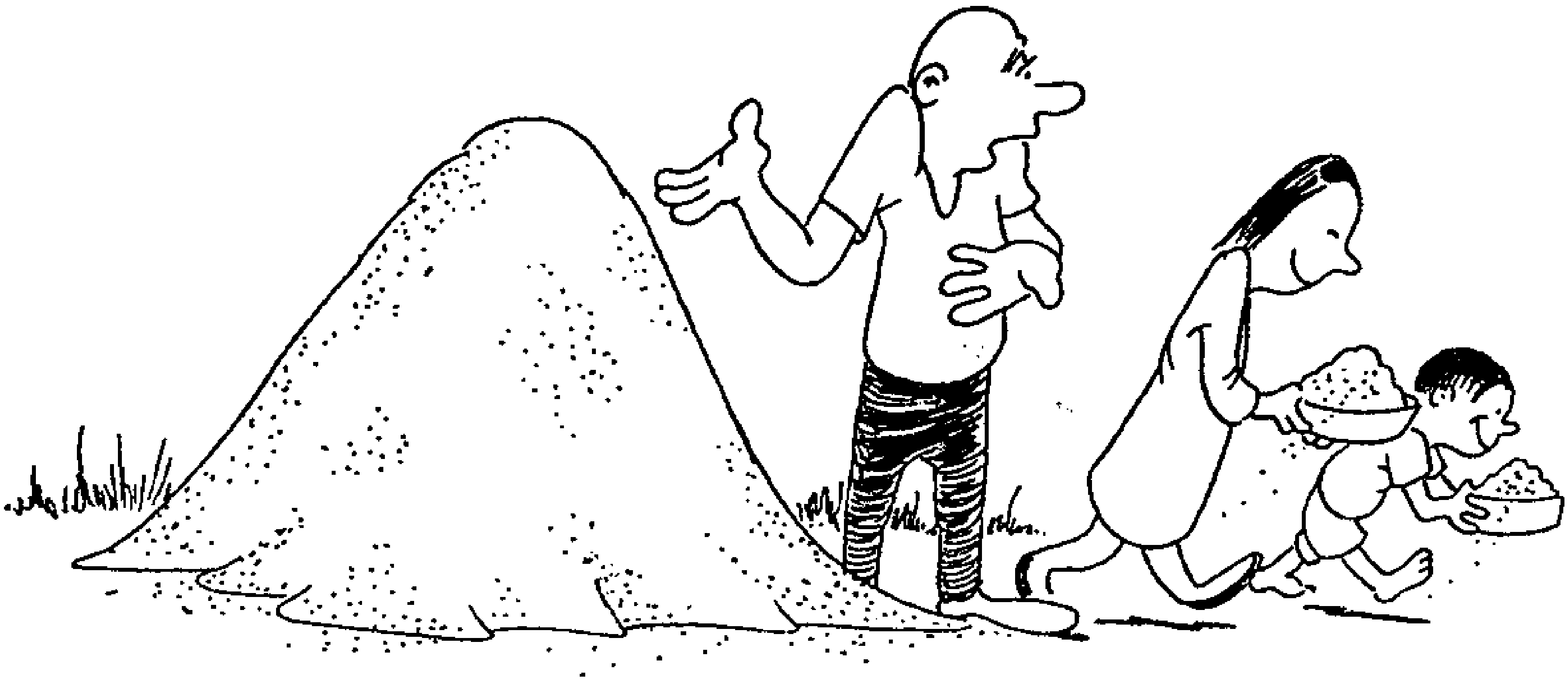
Improve your storage structure



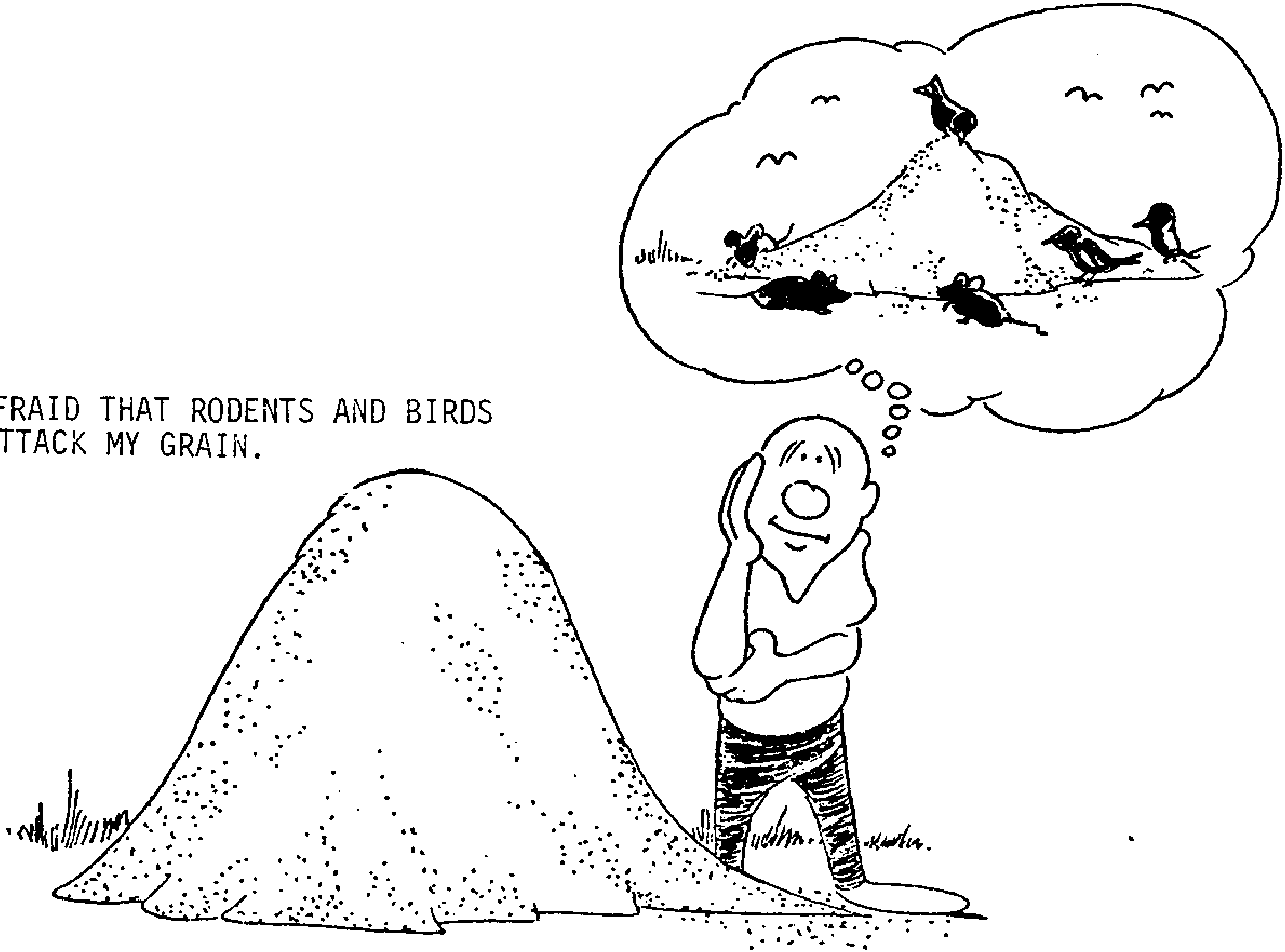
Examine your storage structure before storing grain. Clean it. Attend to cracks and crevices and white-wash it and also make it rat proof and moisture proof as far as possible.

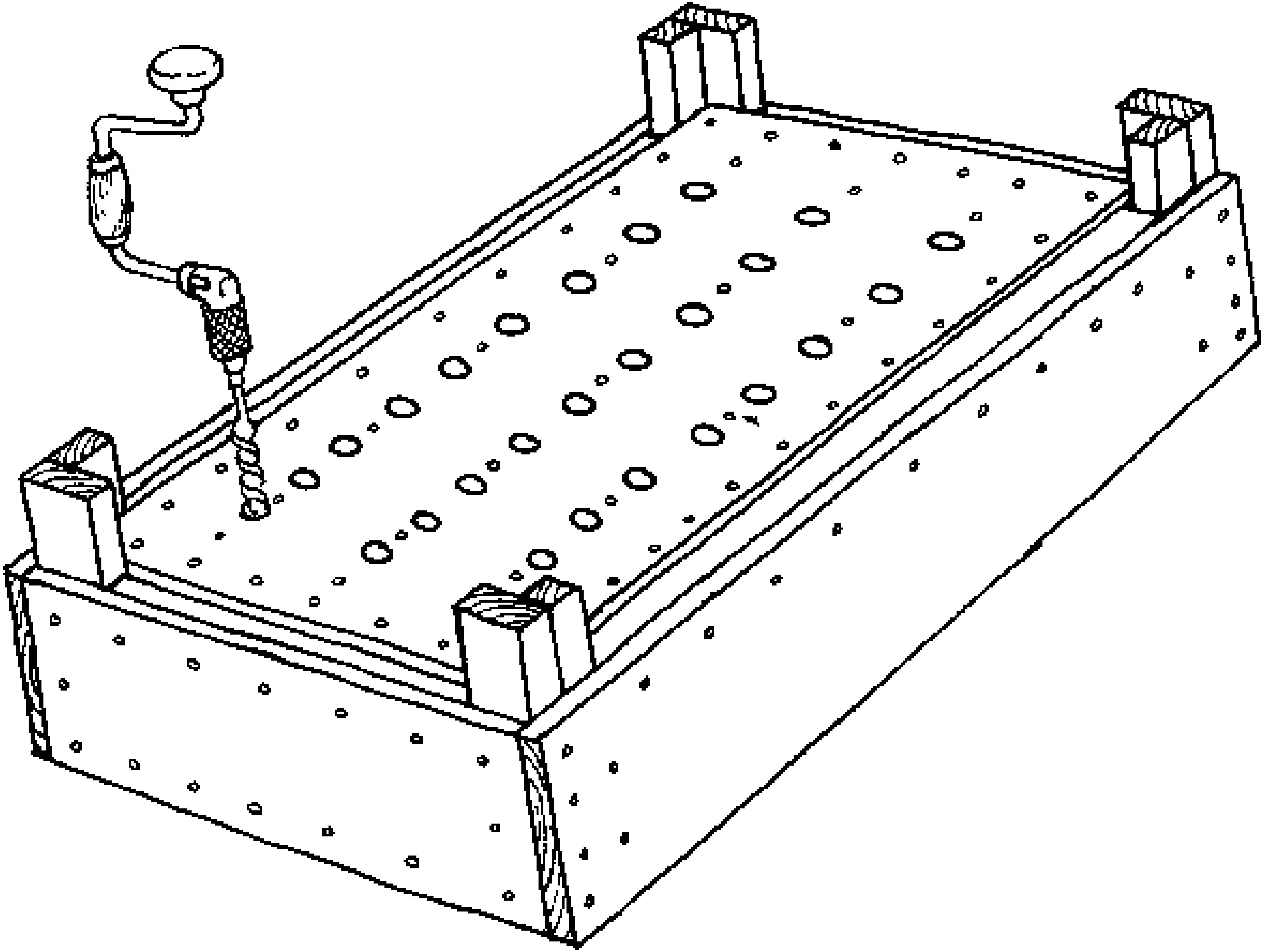

SEED

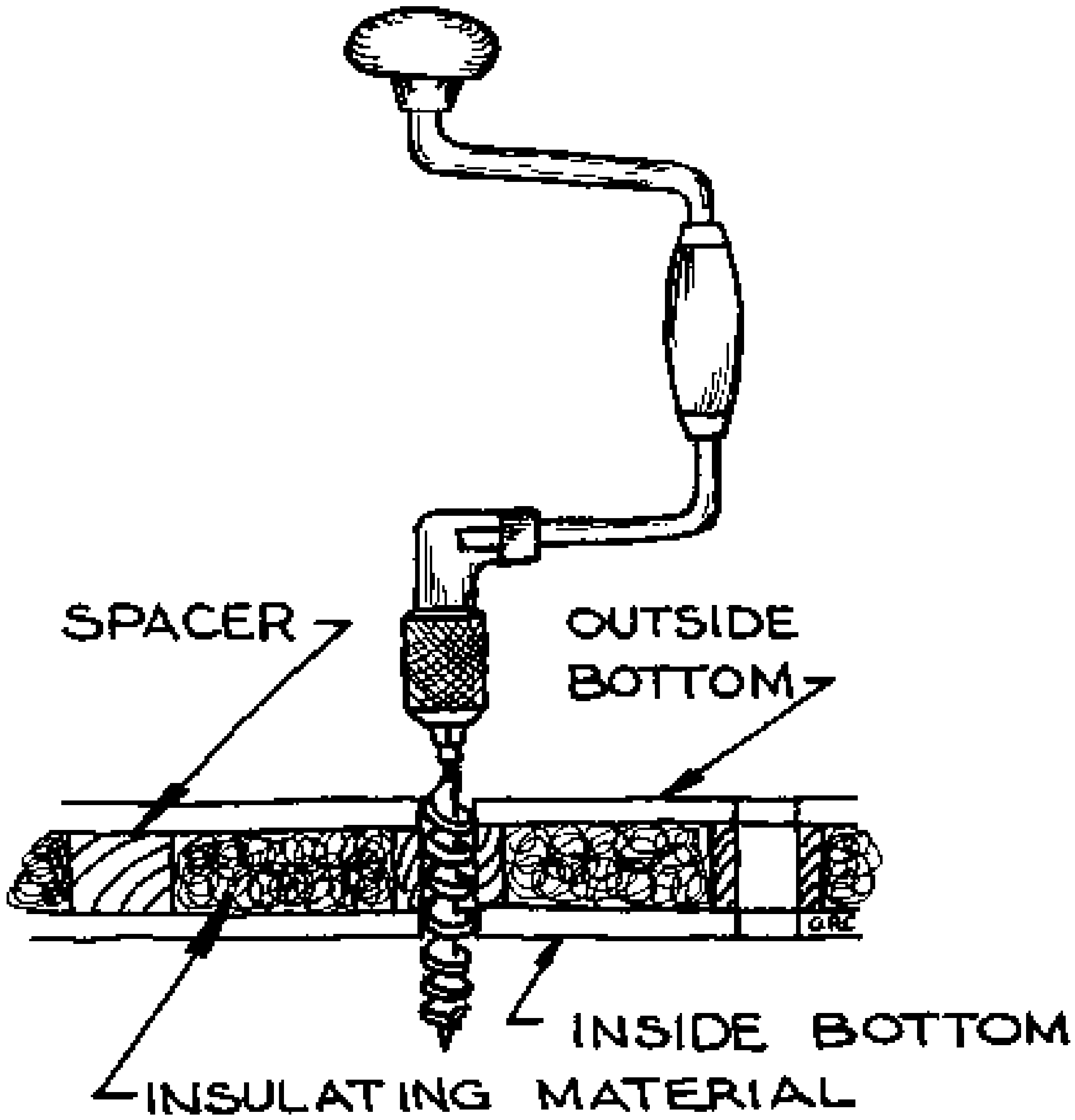
WHAT AM I GOING TO DO TO PROTECT MY GRAIN SO WE WILL HAVE ENOUGH TO EAT FOR THE REST OF THE YEAR?

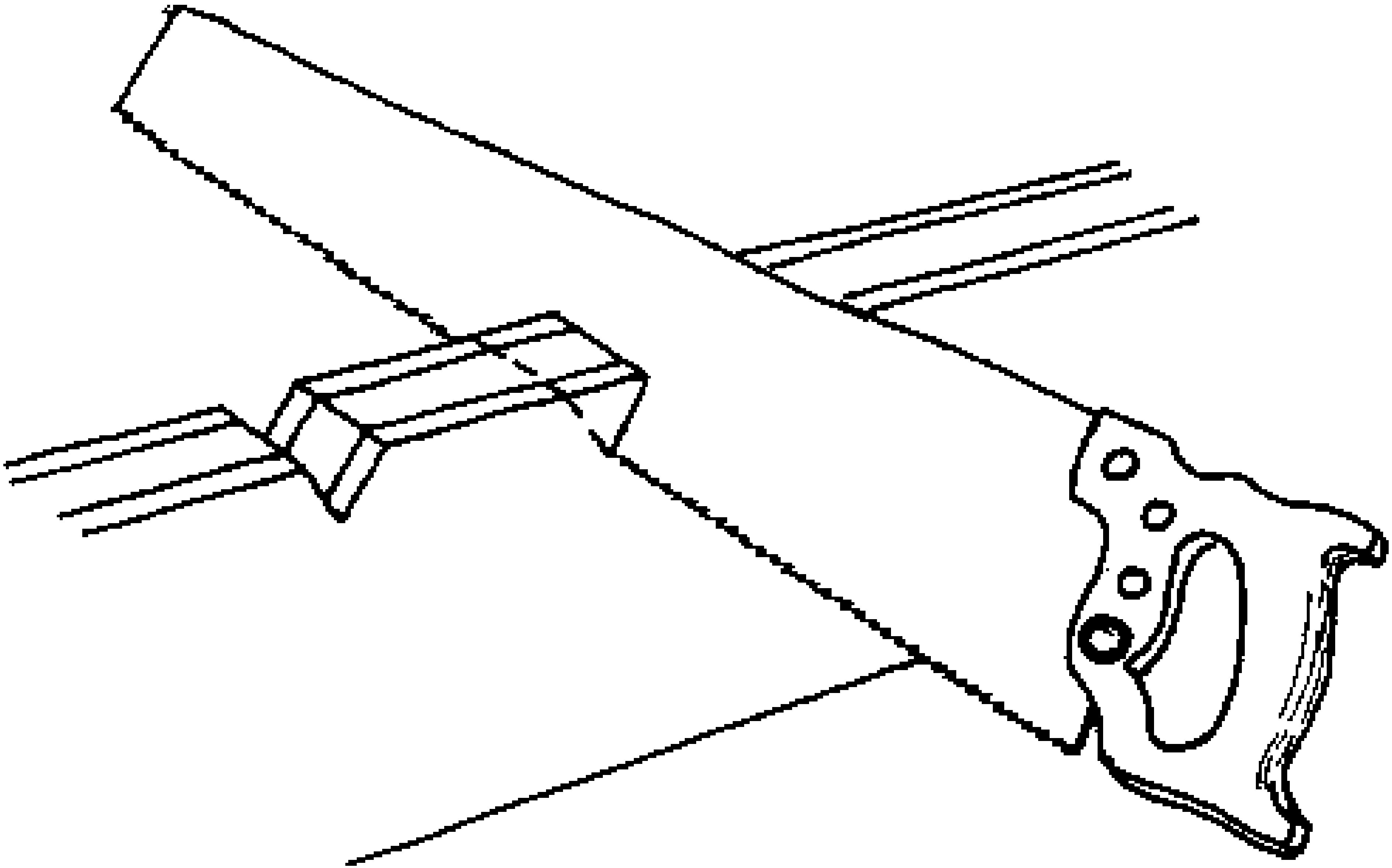


I AM AFRAID THAT RODENTS AND BIRDS
WILL ATTACK MY GRAIN.

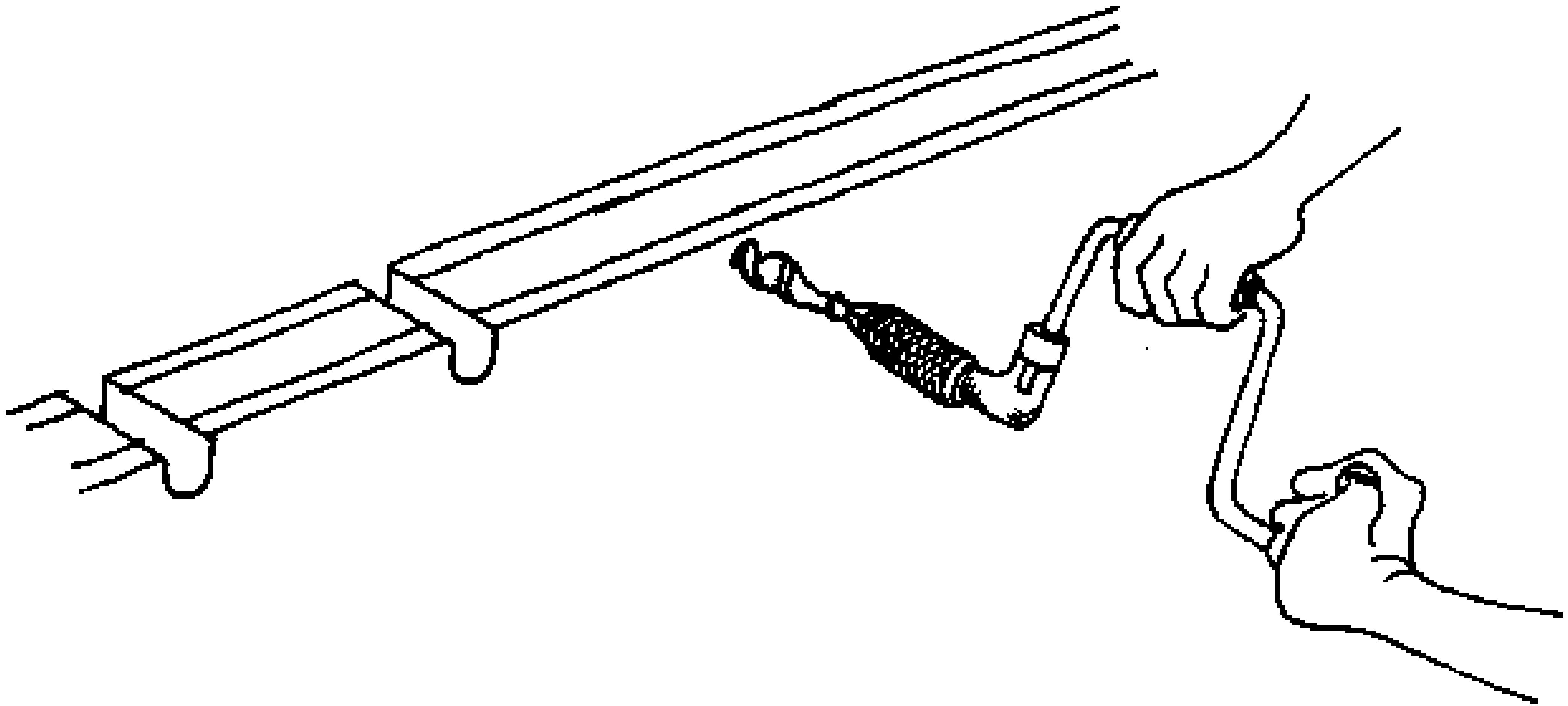




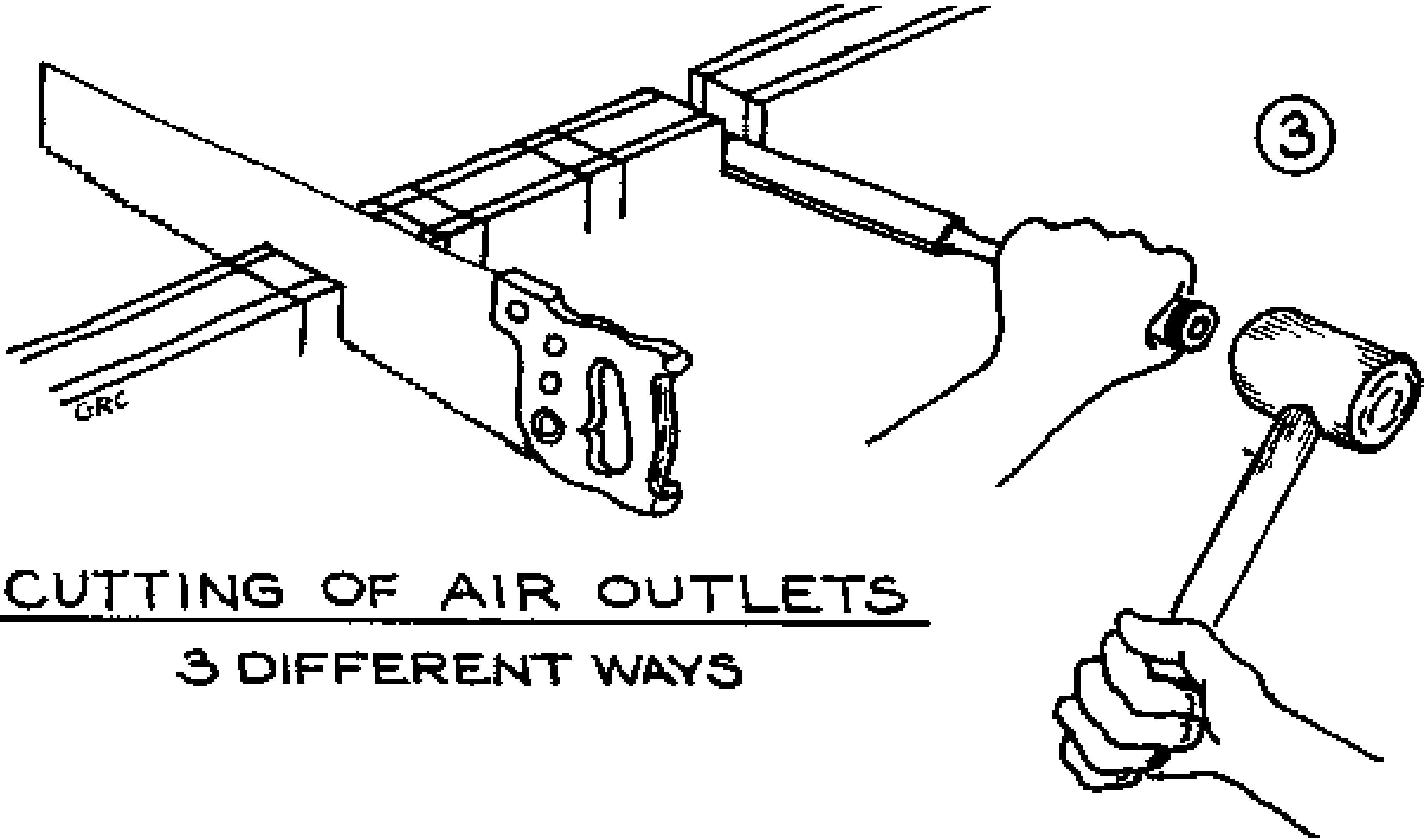

SPACER
OUTSIDE
BOTTOM
INSIDE BOTTOM
INSULATING MATERIAL



1

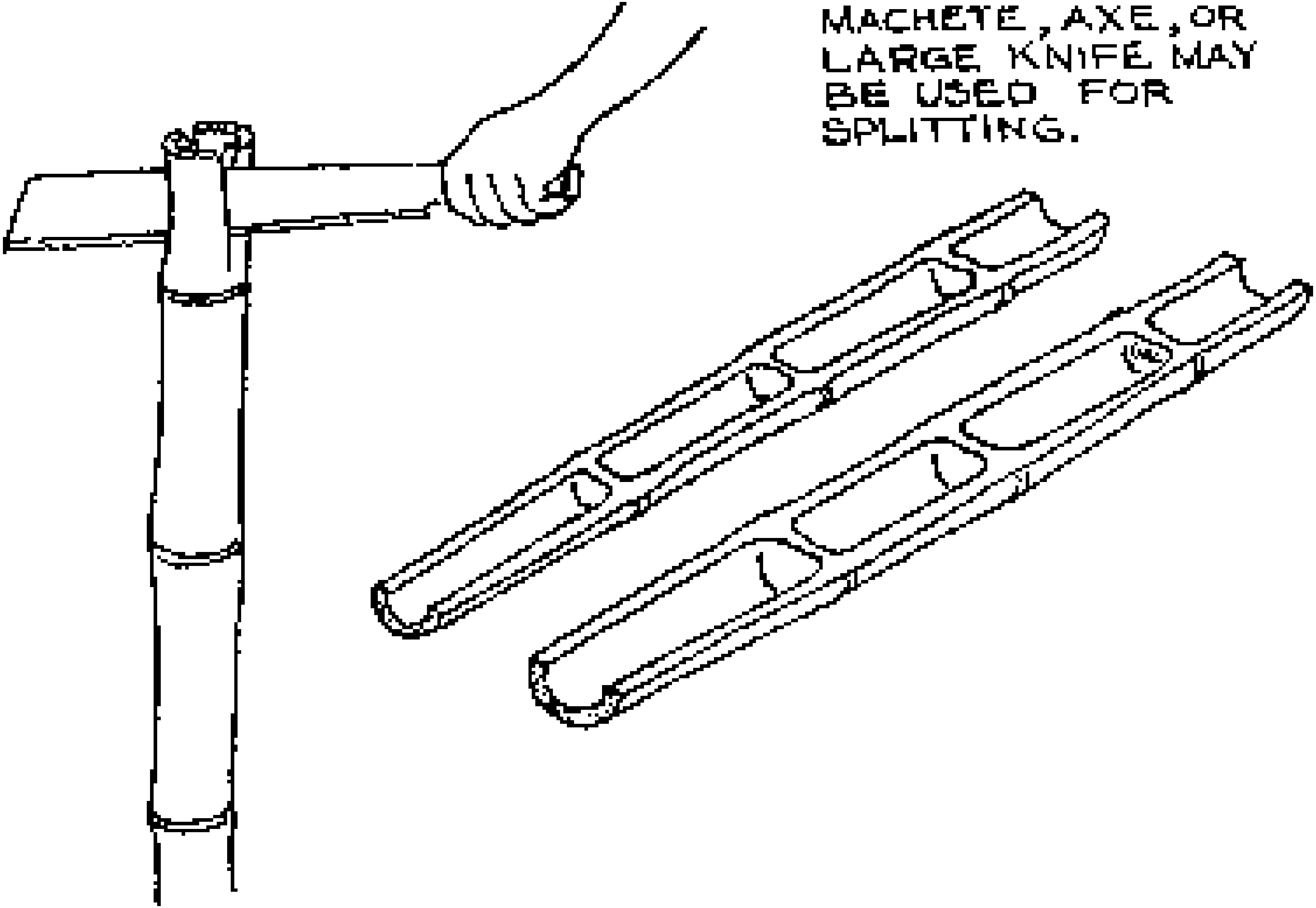


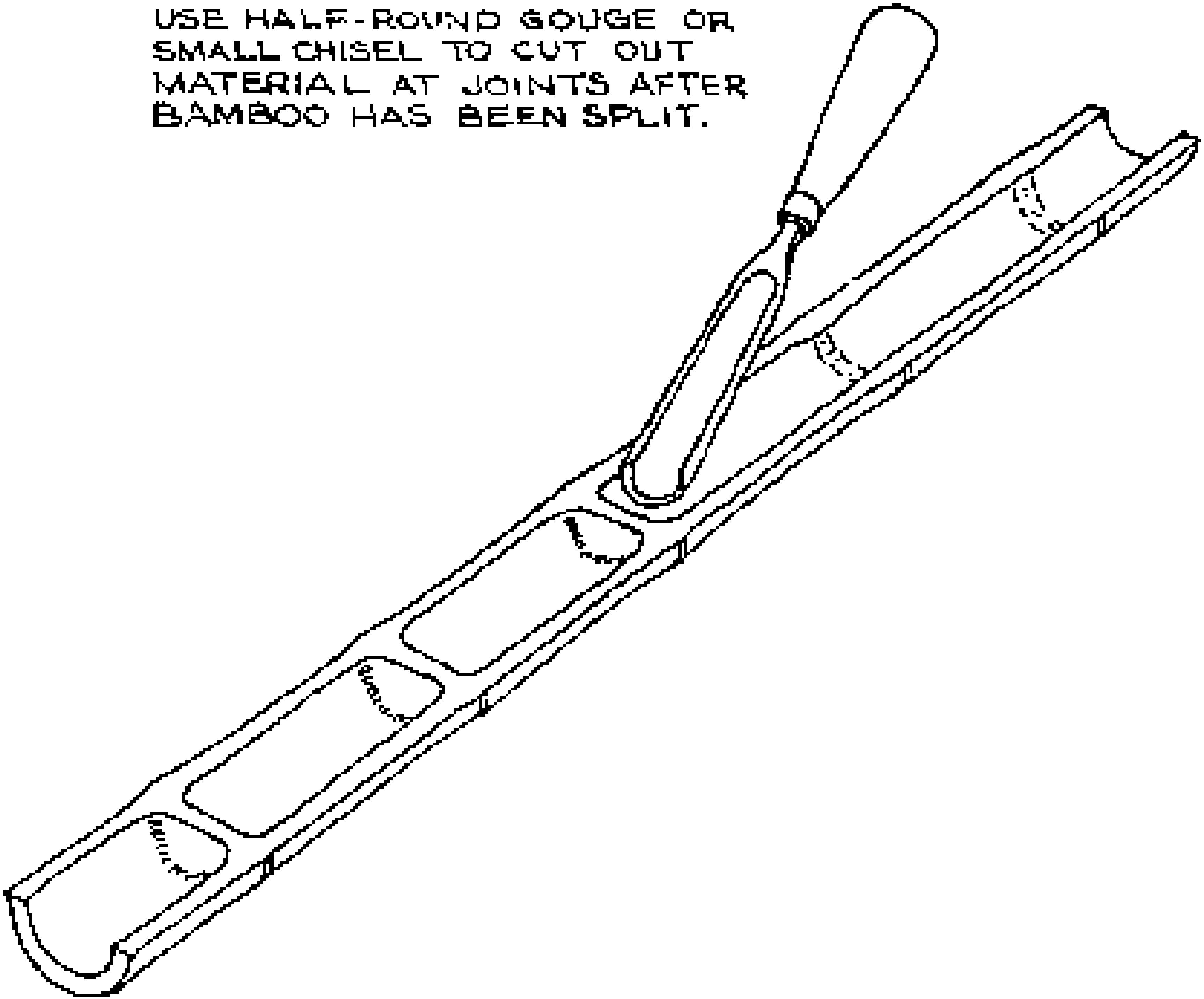
2

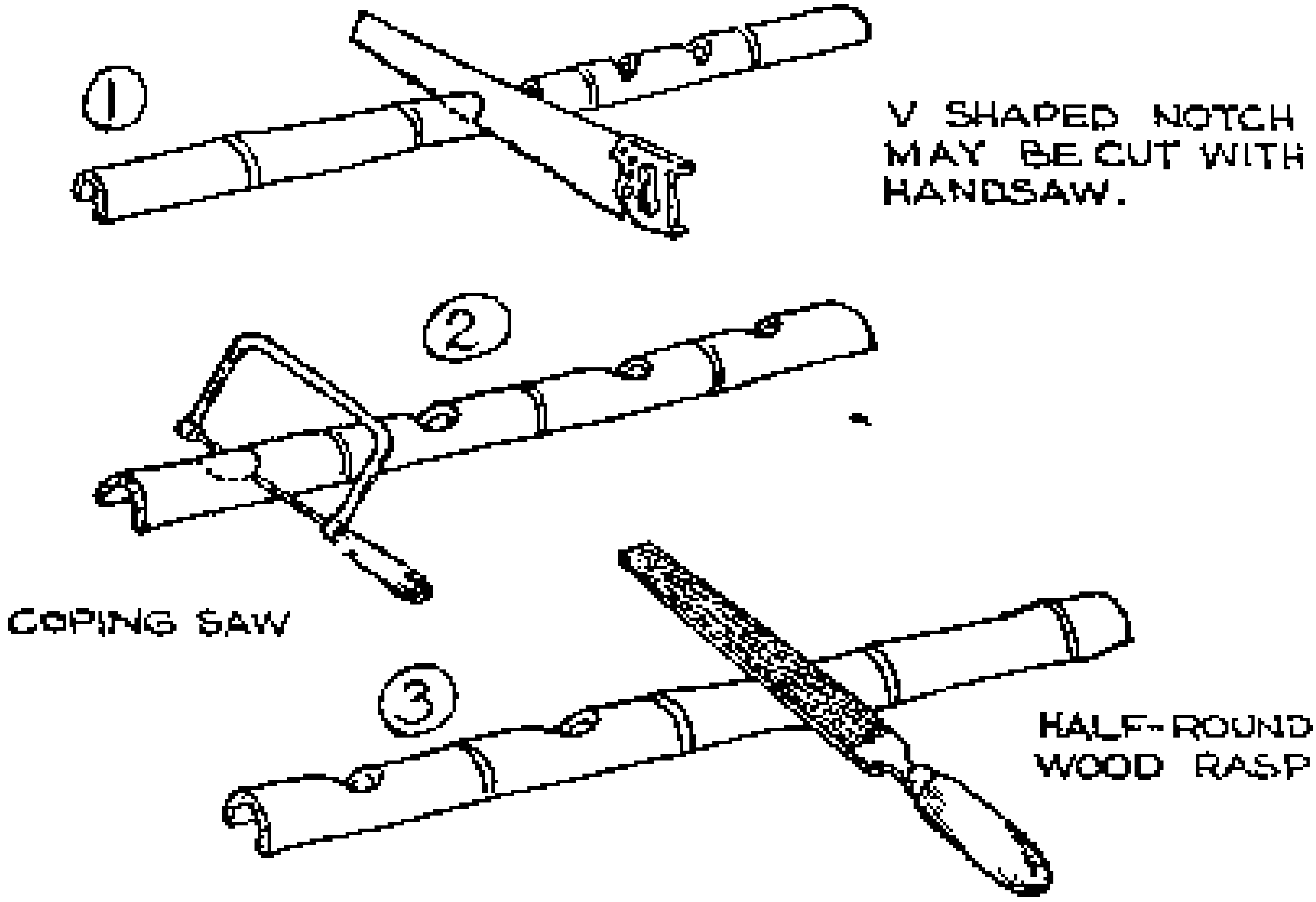


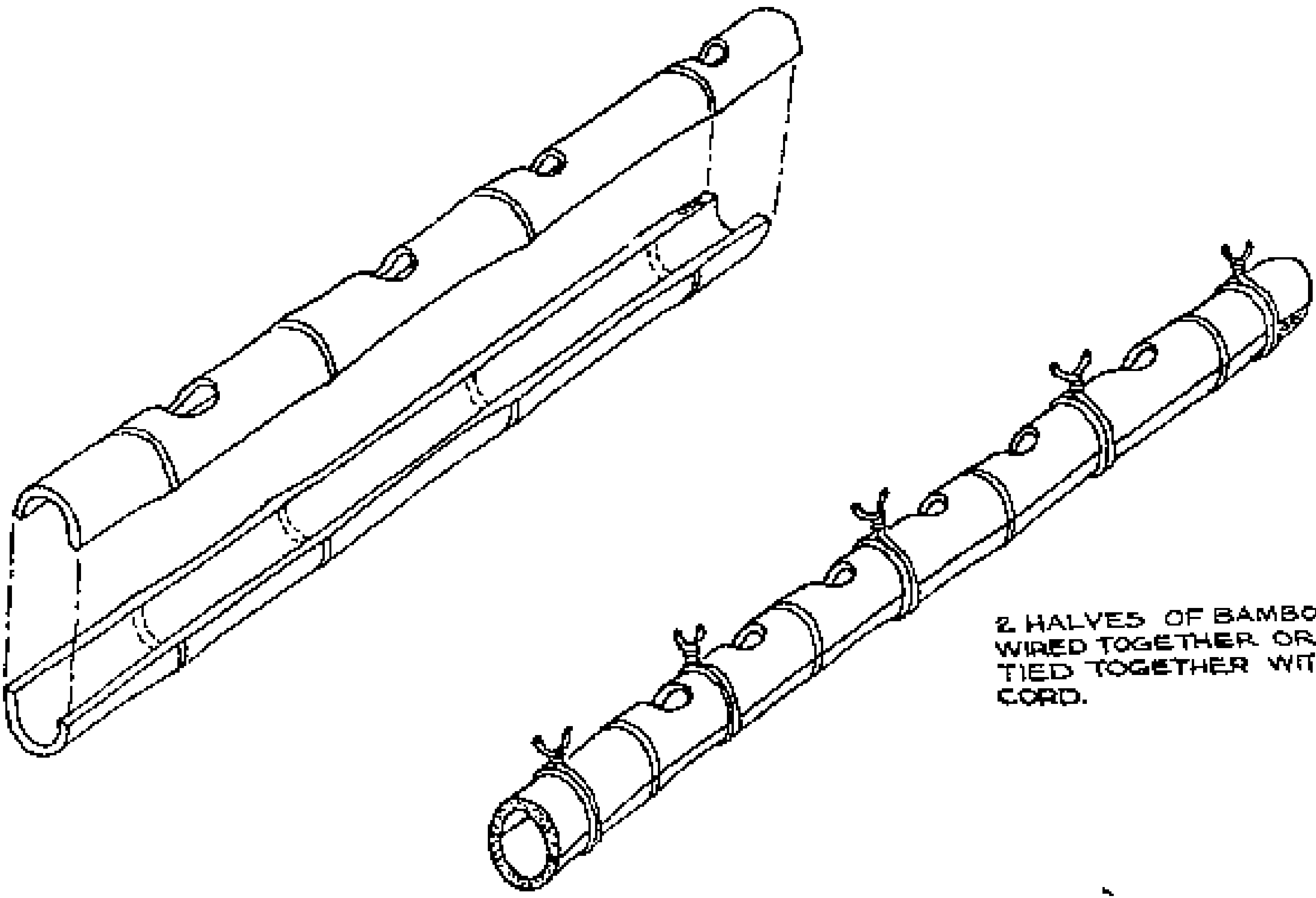
CUTTING OF AIR OUTLETS

3 DIFFERENT WAYS


MACHETE, AXE, OR
LARGE KNIFE MAY
BE USED FOR
SPLITTING.

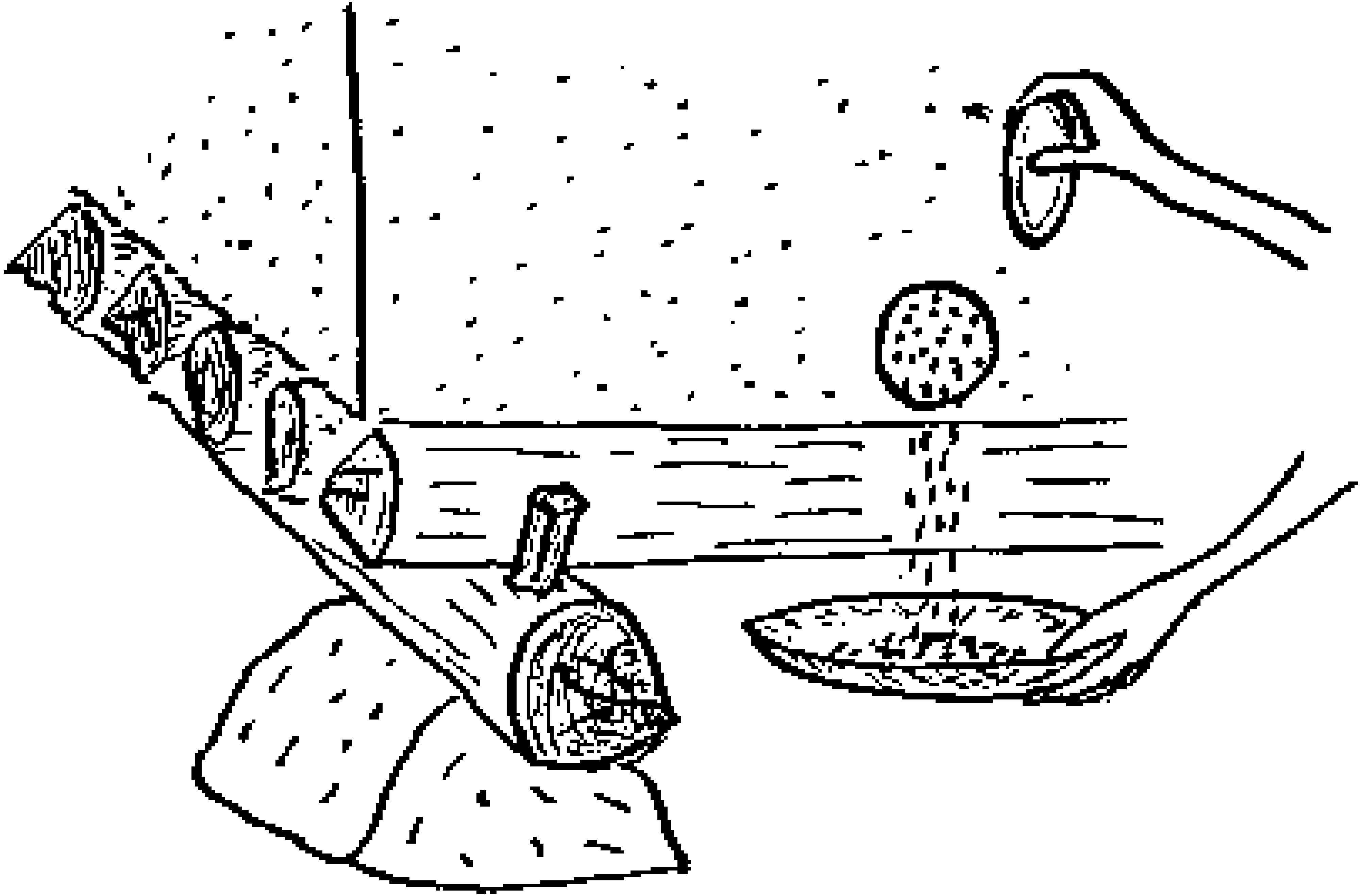

USE HALF-ROUND GOUGE OR
SMALL CHISEL TO CUT OUT
MATERIAL AT JOINTS AFTER
BAMBOO HAS BEEN SPLIT.


1
V SHAPED NOTCH
MAY BE CUT WITH
HANDSAW.
2
COPING SAW
3
HALF-ROUND
WOOD RASP

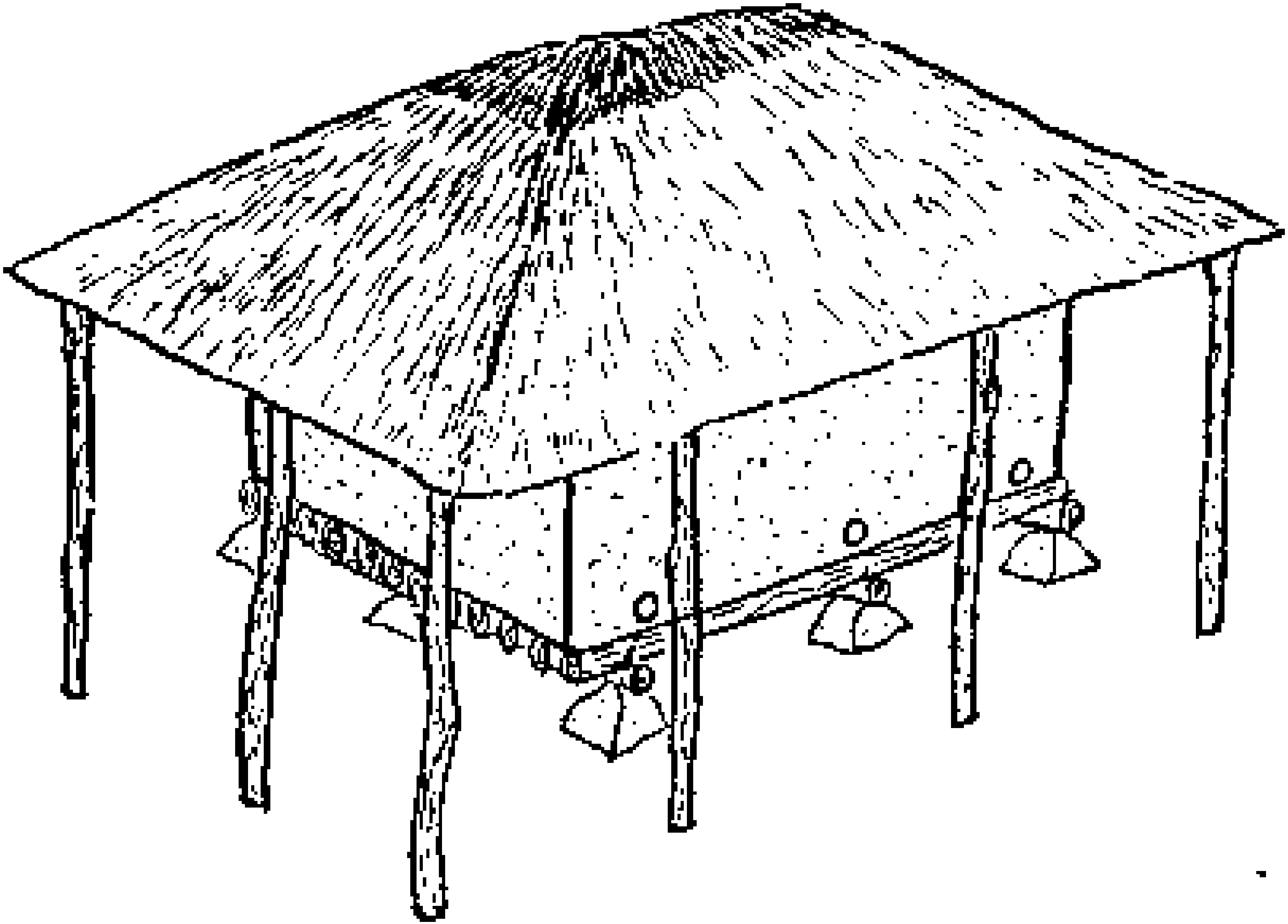


2 HALVES OF BAMBOO WIRED TOGETHER OR TIED TOGETHER WITH CORD.

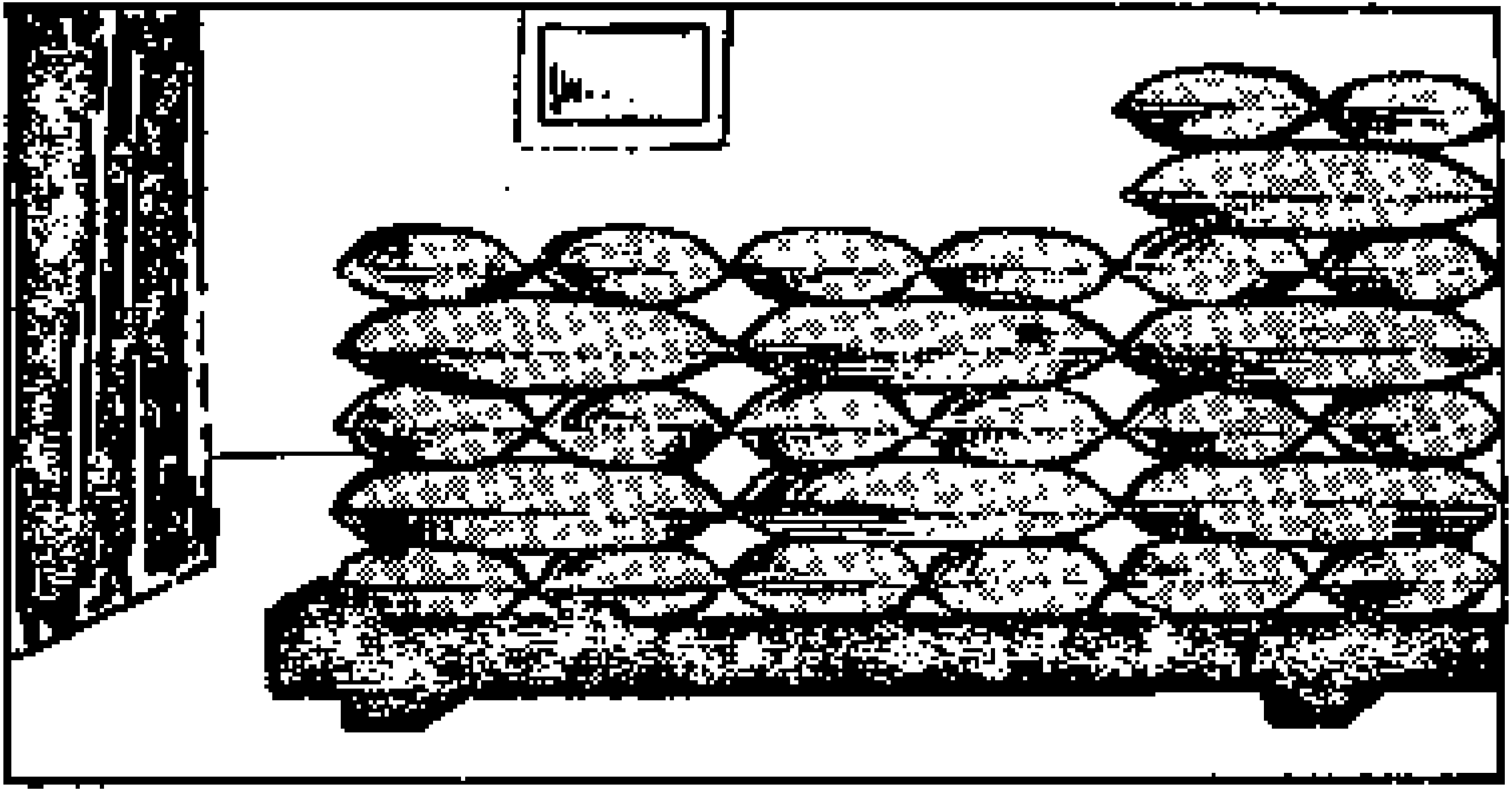
Method of removing grain.



Wide thatch to keep rain and sun off the mud crib.

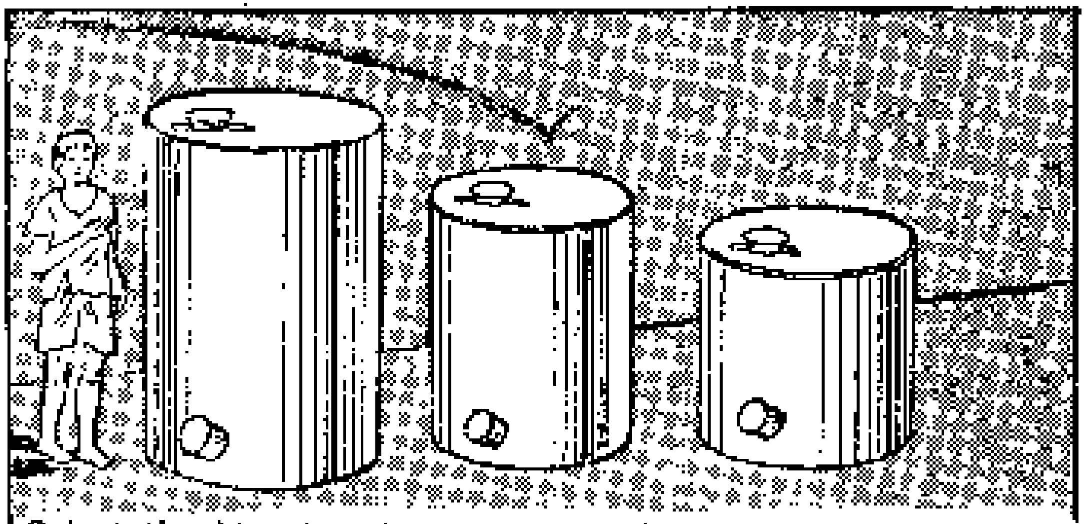


2. Use dunnage to avoid moisture damage to grain stored in bags.



Wooden crate and bamboo mat prevent moisture pick up from ground.

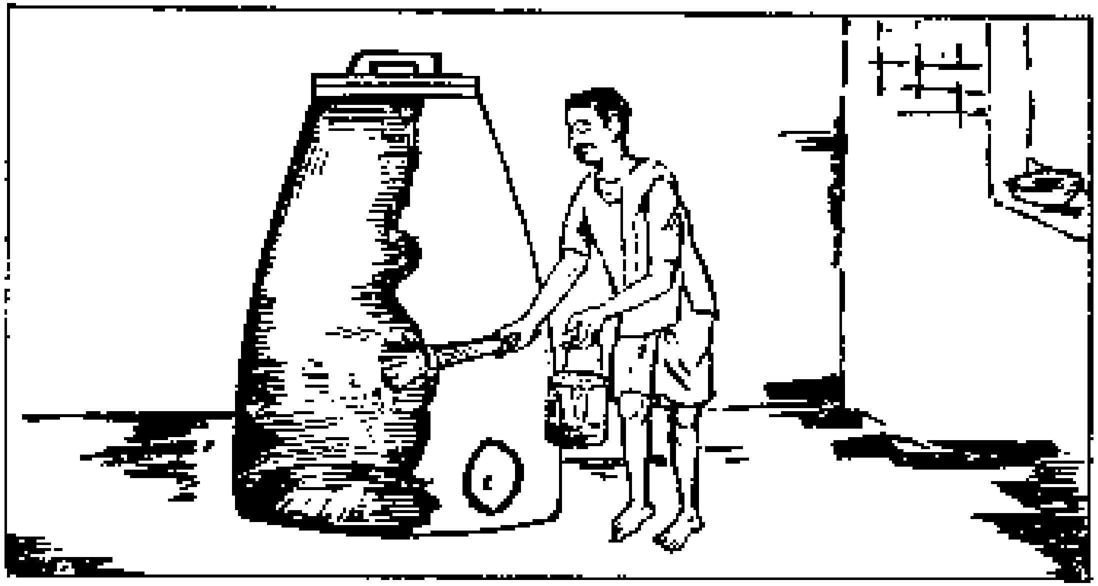
3. Use domestic metal bins.



Select the bins to suit your needs. Improved bins are moisture proof and rat proof. It is easier to fumigate grain in them for insect control.

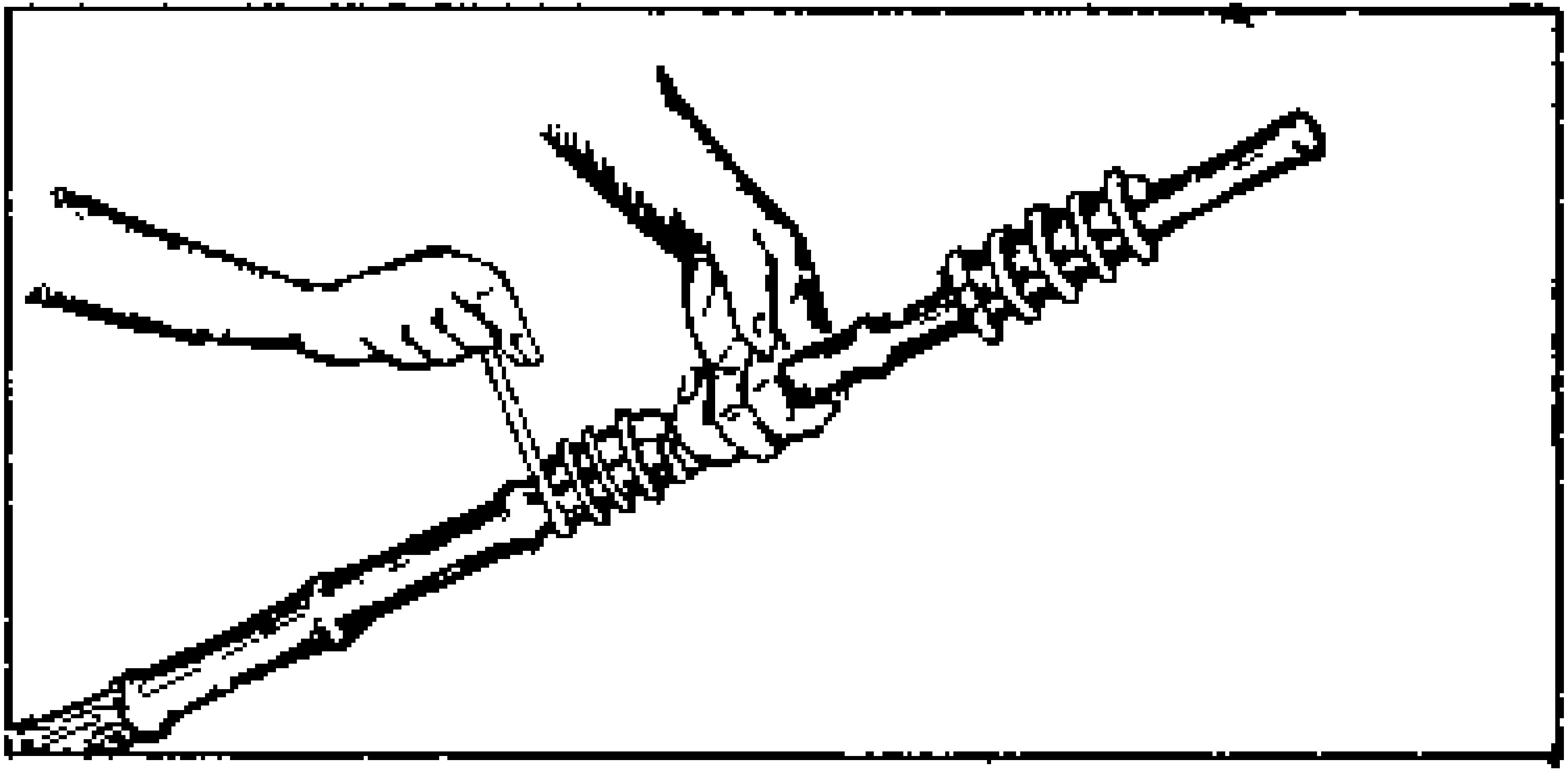
OR

Improve your storage structure



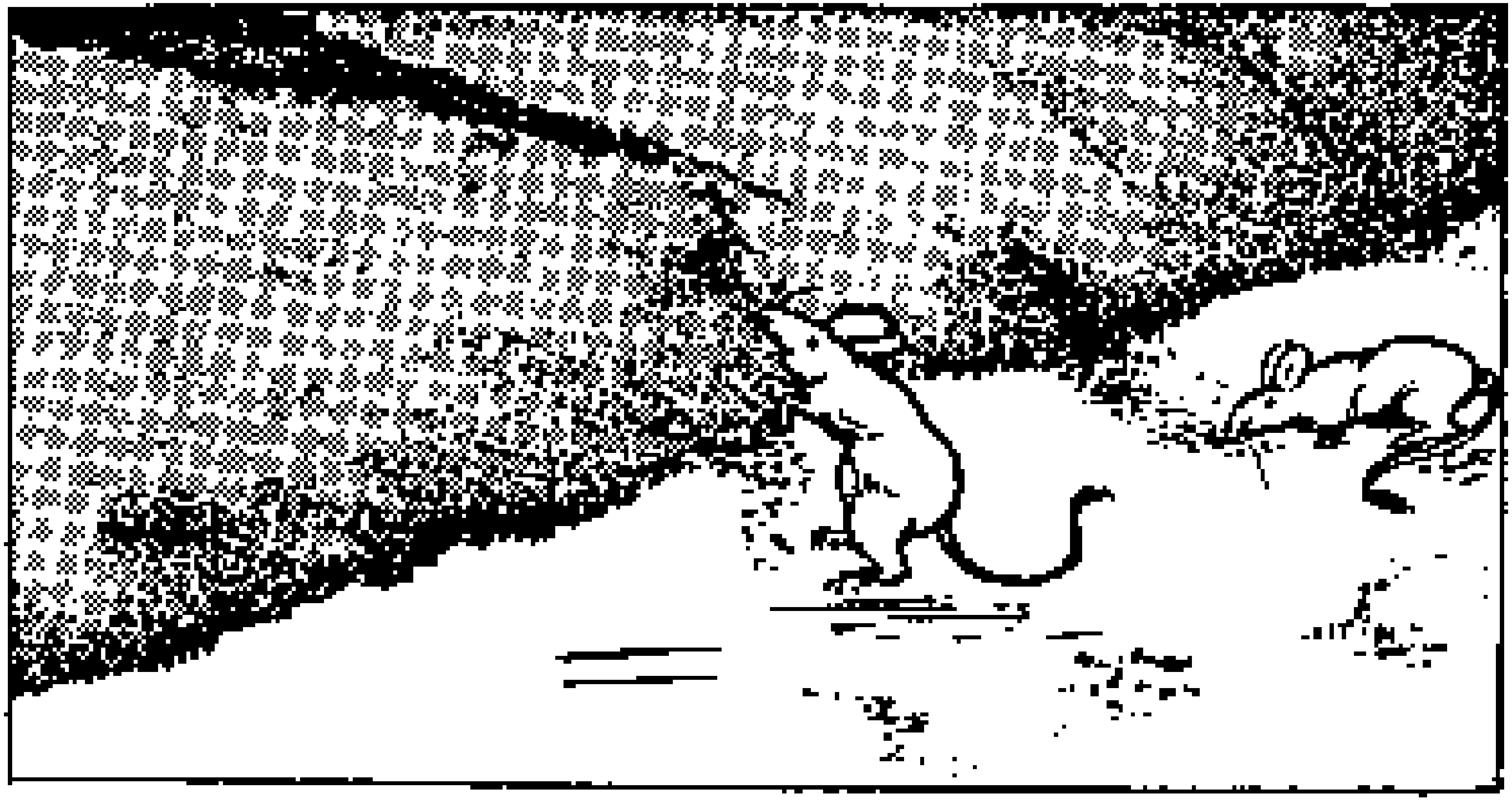
Examine your storage structure before storing grain. Clean it. Attend to cracks and crevices and white-wash it and also make it rat proof and moisture proof as far as possible.

Fumigate with EDB ampoules to avoid insect damage.



Fumigate when the grain is stored. Check periodically and fumigate again if you find live insects.

5. Use anticoagulant for rat control.



Rats damage stored grain and contaminate it with their excreta

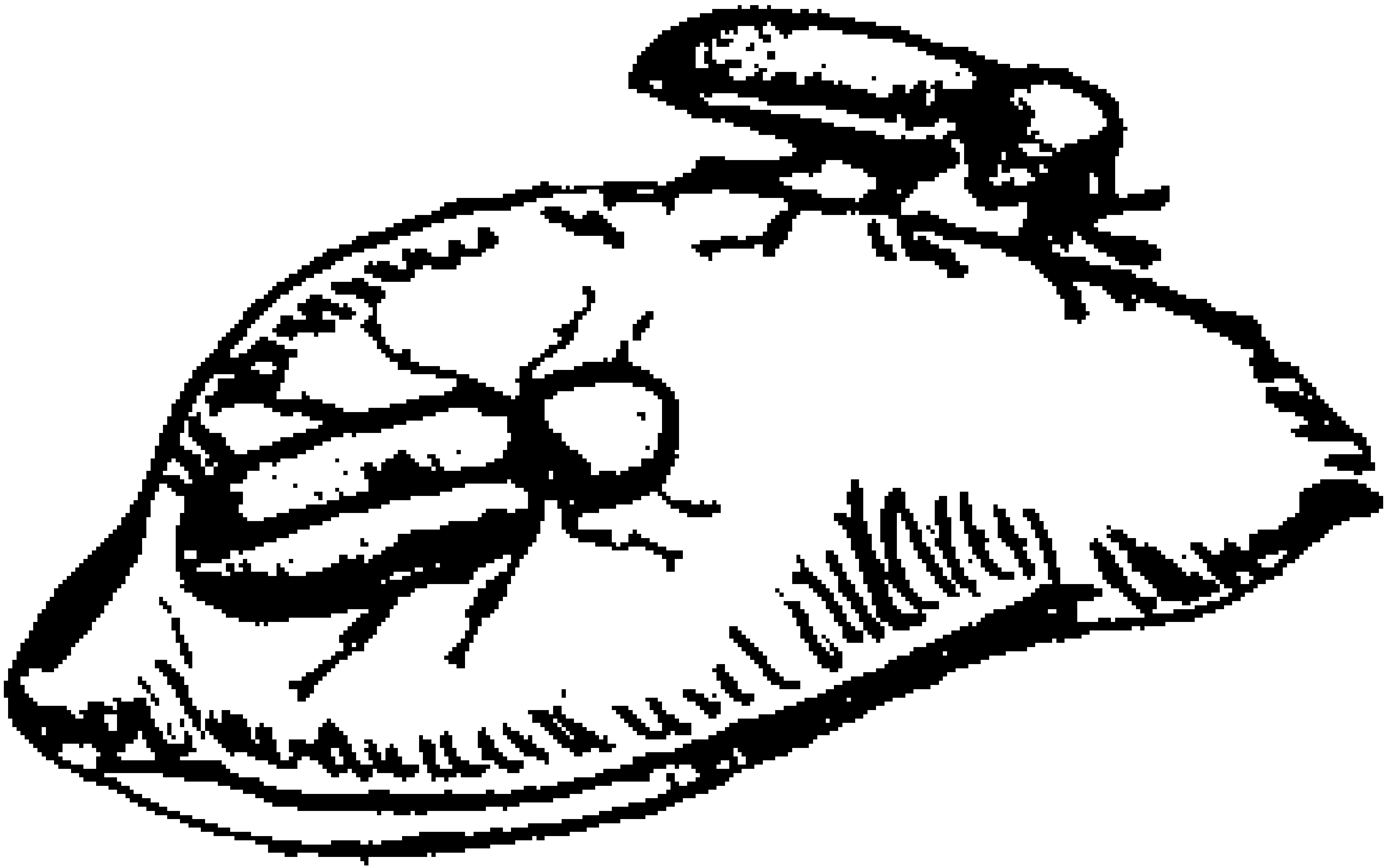
FIGURE 4

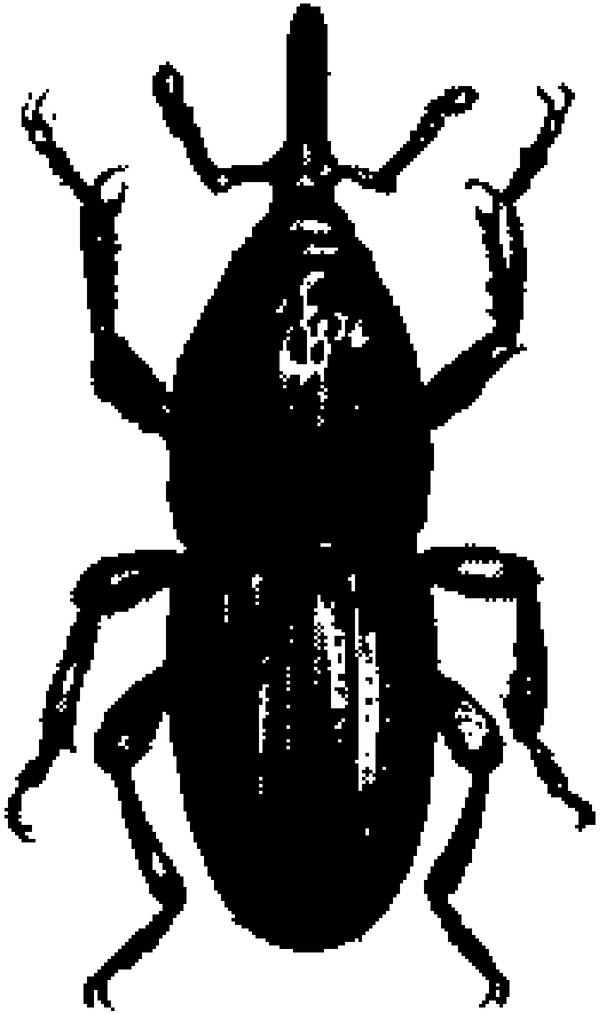
KILOGRAMS INTO POUNDS
(1 kg. = 2.20463 lb.)

kg.	0	1	2	3	4	5	6	7	8	9
0	lb.	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	52.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.19	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.58	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

POUNDS INTO KILOGRAMS
(1 lb. = 0.45359 kg.)

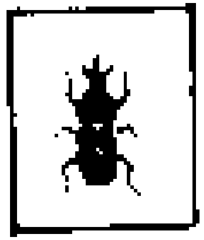
lb.	0	1	2	3	4	5	6	7	8	9
0	kg.	0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082
10	4.536	4.990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618
20	9.072	9.525	9.979	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.730	42.184	42.638	43.091	43.545	43.998	44.452	44.906





ENLARGED

ACTUAL SIZE



STORED-PRODUCT INSECTS

COMMODITY, STORAGE, AND INSECT	INSECTICIDE OR TREATMENT	TOLERANCE (p. p. m.)	FORMULATION	DOSAGE (active ingredient per 1,000 cu. ft. unless otherwise stated)	HOW, WHERE, AND WHEN TO APPLY	SAFETY RESTRICTIONS
GRAIN—Corn, shelled (also Barley and Oats) (con.)						
In concrete or metal upright bins, 3,200-bu. metal bins, or farm-type metal bins Grain weevils, lesser grain borer, grain beetles, Angoumois grain moth, Indian meal moth	Calcium cyanide	25 (hydrogen cyanide)	F	12 - 15 lb./1,000 bu.	Mix into grain stream at 70° F. or above.	Fumigants should be applied only by a trained operator. Aerate after fumigation.
	Carbon tetrachloride + carbon disulfide (80:20 mixture)	Exempt	F	3 gal./1,000 bu.*	Gravity-distribution fumigation. Surface application or layering method. 60° F. or above.	
				1.75 gal.*	Forced-distribution fumigation. Closed-recirculation or single-pass. 60° F. or above.	
				2 gal.*	Forced distribution fumigation. Closed-recirculation or single-pass. Below 60° F.	
	Chloroform + carbon disulfide + ethylene dibromide	50 (inorganic bromide) Others exempt	F	2.25 gal./1,000 bu.*	Gravity distribution fumigation. Surface application or layering method. 60° F. or above.	
				2.75 gal./1,000 bu.*	Gravity-distribution fumigation. Surface application or layering method. Below 60° F.	
	Chloropicrin	Exempt	F	3 lb./1,000 bu.*	Gravity-distribution fumigation. Surface application. 70° F. or above.	
				4 lb./1,000 bu.*	Gravity-distribution fumigation. Surface application. Below 70° F.	
	Chloropicrin + methyl chloride (85:15 mixture)	Exempt	F	2 lb.	Forced-distribution fumigation. Closed-recirculation or single-pass. 70° F. or above.	
				3 lb.	Forced distribution fumigation. Closed-recirculation or single-pass. Below 70° F.	

*Double the dosage if used in wooden bins.

FIGURE 2

Inches into centimeters

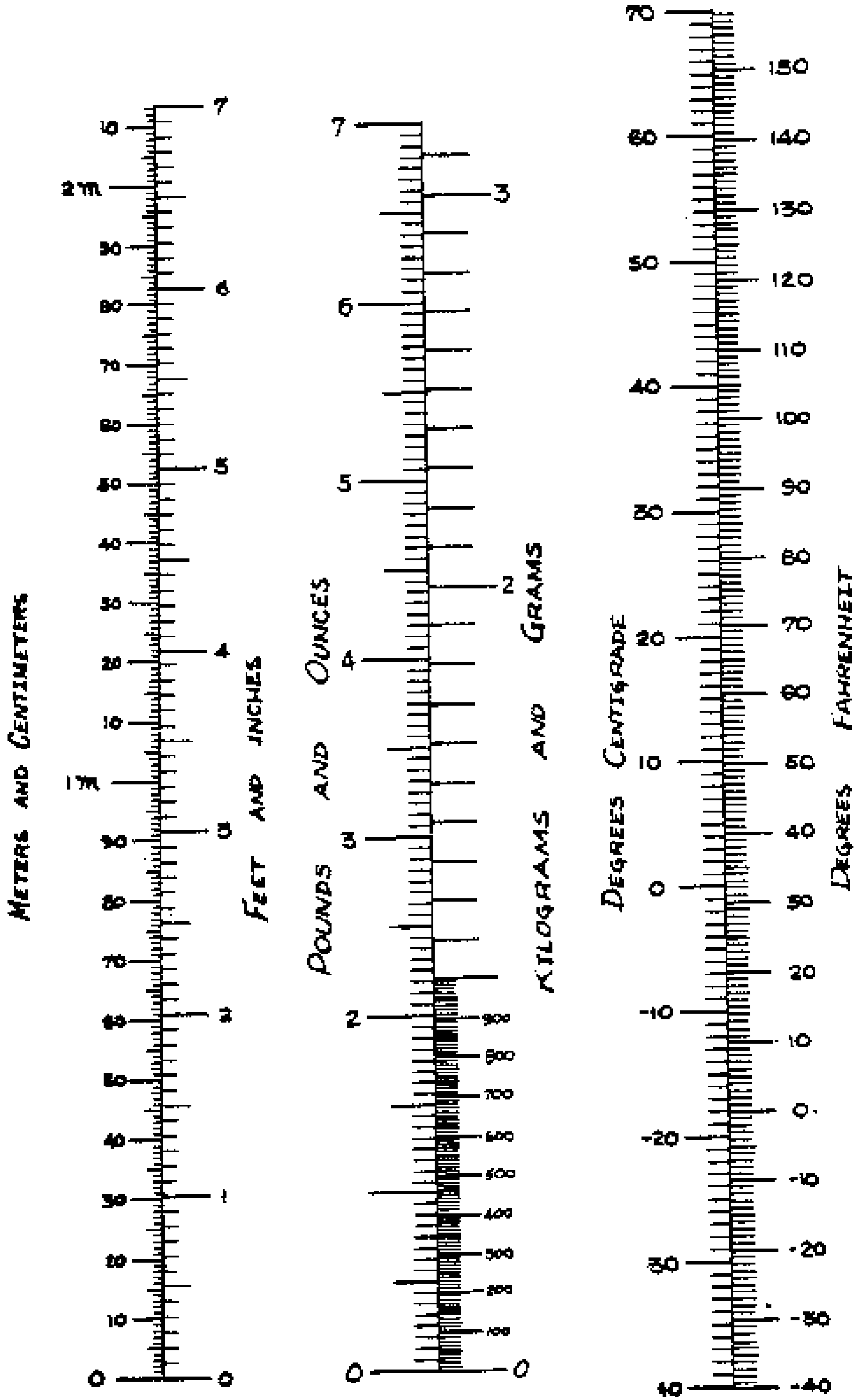
(1 in. = 2.539977 cm.)

inches	0	1	2	3	4	5	6	7	8	9
0	cm.	2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.86
10	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
20	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
30	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
40	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
50	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
60	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
70	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
80	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
90	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46

Centimeters into inches

(1 cm. = 0.3937 in.)

cm.	0	1	2	3	4	5	6	7	8	9
0	inches	0.394	0.787	1.181	1.575	1.969	2.362	2.756	3.150	3.543
10	3.937	4.331	4.724	5.118	5.512	5.906	6.299	6.693	7.087	7.480
20	7.874	8.268	8.661	9.055	9.449	9.843	10.236	10.630	11.024	11.417
30	11.811	12.205	12.598	12.992	13.386	13.780	14.173	14.567	14.961	15.354
40	15.748	16.142	16.535	16.929	17.323	17.717	18.110	18.504	18.898	19.291
50	19.685	20.079	20.472	20.866	21.260	21.654	22.047	22.441	22.835	23.228
60	23.622	24.016	24.409	24.803	25.197	25.591	25.984	26.378	26.772	27.165
70	27.559	27.953	28.346	28.740	29.134	29.528	29.921	30.315	30.709	31.102
80	31.496	31.890	32.283	32.677	33.071	33.465	33.858	34.252	34.646	35.039
90	35.433	35.827	36.220	36.614	37.008	37.402	37.795	38.189	38.583	38.976



Meters and Centimeters
Feet and Inches
Pounds and Ounces
Kilograms and Grams
Degrees Centigrade
Degrees Fahrenheit

FIGURE 4

Kilograms into pounds
(1 kg. = 2.20463 lb.)

kg.	0	1	2	3	4	5	6	7	8	9
0	lb.	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
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20	44.09	46.30	48.50	50.71	52.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.19	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.58	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Pounds into kilograms
(1 lb. = 0.45359 kg.)

lb.	0	1	2	3	4	5	6	7	8	9
0	kg.	0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082
10	4.536	4.990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618
20	9.072	9.525	9.979	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.730	42.184	42.638	43.091	43.545	43.998	44.452	44.906

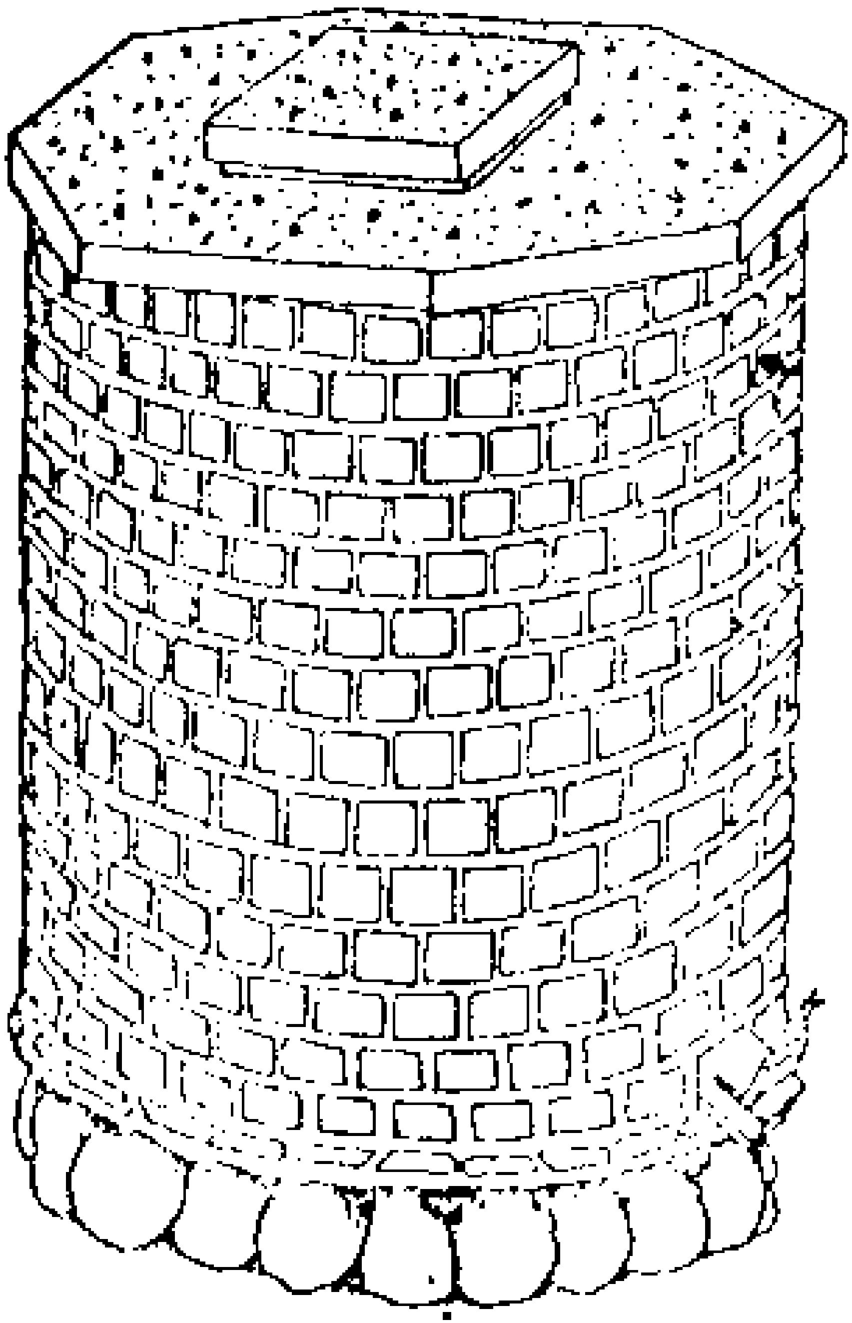


FIGURE 2

Inches into centimeters

(1 in. = 2.539977 cm.)

inches	0	1	2	3	4	5	6	7	8	9
0	cm.	2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.86
10	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
20	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
30	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
40	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
50	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
60	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
70	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
80	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
90	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46

Centimeters into inches

(1 cm. = 0.3937 in.)

cm.	0	1	2	3	4	5	6	7	8	9
0	inches	0.394	0.787	1.181	1.575	1.969	2.362	2.756	3.150	3.543
10	3.937	4.331	4.724	5.118	5.512	5.906	6.299	6.693	7.087	7.480
20	7.874	8.268	8.661	9.055	9.449	9.843	10.236	10.630	11.024	11.417
30	11.811	12.205	12.598	12.992	13.386	13.780	14.173	14.567	14.961	15.354
40	15.748	16.142	16.535	16.929	17.323	17.717	18.110	18.504	18.898	19.291
50	19.685	20.079	20.472	20.866	21.260	21.654	22.047	22.441	22.835	23.228
60	23.622	24.016	24.409	24.803	25.197	25.591	25.984	26.378	26.772	27.165
70	27.559	27.953	28.346	28.740	29.134	29.528	29.921	30.315	30.709	31.102
80	31.496	31.890	32.283	32.677	33.071	33.465	33.858	34.252	34.646	35.039
90	35.433	35.827	36.220	36.614	37.008	37.402	37.795	38.189	38.583	38.976

FIGURE 4

Kilograms into pounds

(1 kg. = 2.20463 lb.)

kg.	0	1	2	3	4	5	6	7	8	9
0	lb.	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	52.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.19	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.58	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Pounds into kilograms

(1 lb. = 0.45359 kg.)

lb.	0	1	2	3	4	5	6	7	8	9
0	kg.	0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082
10	4.536	4.990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618
20	9.072	9.525	9.979	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.730	42.184	42.638	43.091	43.545	43.998	44.452	44.906

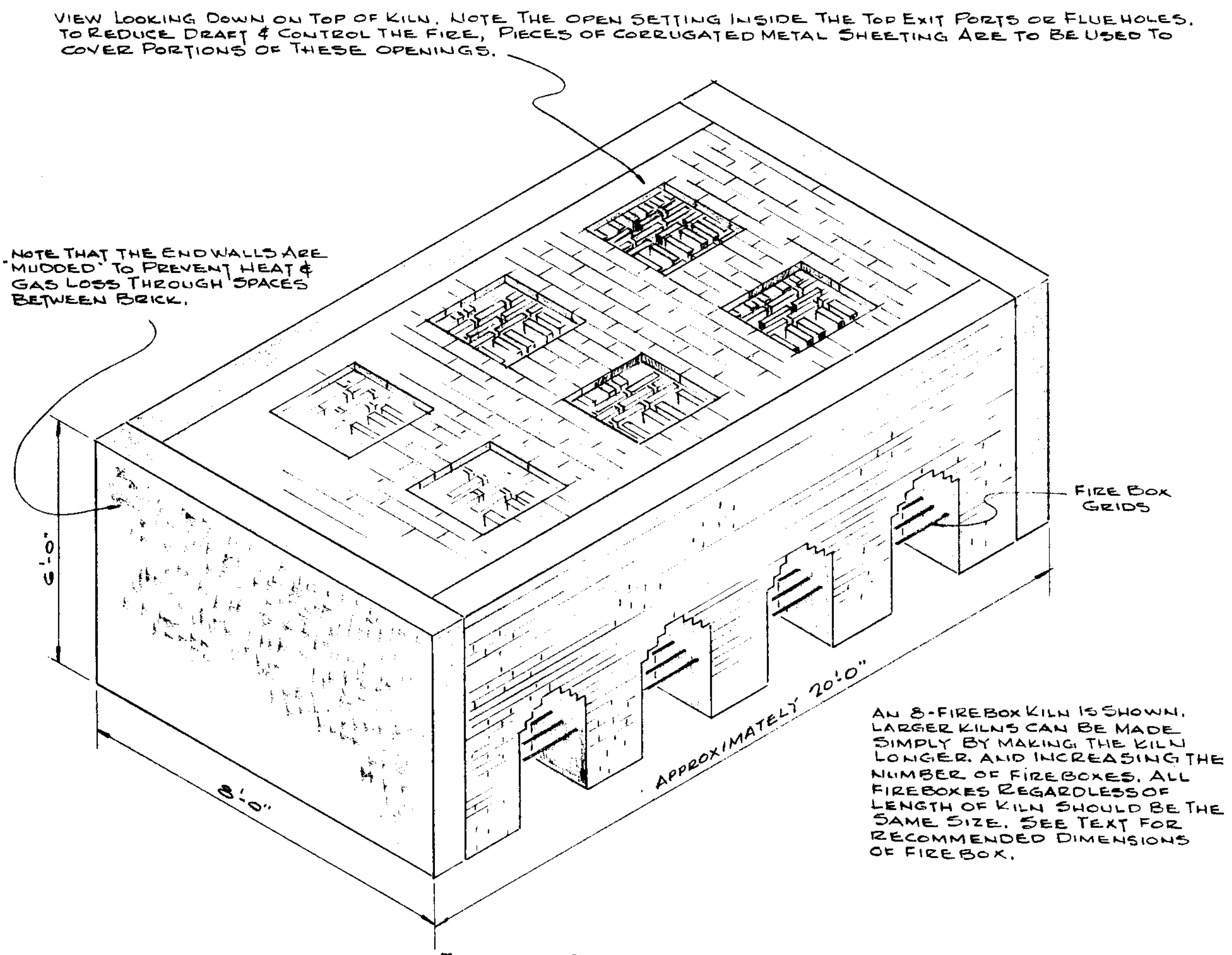


ILLUSTRATION No 6 EIGHT - FIREBOX KILN

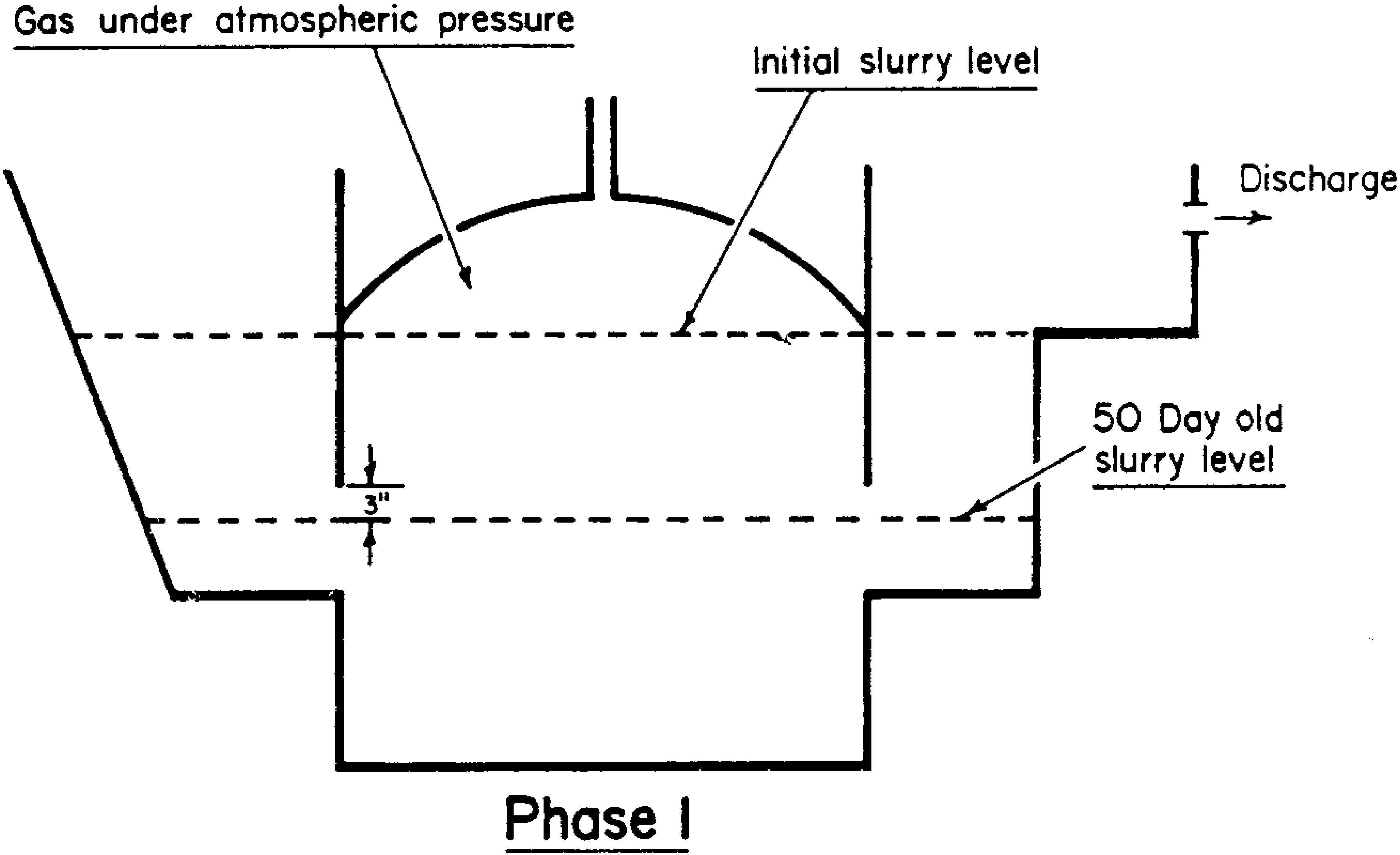


Figure III-5a. Slurry and pressure levels in Janata design

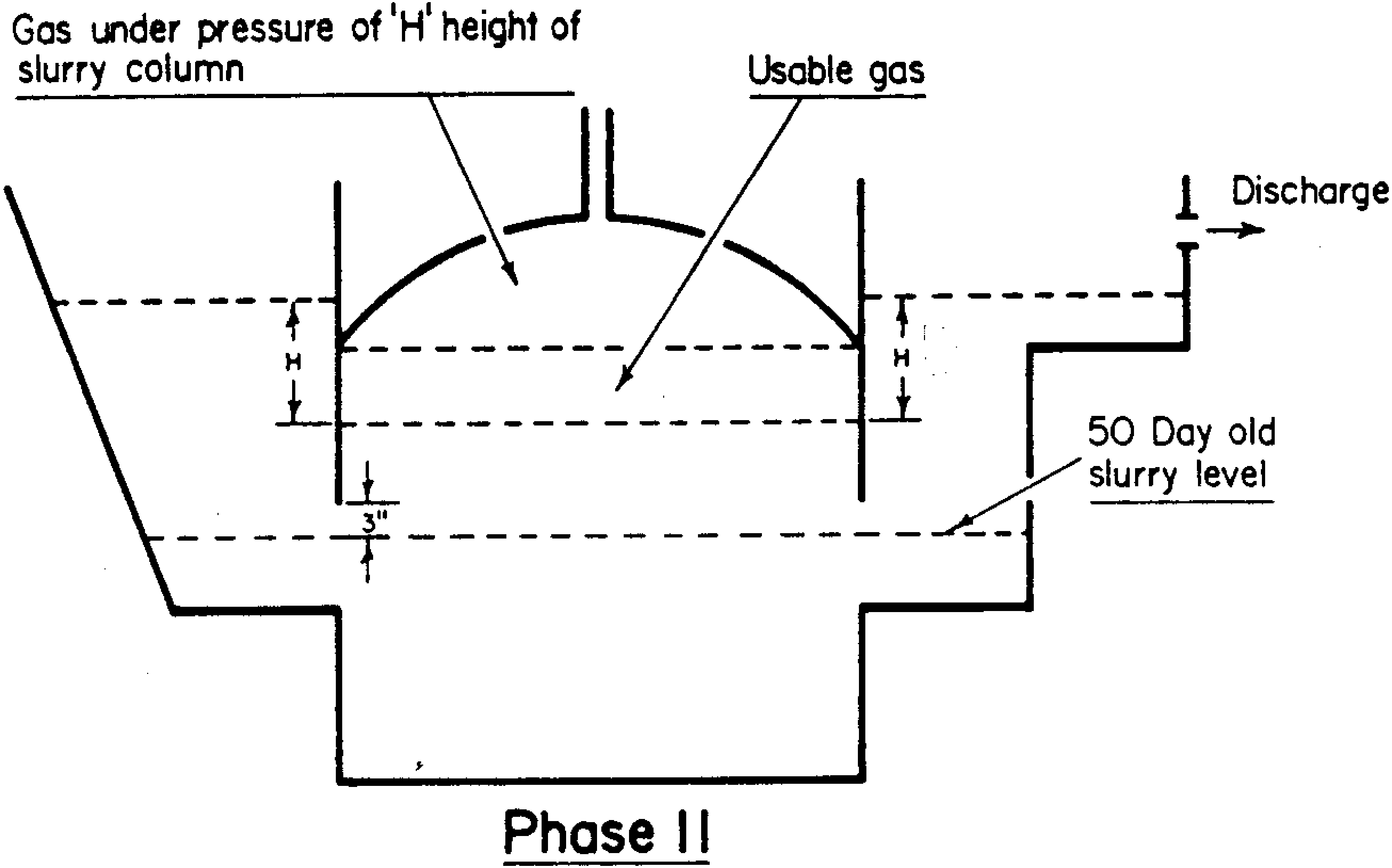


Figure III-5b. Slurry and pressure levels in Janata design

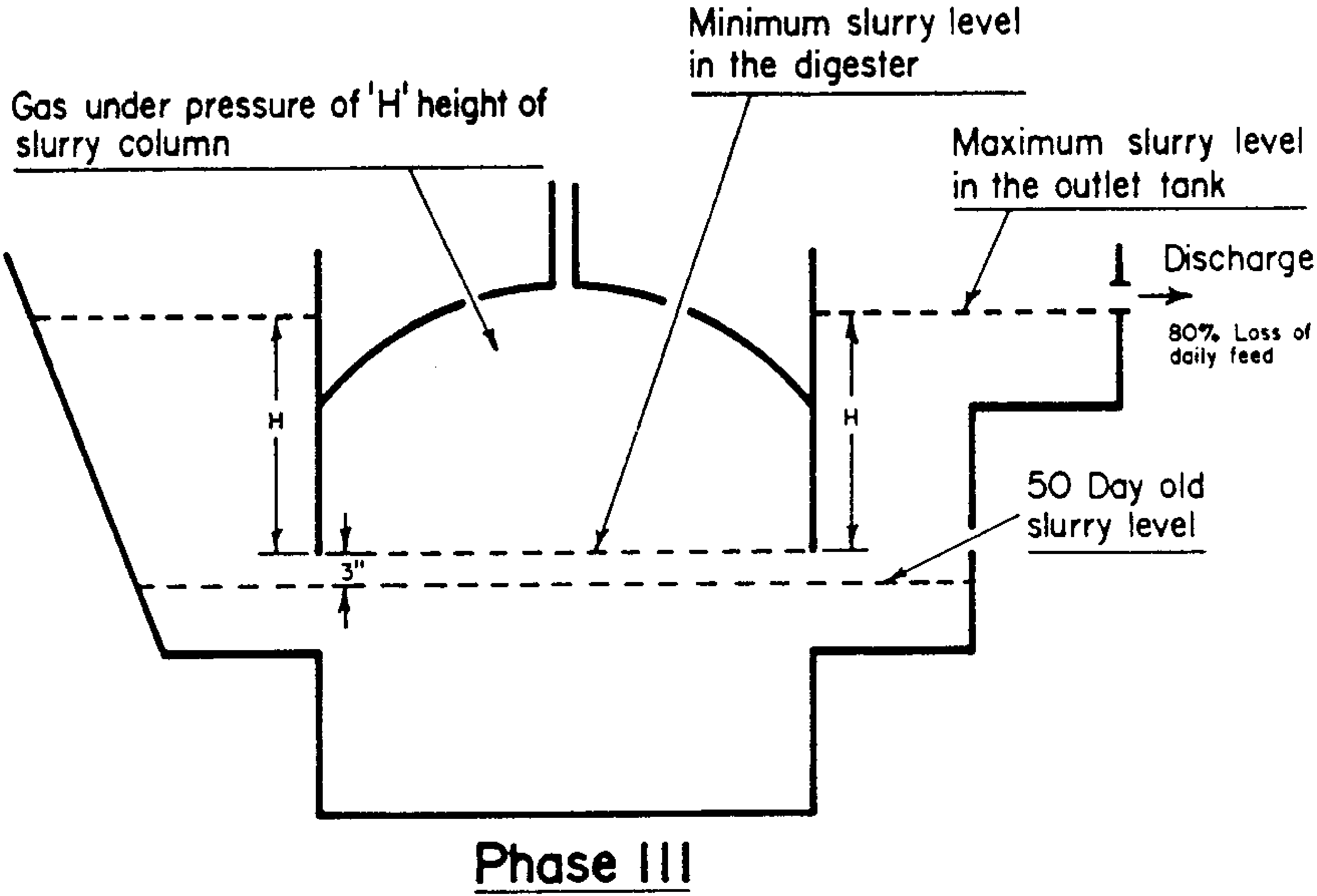


Figure III-5c. Slurry and pressure levels in Janata design

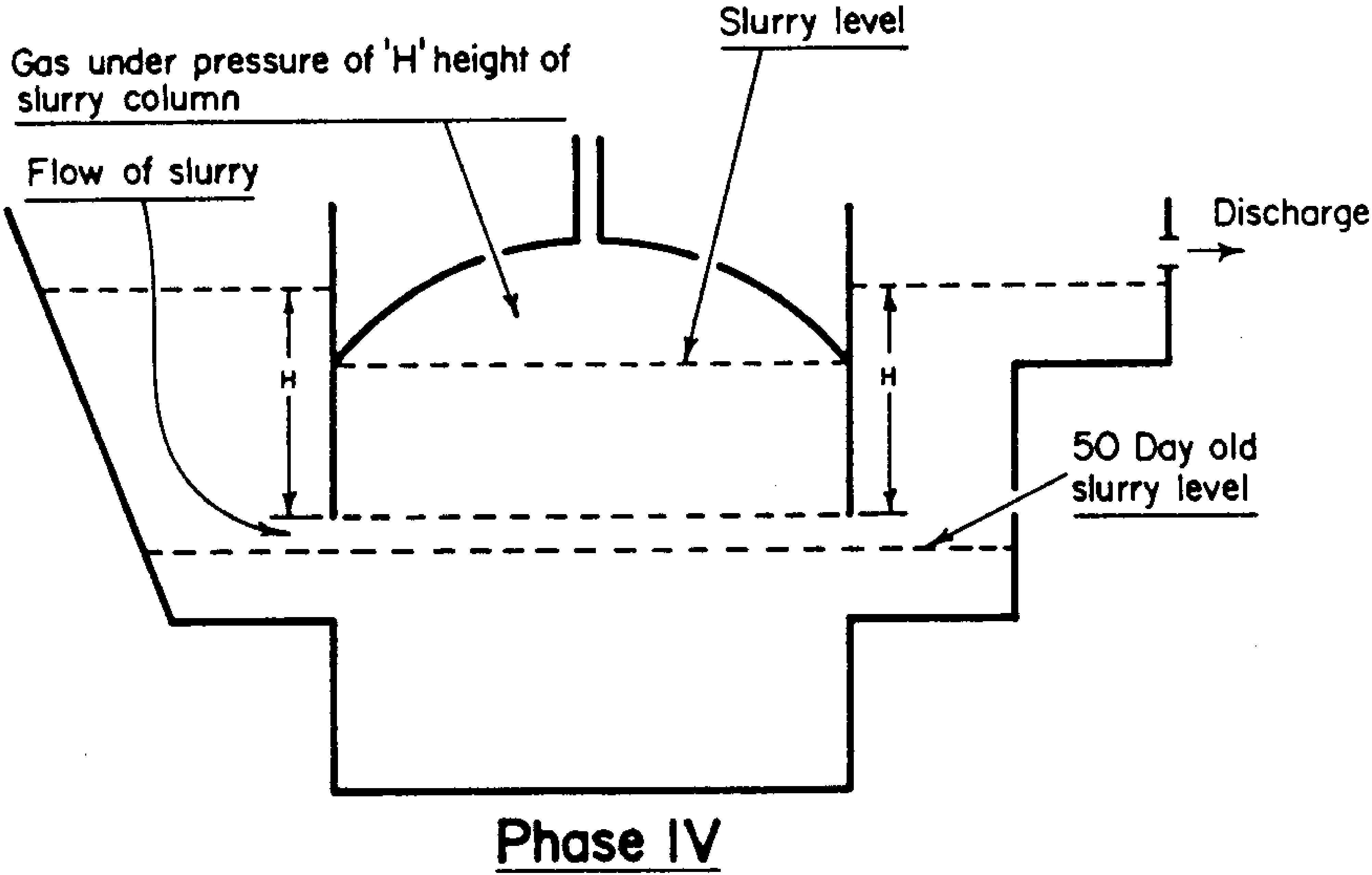


Figure III-5d. Slurry and pressure levels in Janata design

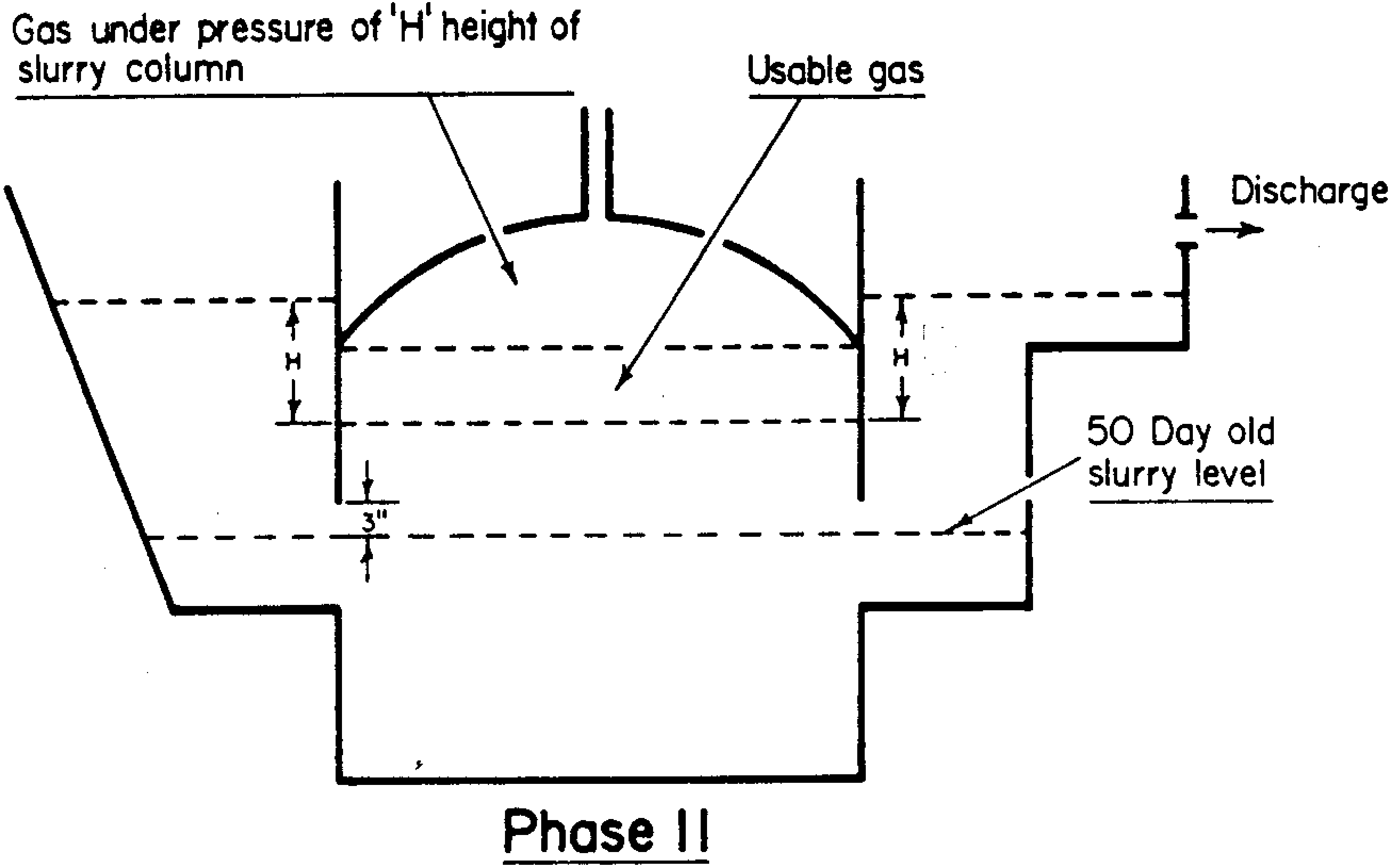


Figure III-5b. Slurry and pressure levels in Janata design

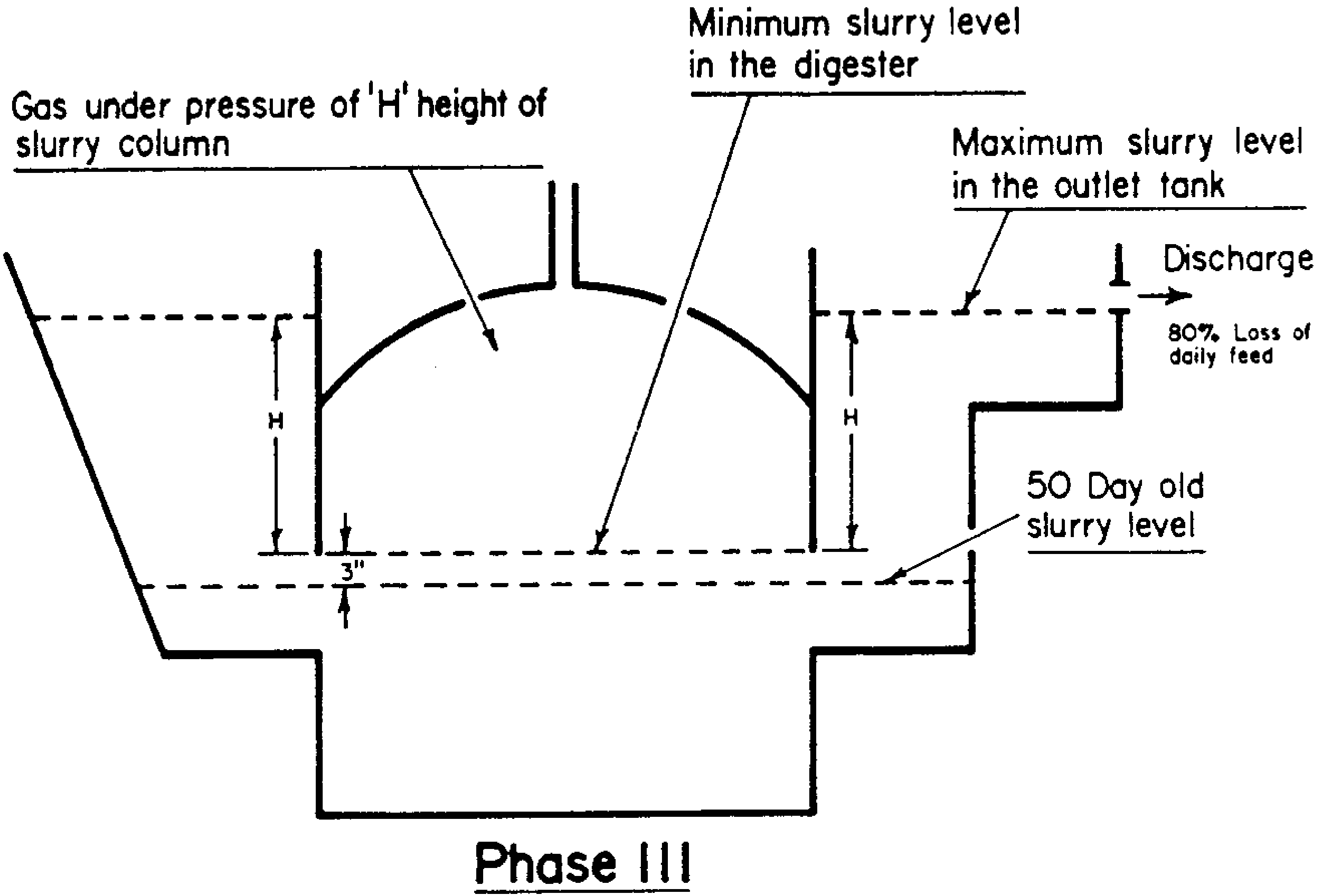


Figure III-5c. Slurry and pressure levels in Janata design

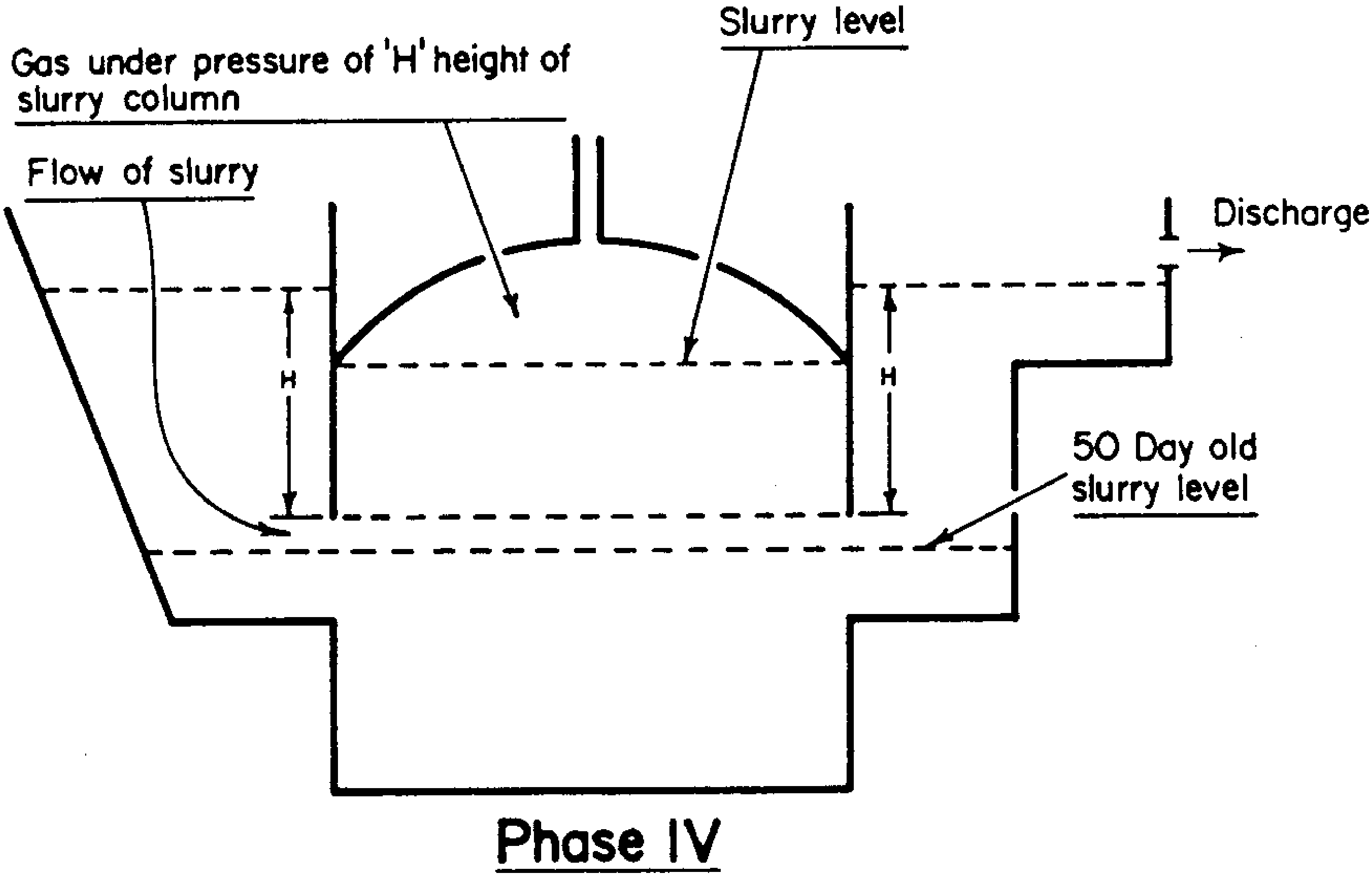
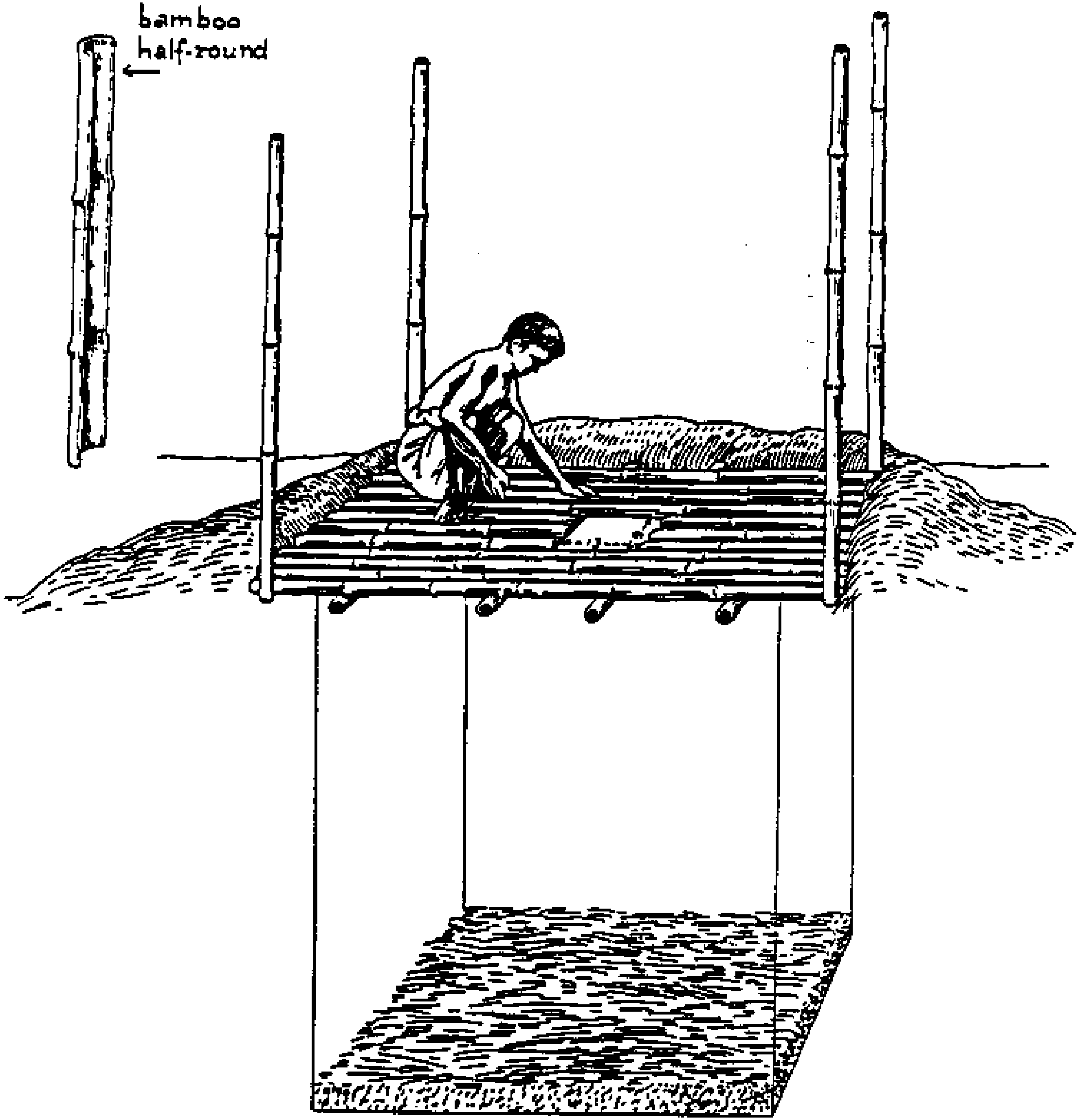
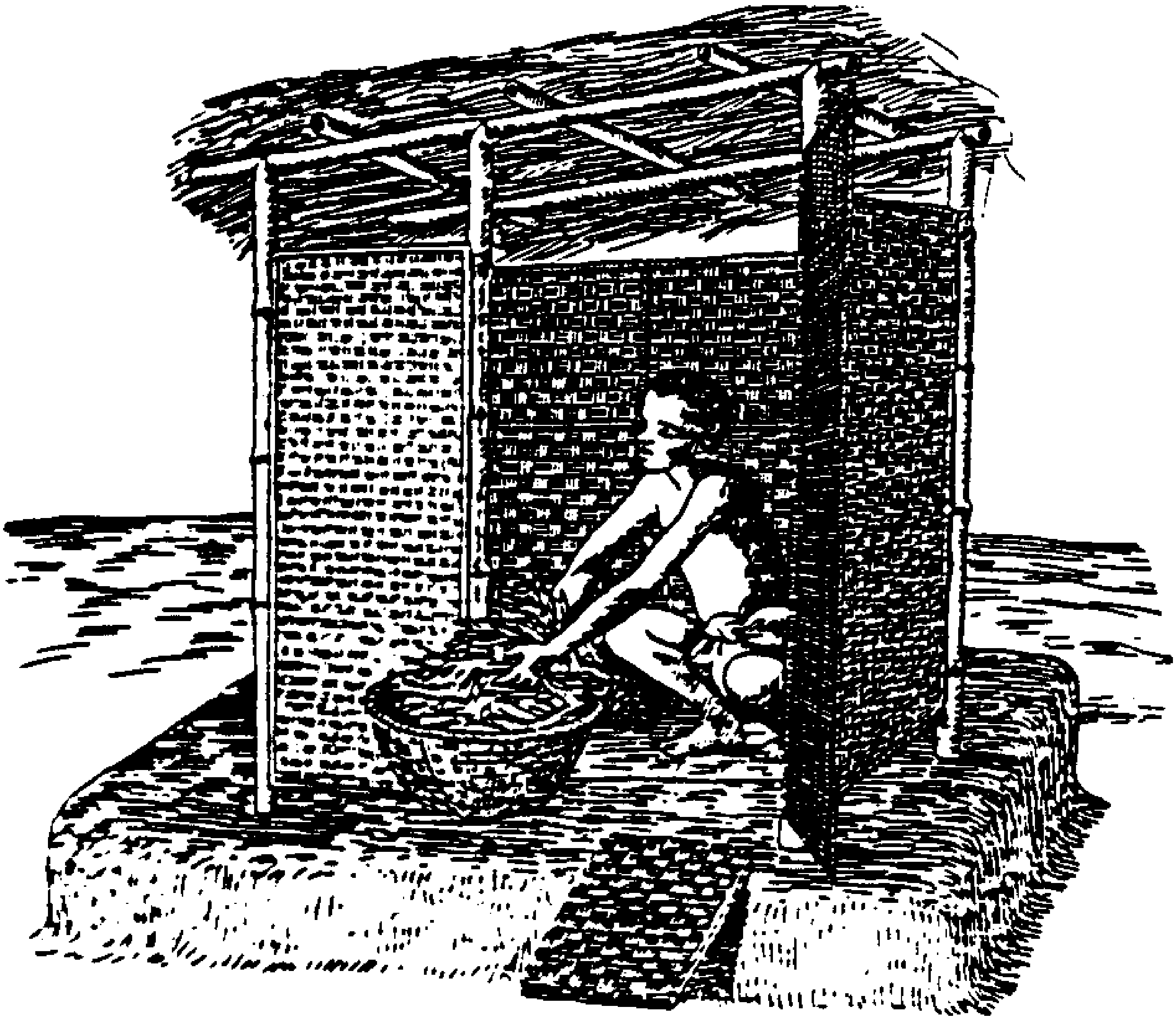


Figure III-5d. Slurry and pressure levels in Janata design



Cover the floor poles with half-rounds of bamboo, leaving a hole, approximately 6" X 13", in the middle of the floor.



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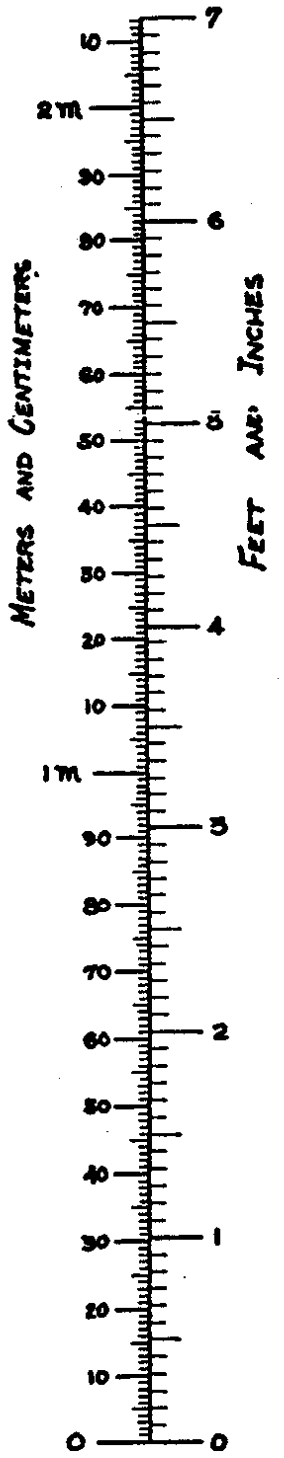
NEW BEE PURCHASES/TRADES

DATE	SOURCE	TYPE	QUANTITY	COST	TO HIVE#	LOCATION	COMMENTS

HONEY/WAX SALES

DATE	PRODUCT	CUSTOMER	QUANTITY	PRICE	COMMENTS


METERS AND CENTIMETERS
FEET AND INCHES
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90
80
70
60
50
40
30
20
10
1 m
90
80
70
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50
40
30
20
10
0
7
6
5
4
3
2
1
0

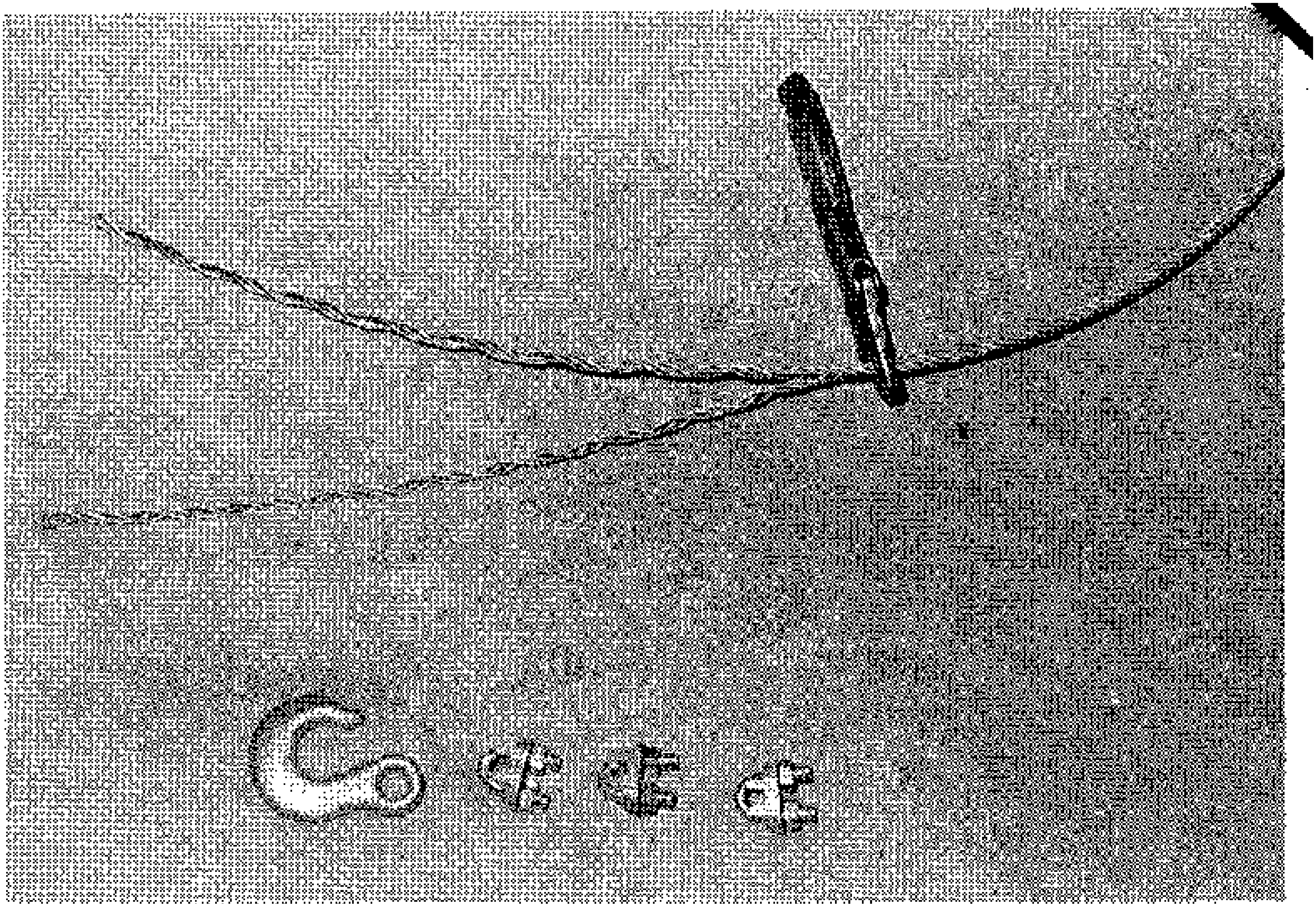


Photo 6.02 a

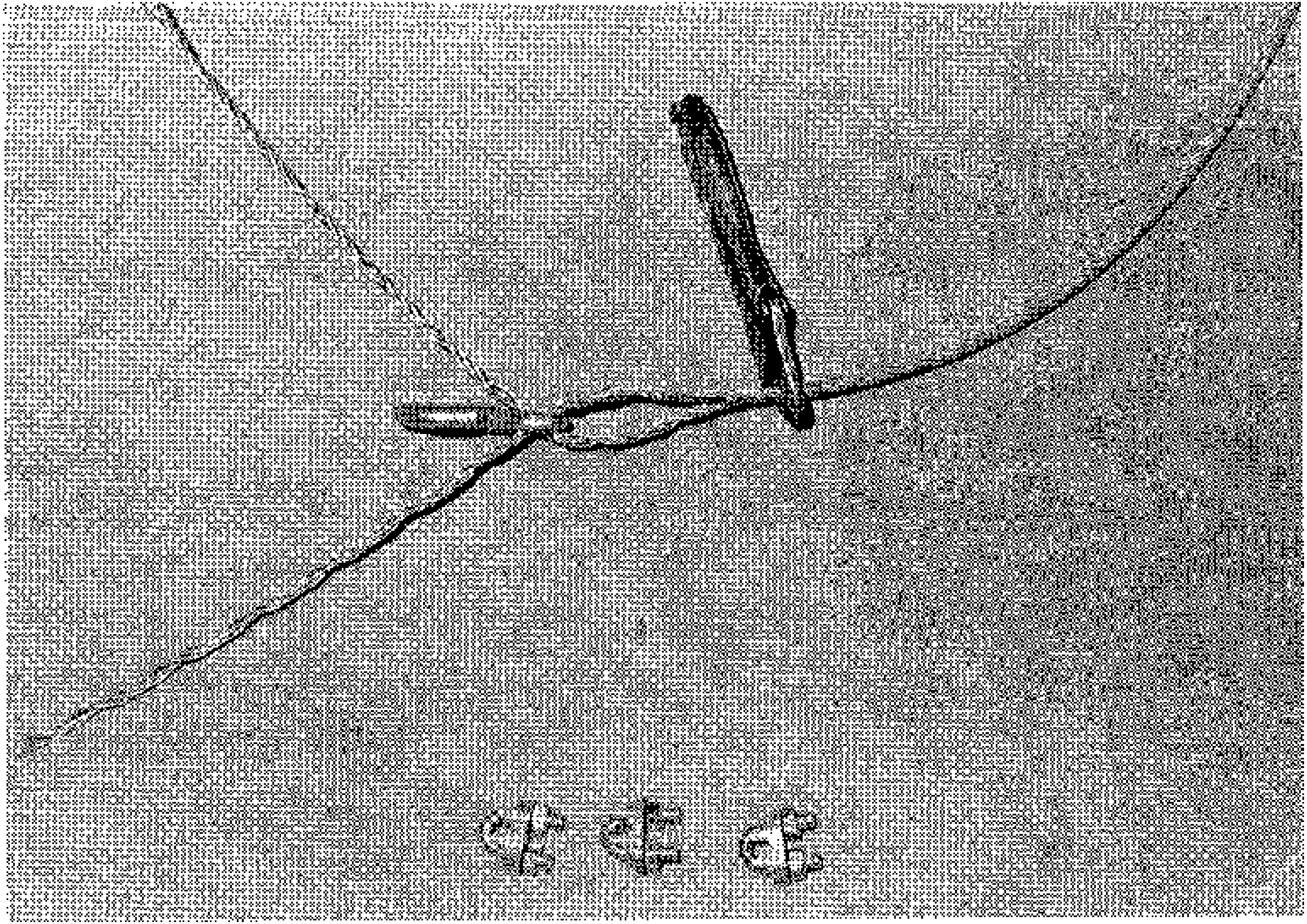


Photo 6.02b

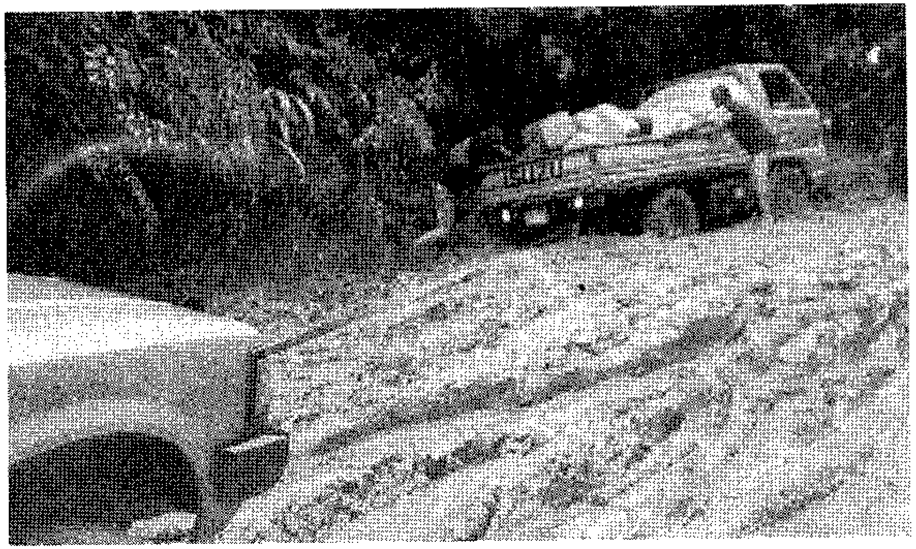


Photo 6.13c *A nylon towing strap is shown in use to pull out a stranded truck that has slipped off the road. The nylon strap offers the advantage of stretching. This allows the towing truck in this example to back up, stretching the strap to combine the force of the towing truck and the potential energy in the extended strap. The resulting force can be very effective in exerting a sudden pull to extricate a stuck vehicle.*

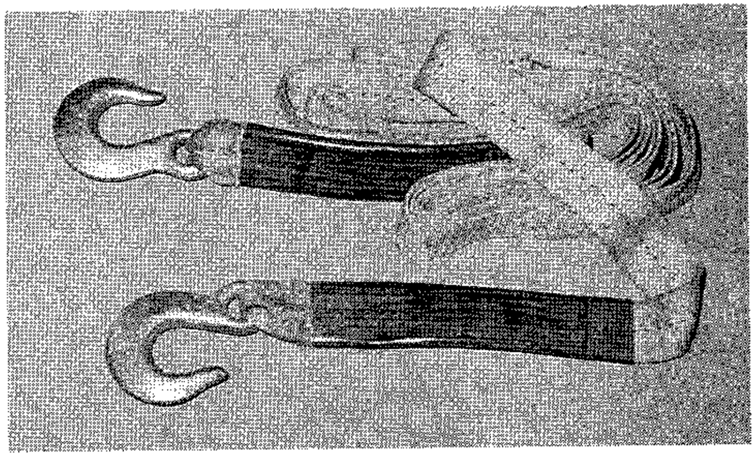


Photo 6.13d *A nylon tow strap, such as the one above, has the advantage of being able to stretch. From the perspective of physics, this offers potential energy contained in the strap, as well as the tractive effort of the towing vehicle. The combination is substantially more effective in freeing a mired vehicle than can be obtained with a chain or wire cable. To take advantage of this, however, it is necessary to "jerk" the mired vehicle loose; the nylon strap will not be nearly as effective with a slow, steady pull.*

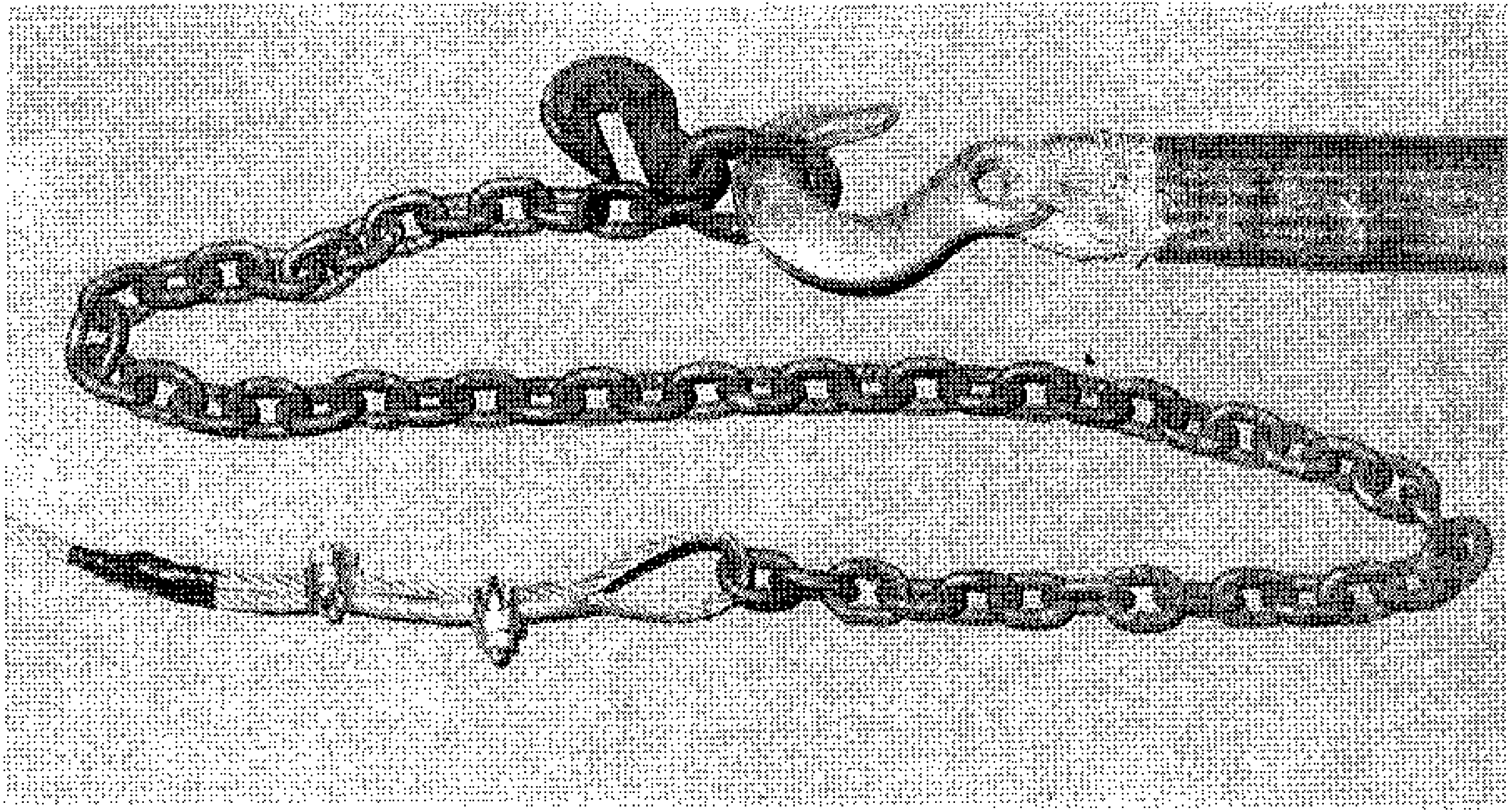
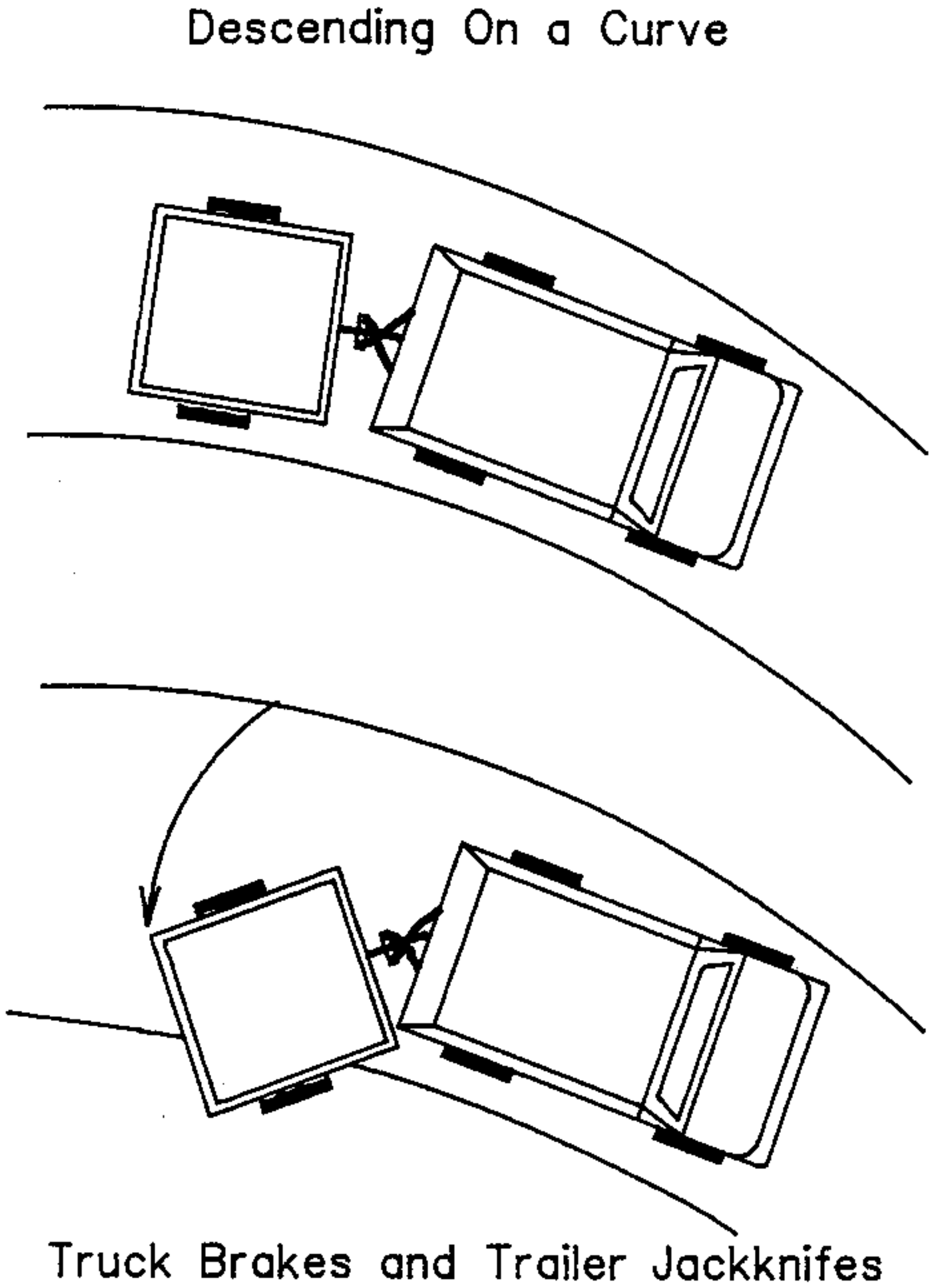
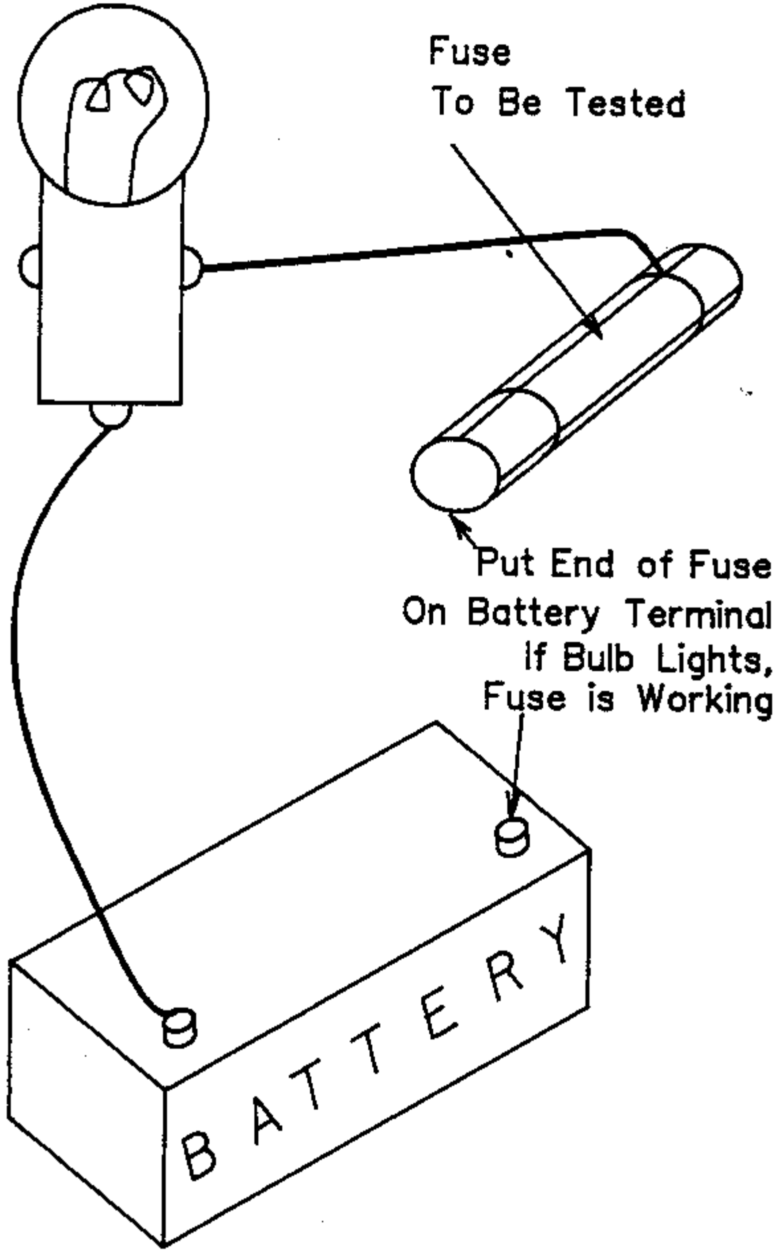


Photo 6.21c *A length of chain and a grab hook have been added to this winch cable. The chain can be wrapped around an axle or tow hook without bending or damaging the wire cable. The grab hook enables the operator to form a fixed loop of any size that will not close up and jam on the towed vehicle. The last link of the chain is a large ring, allowing a tow cable or strap to be connected to extend the reach of the winch cable.*



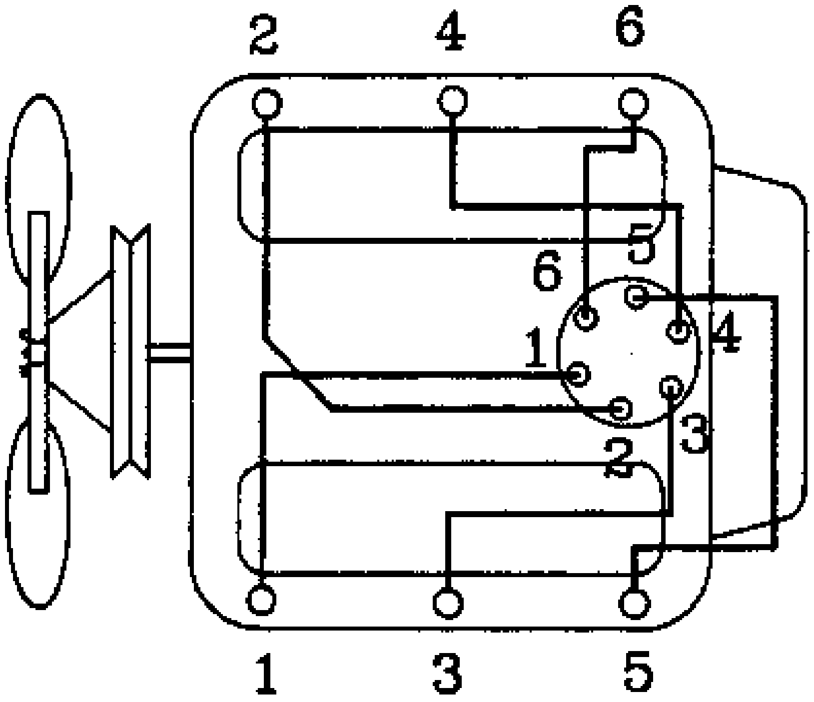
Jackknifing Trailer
Figure 6.82b



Testing a Fuse
Figure 9.70b

Firing Order

1-6-5-4-3-2



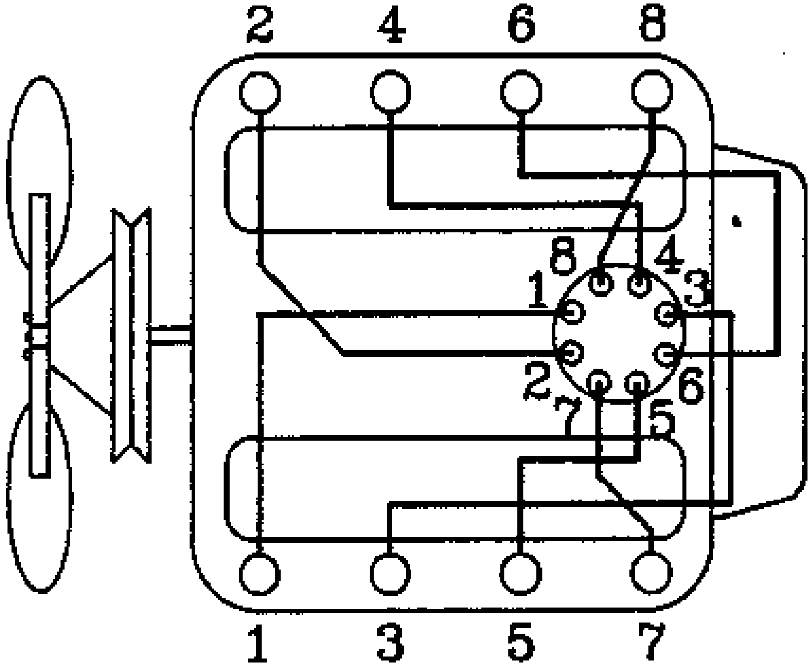
V - 6 Cylinder

Gasoline Engine

Spark Plug Wires
Figure 10.55c

Firing Order

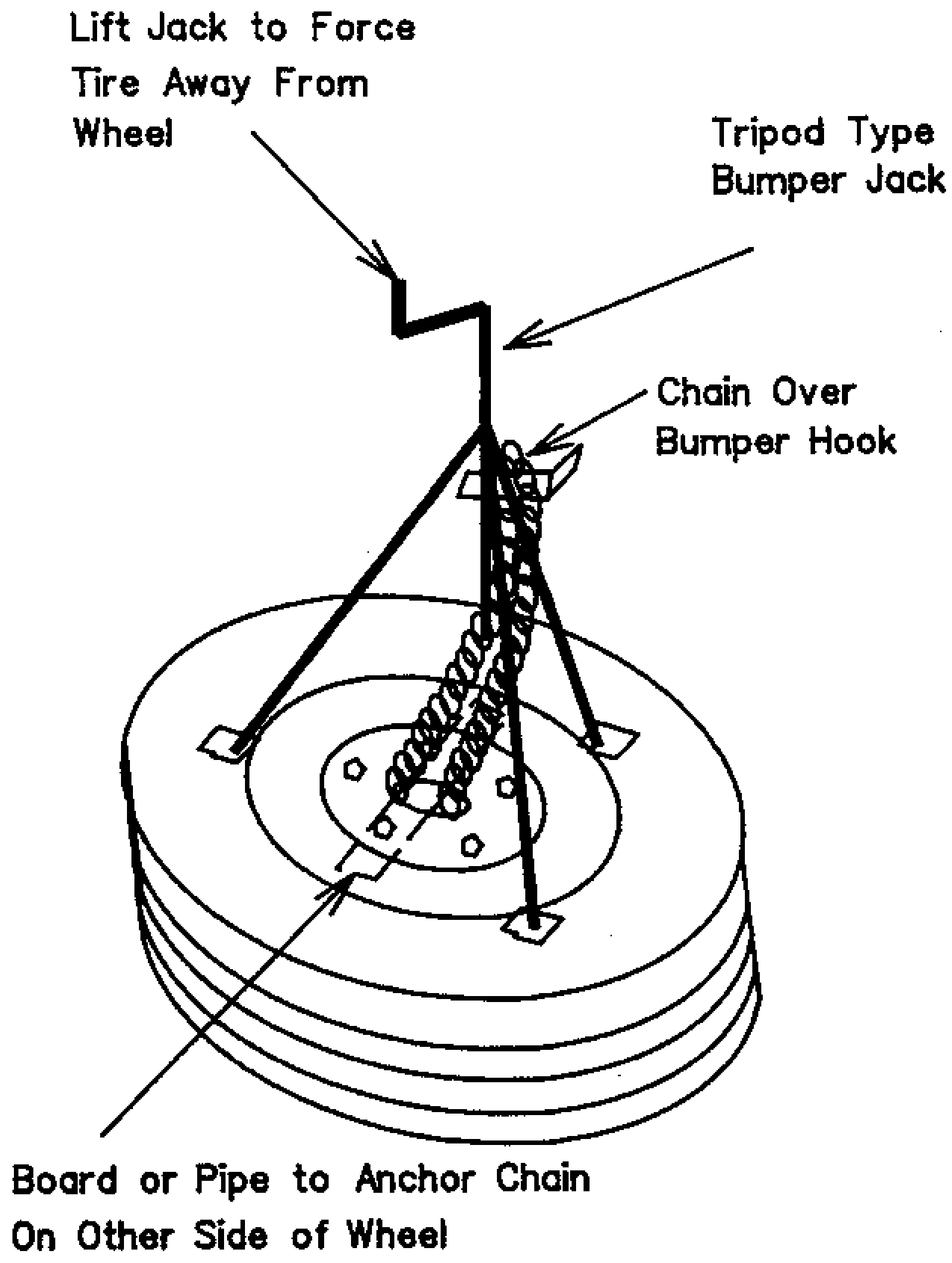
1-8-4-3-6-5-7-2



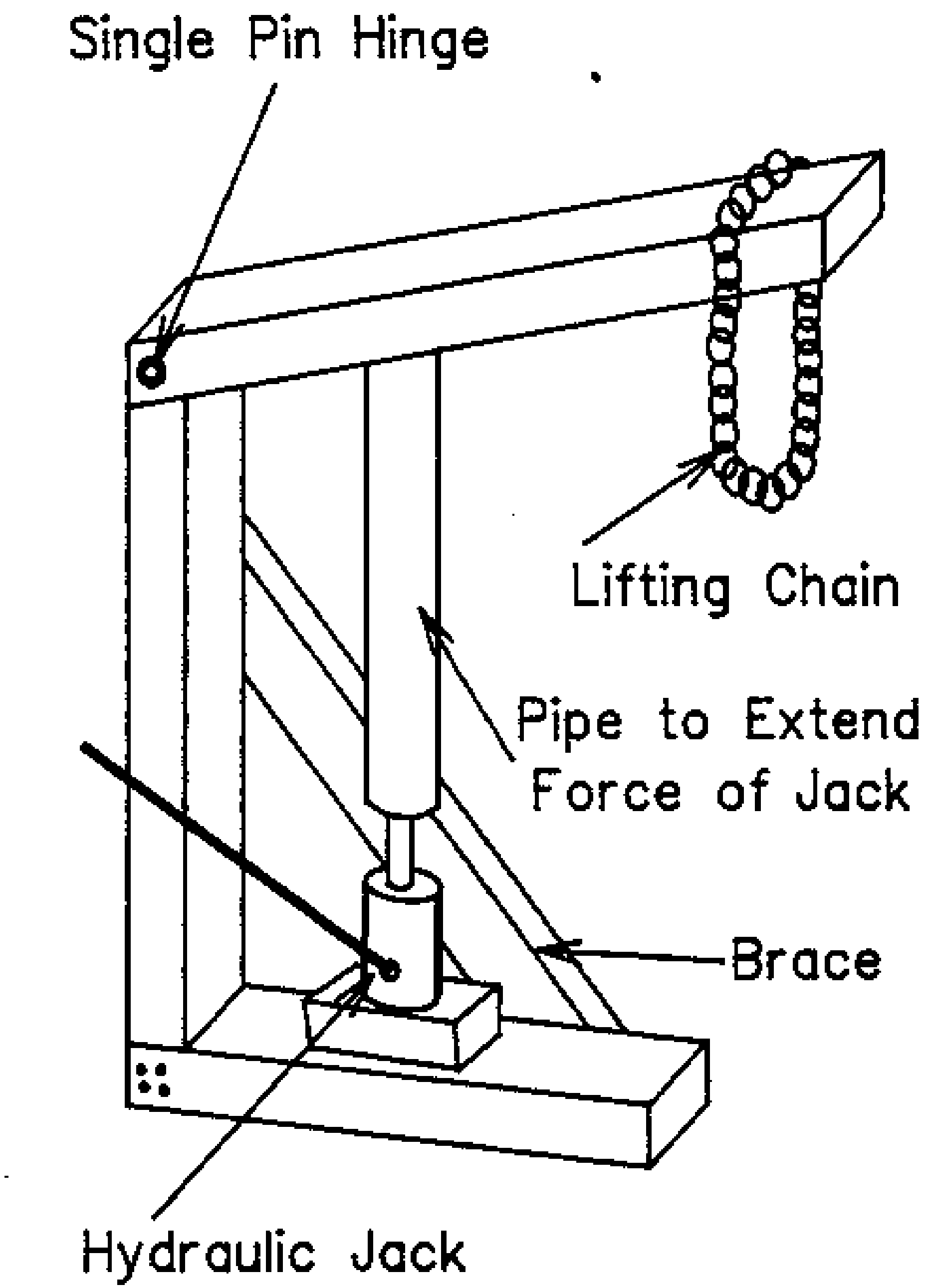
V - 8 Cylinder

Gasoline Engine

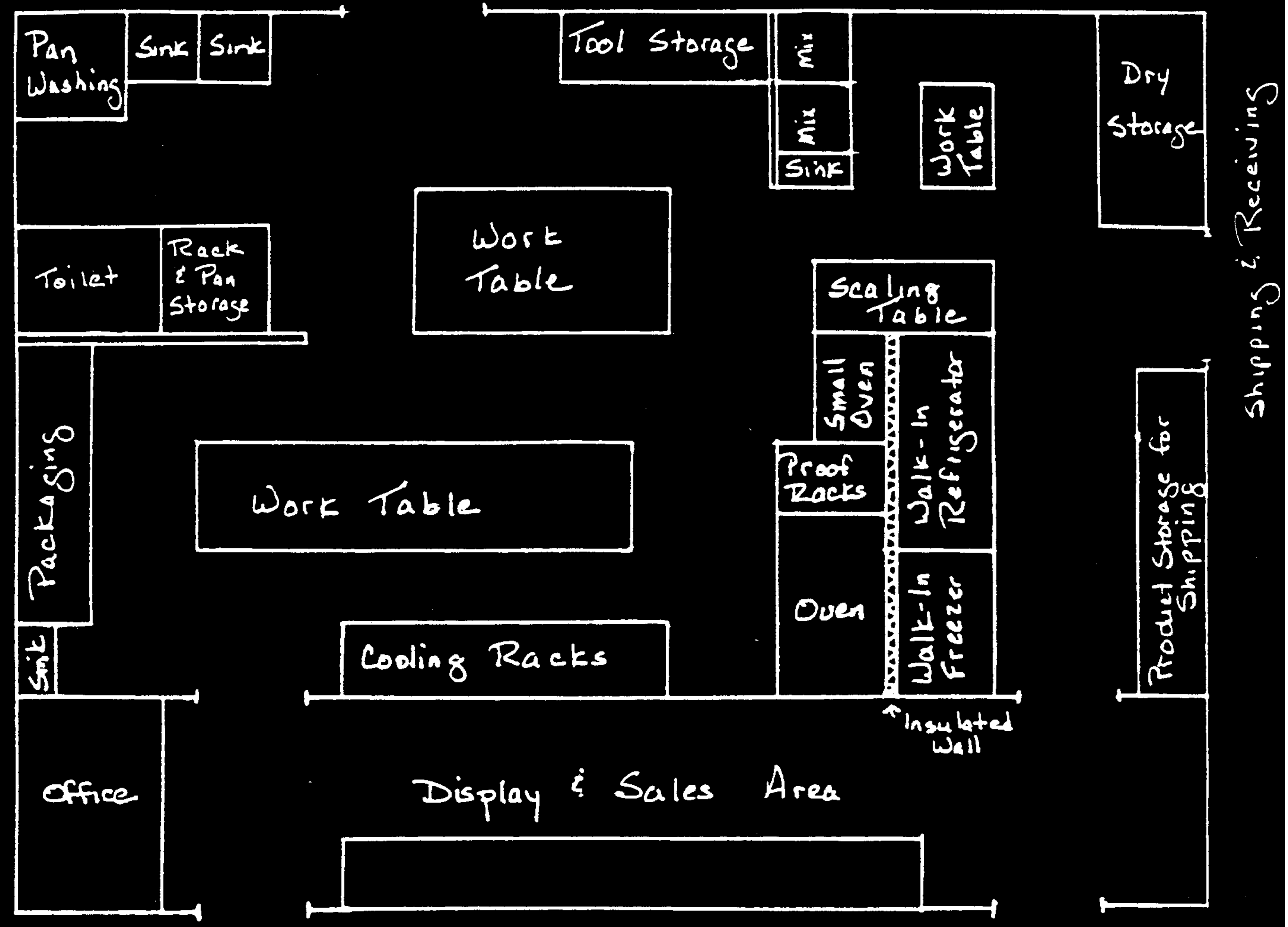
Spark Plug Wires
Figure 10.55d



Homemade Tire Remover
Figure 14.50b



Homemade Hoist
Figure 14.50c



Pan Washing
Sink
Sink
Tool Storage
Mix
Mix
Sink
Work Table
Dry Storage
Shipping & Receiving
Toilet
Rack & Pan Storage
Work Table
Scaling Table
Small Oven
Walk-In Refrigerator
Proof Racks
Oven
Walk-In Freezer
Packaging
Work Table
Product Storage for Shipping
Sink
Cooling Racks
Insulated Wall
Office
Display & Sales Area

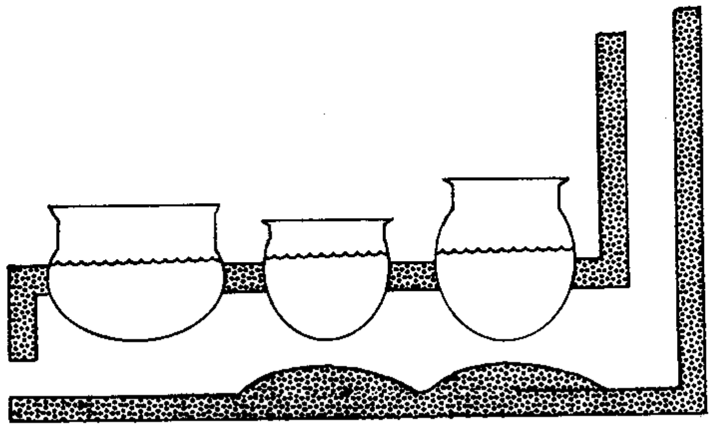


Figure 1d: Three pot mass wood stove with chimney.

Final Energy Balance:

Gains:

6 %	absorbed by water and food
	Losses:
4 %	lost by evaporation from pots
2.1%	lost from pot surfaces
13.9%	absorbed by stove body
30.2%	lost as thermal energy in flue gases
1.1%	lost as carbon monoxide
1.9%	lost to evaporate moisture in fuel
5.9%	lost as latent heat of vaporization of water produced by combustion
11. %	lost as charcoal residue

Reference (3)

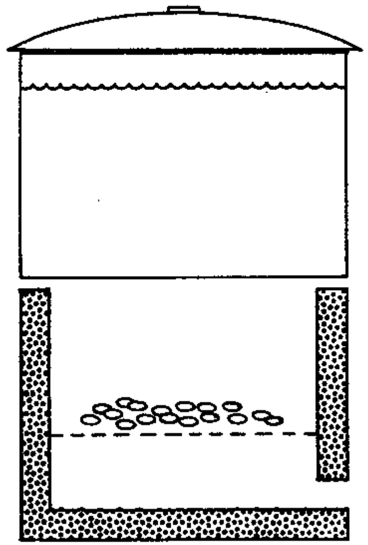


Figure 1e: Thai charcoal stove.

Final Energy Balance:

Gains:

3.1%	absorbed by water and food
	Losses:
4.6%	lost by evaporation from pot
0.2%	lost by convection and radiation from pot lid
13.0%	absorbed by stove body
1.3%	lost by convection and radiation from stove body
2.1%	lost as thermal energy in flue gases
0.7%	lost as carbon monoxide due to incomplete combustion
75. %	lost in the conversion of wood to charcoal

Reference (4)

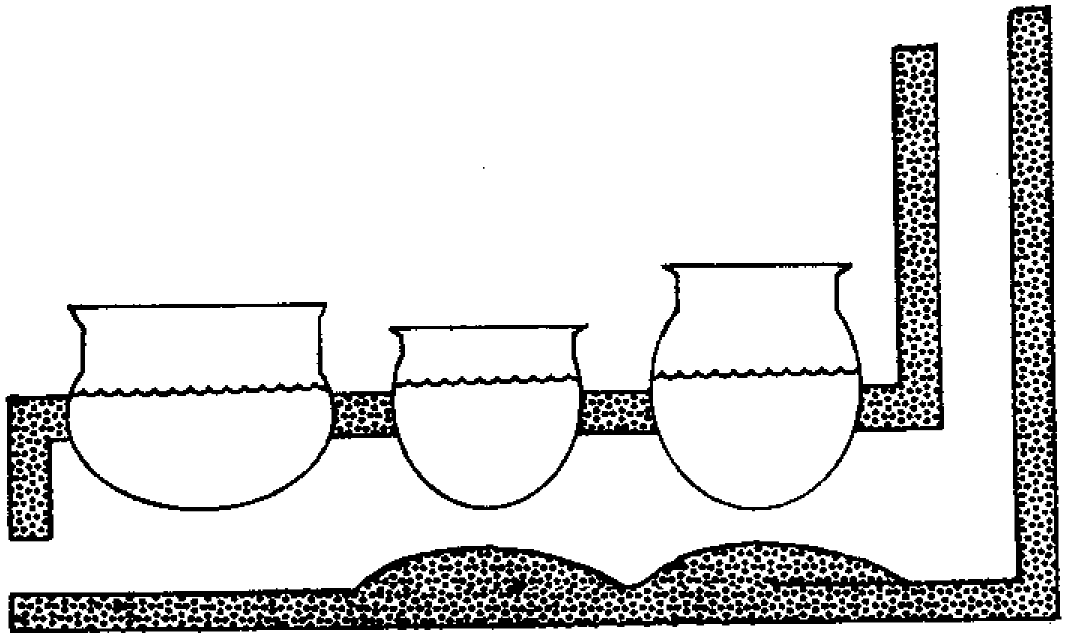


Figure 1d: Three pot mass wood stove with chimney.

Final Energy Balance:

	Gains:
6 %	absorbed by water and food
	Losses:
4 %	lost by evaporation from pots
2.1%	lost from pot surfaces
13.9%	absorbed by stove body
30.2%	lost as thermal energy in flue gases
1.1%	lost as carbon monoxide
1.9%	lost to evaporate moisture in fuel
5.9%	lost as latent heat of vaporization of water produced by combustion
11. %	lost as charcoal residue

Reference (3)

FIGURE 1A: Double metal wall over the entire surface of the stove with air or insulant in the enclosed area.

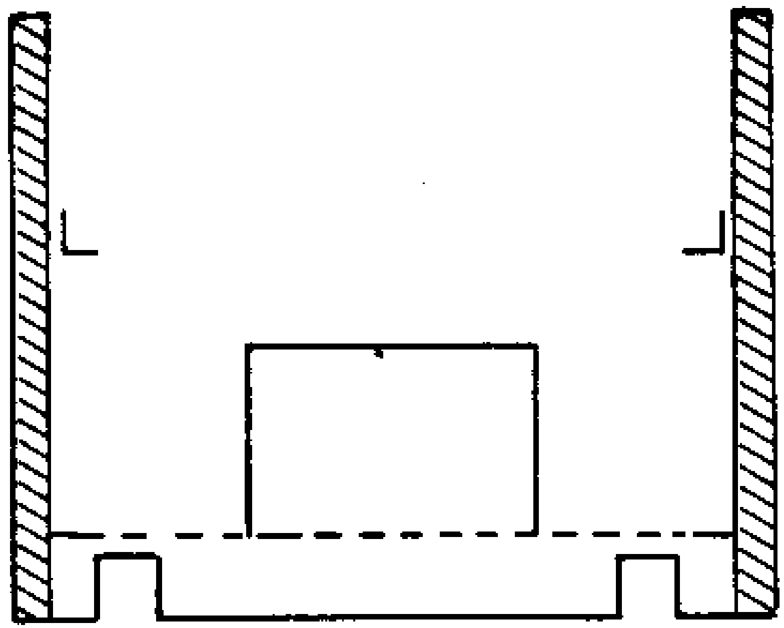


FIGURE 1B: Double metal wall in the combustion chamber alone with air or insulant in the enclosed area.

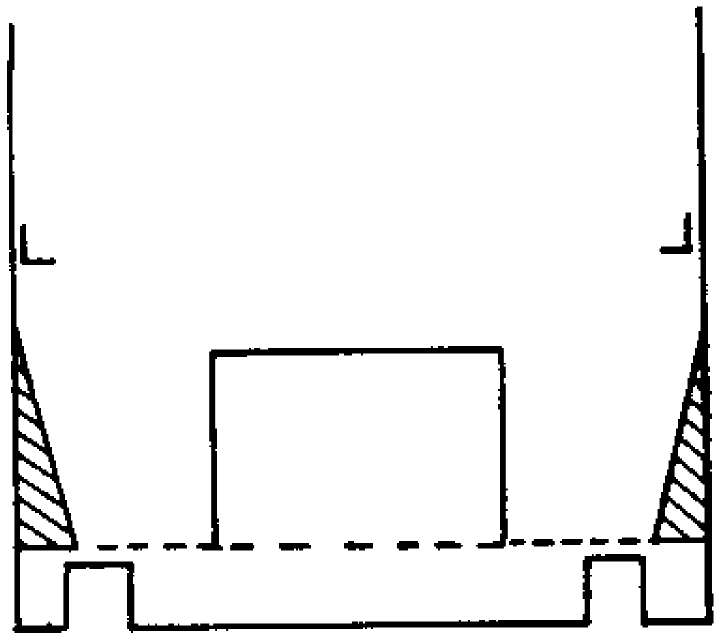


FIGURE 1, continued

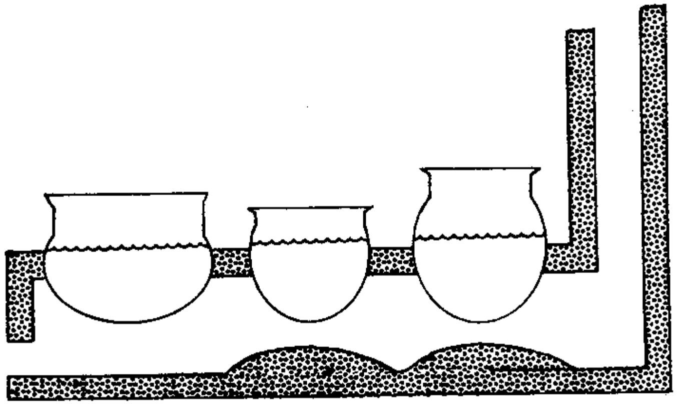


Figure 1d: Three pot mass wood stove with chimney.

Final Energy Balance:

	Gains:
6 %	absorbed by water and food
	Losses:
4 %	lost by evaporation from pots
2.1%	lost from pot surfaces
13.9%	absorbed by stove body
30.2%	lost as thermal energy in flue gases
1.1%	lost as carbon monoxide
1.9%	lost to evaporate moisture in fuel
5.9%	lost as latent heat of vaporization of water produced by combustion
11. %	lost as charcoal residue

Reference (3)

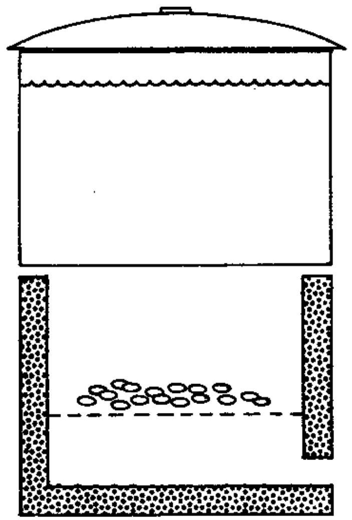


Figure 1e: Thai charcoal stove.

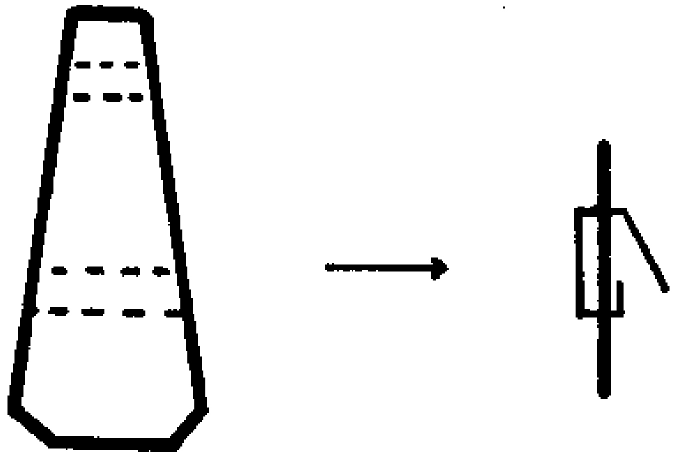
Final Energy Balance:

	Gains:
3.1%	absorbed by water and food
	Losses:
4.6%	lost by evaporation from pot
0.2%	lost by convection and radiation from pot lid
13.0%	absorbed by stove body
1.3%	lost by convection and radiation from stove body
2.1%	lost as thermal energy in flue gases
0.7%	lost as carbon monoxide due to incomplete combustion
75. %	lost in the conversion of wood to charcoal

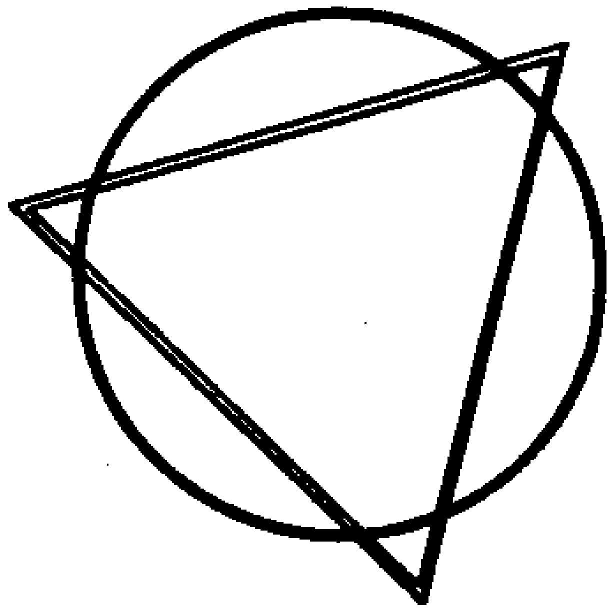
Reference (4)

FIGURE 3 continued

Pot supports can be folded through slots in the wall or welded into place. Care must be taken, however, to avoid deformation of the stove wall.



Alternatively, pot supports can be formed from a triangle of metal rod. This reduces the forces warping the stove wall, but tend to shield more of the pot surface, support the pot less stably, and allow the use of pots that are too small for the stove.



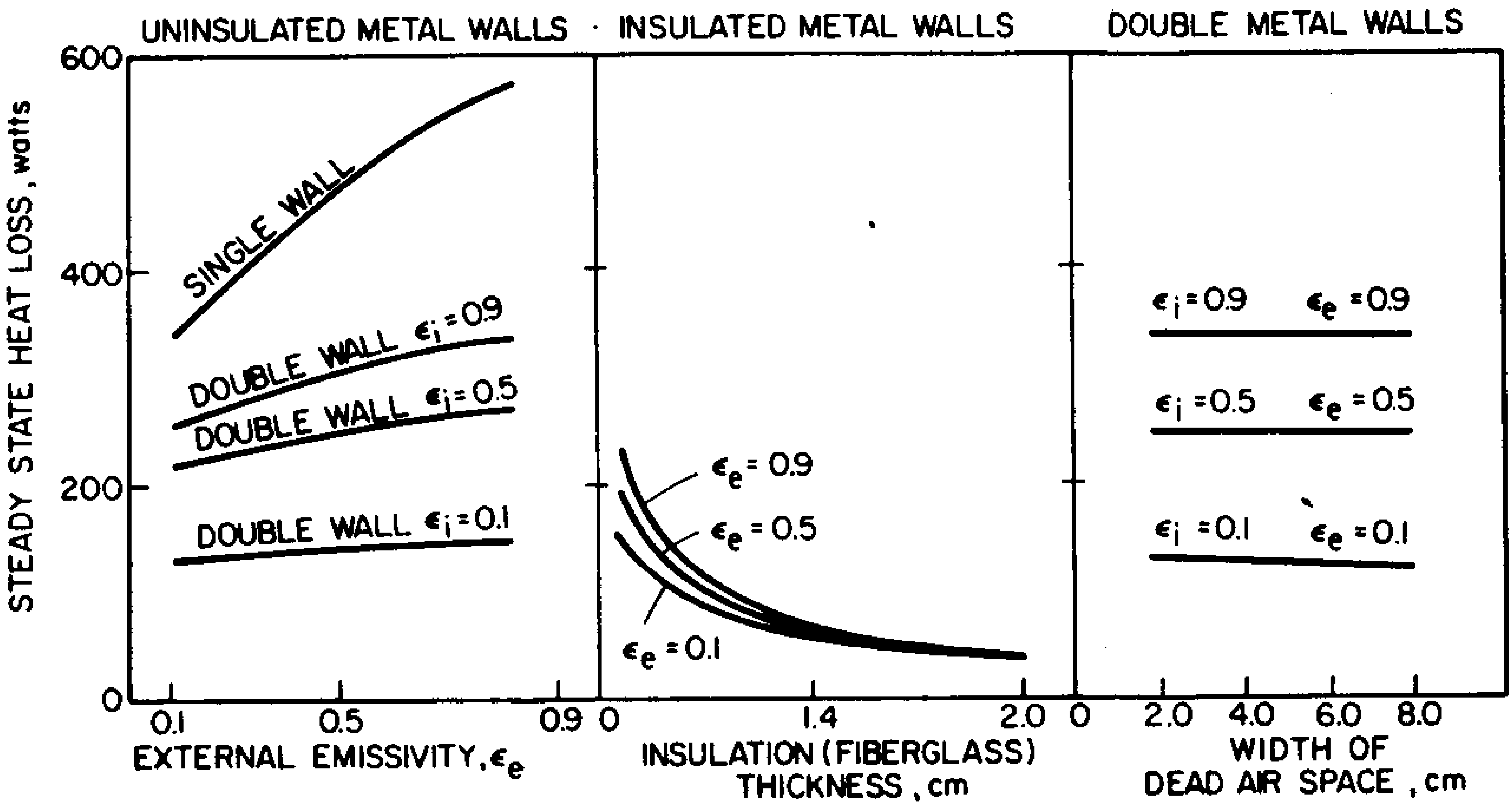


FIGURE 5: Steady state heat loss from combustion chamber walls as a function of various parameters. The emissivity, ϵ, is defined in Appendix C.

FIGURE 11A: Total stove efficiency versus heat flux to the pot as a function of channel gap and length for family sized stoves.

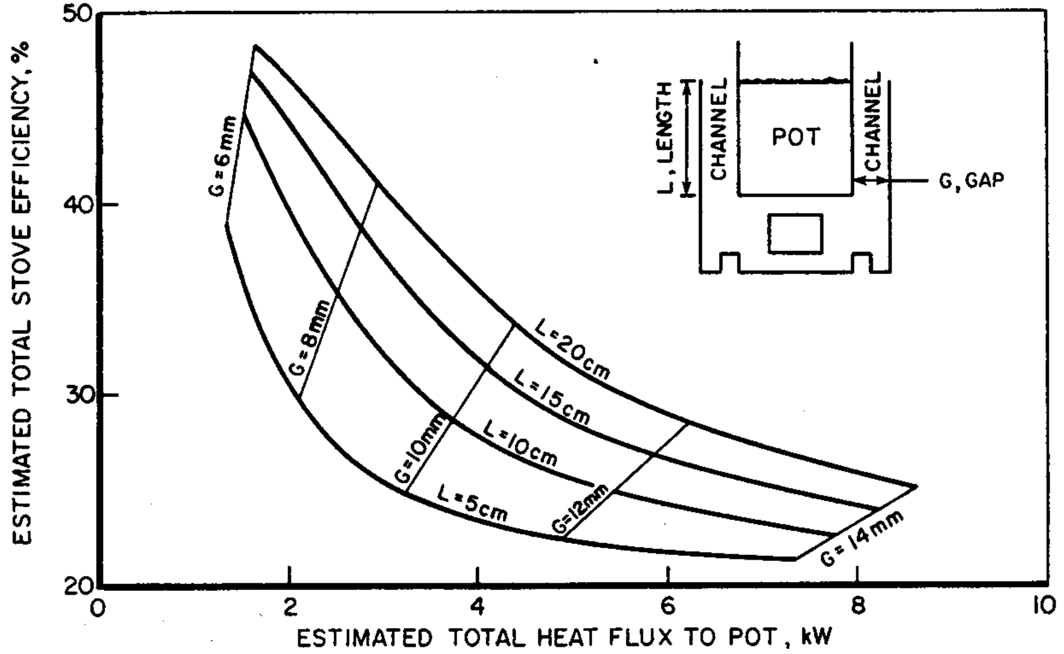
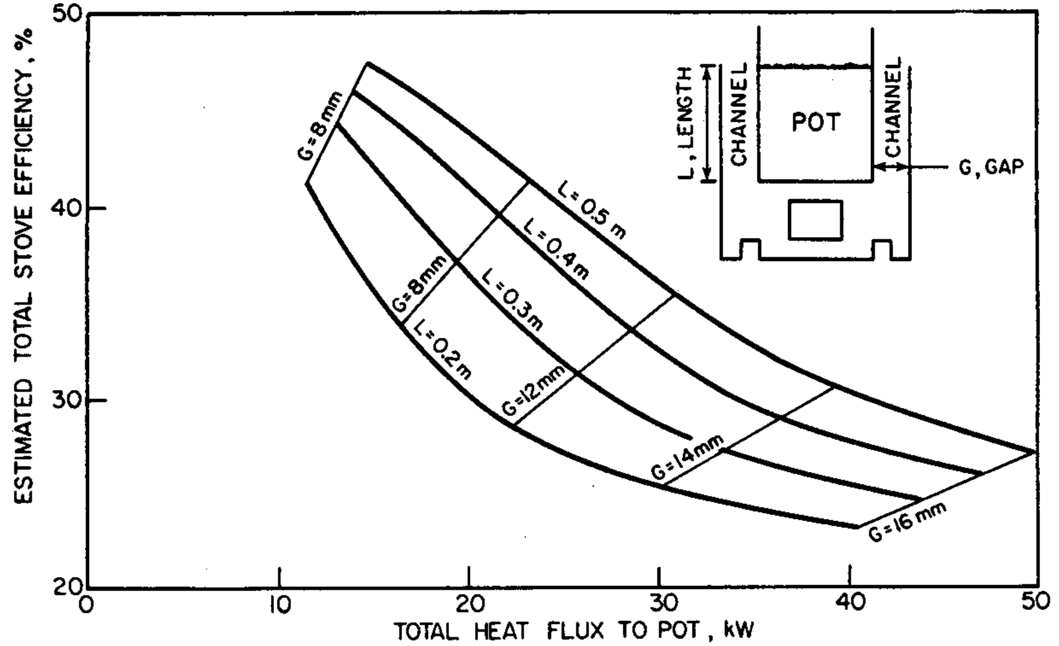


FIGURE 11B: Total stove efficiency versus total flux to the pot as a function of channel gap and length for industrial scale stoves.



$$t = \frac{17.2 - 16.2}{1.72\left[\frac{1}{10} + \frac{1}{10}\right]^{\frac{1}{2}}} = 1.30$$

$$f = 10 + 10 - 2 = 18$$

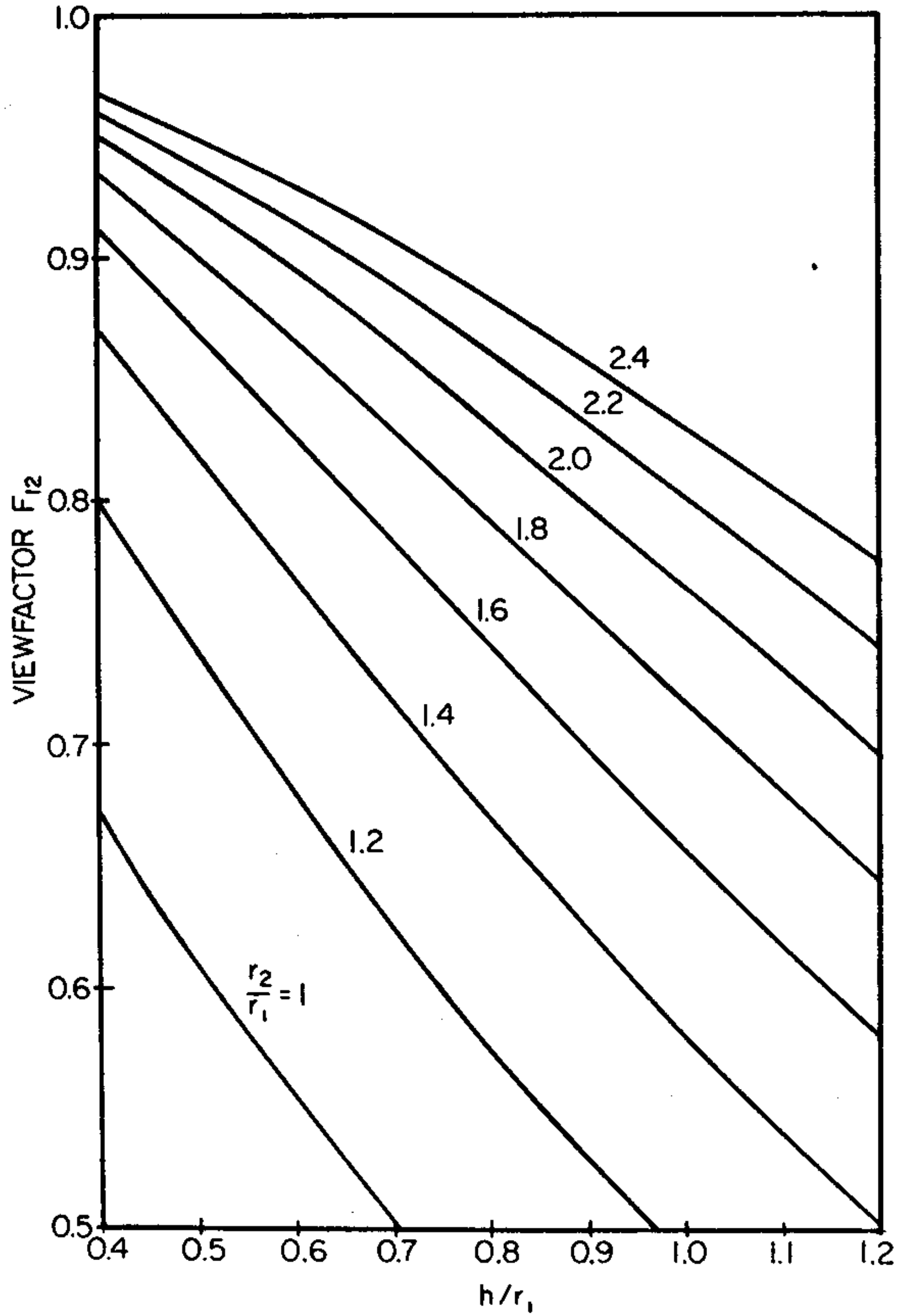

1.0
0.9
0.8
0.7
0.6
0.5
VIEWFACTOR F_{12}
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
h/r_1
2.4
2.2
2.0
1.8
1.6
1.4
1.2
$\frac{r_2}{r_1} = 1$

FIGURE 14B

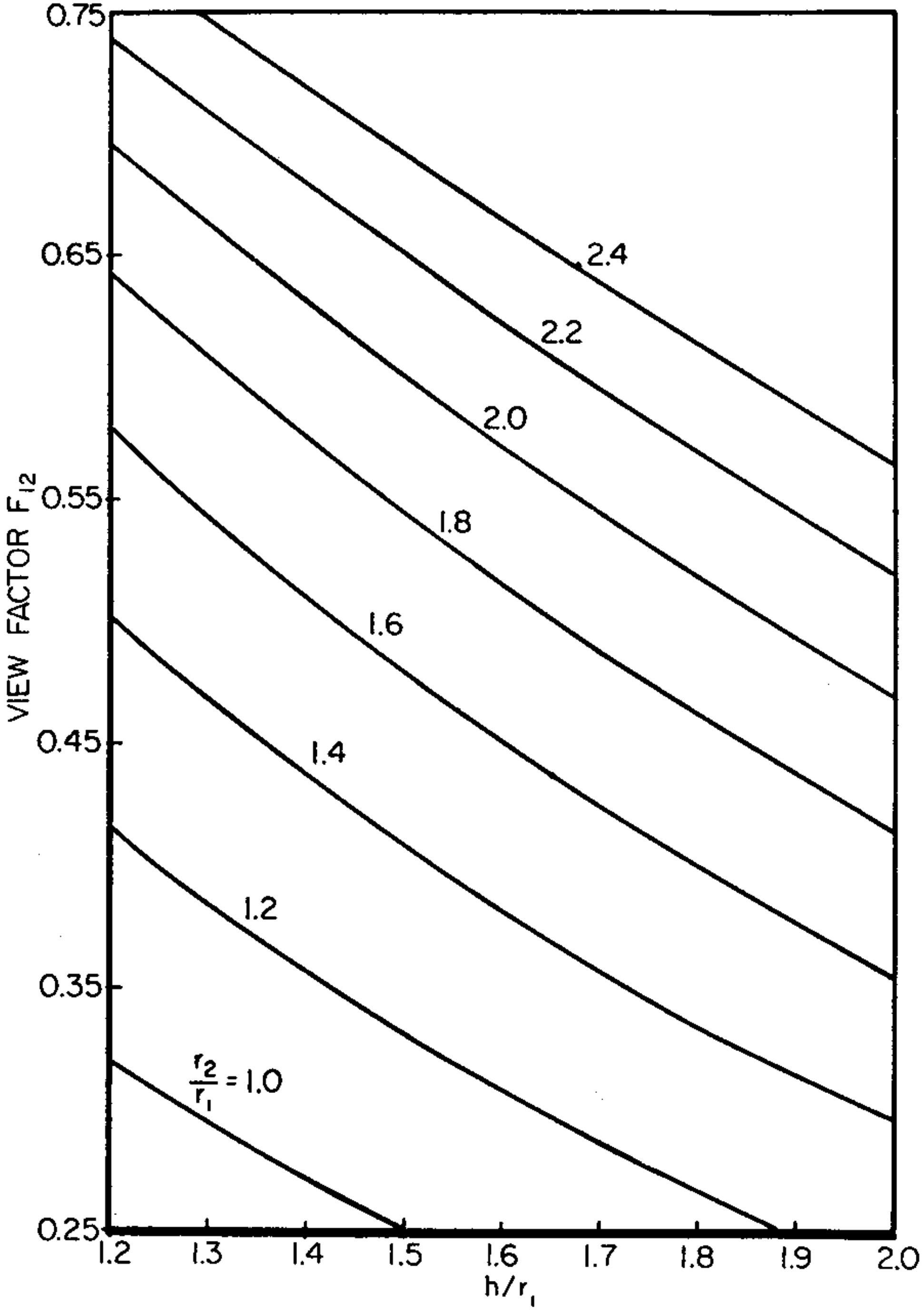

0.75
0.65
0.55
0.45
0.35
0.25
VIEW FACTOR F_{12}
2.4
2.2
2.0
1.8
1.6
1.4
1.2
$\frac{r_2}{r_1} = 1.0$
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
h/r_1

FIGURE 14C

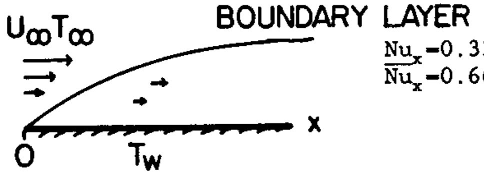
trance, the heat transfer coefficient is then $h=.02624(3.657)/0.1=0.96$ $W/m^2 {}^\circ C$ where the value for k for air is from Table 3. If the wall of the pipe is at 285 K, then the heat transfer along a 2 meter section of the pipe will be $Q=hA(T_1-T_2)=\pi hLD(T_1-T_2)=0.96(2\pi 0.1)(300-285)=9.05$ W. The gas velocity does not enter into the calculation because of the assumption that the flow is laminar and fully developed. See (1-5,7) for details.

The pressure drop can also be calculated. From the table, fRe=64.0. If the average air flow velocity is 0.3 m/s, $Re=.3(.1)/16.84\times10^{-6}=1.782\times10^3$ where ν was taken from Table 3. The friction factor is then $f=64/Re=3.59\times10^{-2}$ and the pressure drop along this same 2 m section of pipe is $\Delta P=fL\rho u^2/2D_h=$ $(3.59\times10^{-2})2(1.1774)(0.3^2)/0.2=3.8\times10^{-2}$ $mkg/s^2m^2=0.038$ $N/m^2=0.038$ Pa where the density of air is again from Table 2.

FORCED CONVECTION: (Reference 8)

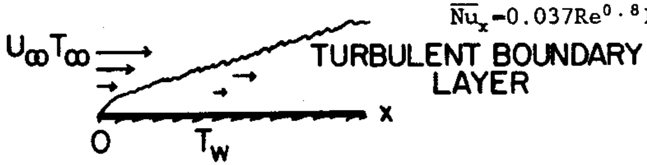
Critical Reynolds numbers: flatplate 3.2×10^5, cylinder 5×10^5, sphere 3×10^5

Laminar flow parallel
to a flat plate
$Re=u_\infty x/\nu<3\times10^5$



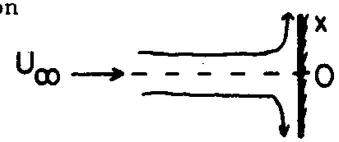
$Nu_x=0.332Re^{0.5}Pr^{0.333}$
$\overline{Nu}_x=0.664Re^{0.5}Pr^{0.333}$

Turbulent flow over
a flat plate
$Re=u_\infty x/\nu>3\times10^5$



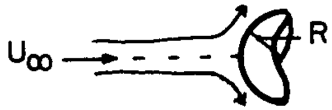
$\overline{Nu}_x=0.037Re^{0.8}Pr^{0.333}$

Laminar plane stagnation
point flow
$Re=ux/\nu$



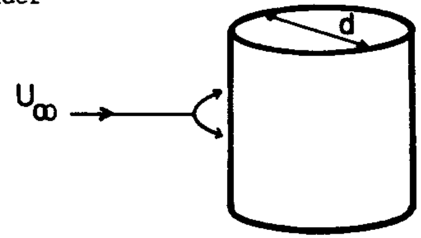
$Nu_x=0.57Re^{0.5}Pr^{0.4}$

Axisymmetric Stagnation
point flow
$Re=uR/\nu$



$Nu_x=0.93Re^{0.5}Pr^{0.4}$

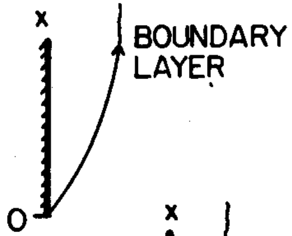
Flow around a cylinder
$Re=u_\infty d/\nu$



$1<Re<4$	$\overline{Nu}_d=0.891Re^{0.333}$
$4<Re<40$	$=0.821Re^{0.385}$
$40<Re<4000$	$=0.615Re^{0.466}$
$4000<Re<40000$	$=0.174Re^{0.618}$
$40000<Re<250000$	$=0.024Re^{0.805}$

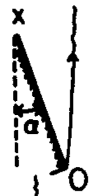
NATURAL CONVECTION (reference 8)

Hot vertical flat plate
laminar $10^4 < GrPr < 10^9$
turbulent $GrPr > 10^9$
$Gr = gx^3 \beta \Delta T/\nu^2$

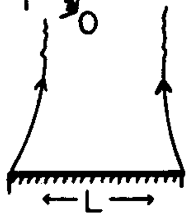


$\overline{Nu}_x = 0.59(GrPr)^{0.25}$
$\overline{Nu}_x = 0.13(GrPr)^{0.333}$

Hot inclined flat plate
$Gr = gx^3 \beta \Delta T \cos\alpha/\nu^2$

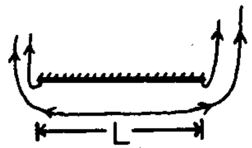


Horizontal plate, hot side up
laminar $10^5 < GrPr < 2\times10^7$
$Gr = gL^3 \beta \Delta T/\nu^2$
turbulent $2\times10^7 < GrPr < 3\times10^{10}$



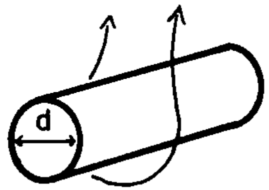
$\overline{Nu}_L = 0.54(GrPr)^{0.25}$
$\overline{Nu}_L = 0.14(GrPr)^{0.333}$

Horizontal plate, hot side down
$Gr = gL^3 \beta \Delta T/\nu^2$
$3\times10^5 < GrPr < 3\times10^{10}$



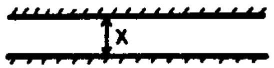
$\overline{Nu}_L = 0.27(GrPr)^{0.25}$

Heated horizontal cylinder
$Gr = gd^3 \beta \Delta T/\nu^2$
laminar, $10^3 < GrPr < 10^9$



$\overline{Nu}_d = 0.525(GrPr)^{0.25}$

Horizontal parallel plates
lower plate hot
$Gr = gx^3 \beta \Delta T/\nu^2$
$Gr < 10^3$
$10^4 < Gr < 3.2\times10^5$
$3.2\times10^5 < Gr < 10^7$



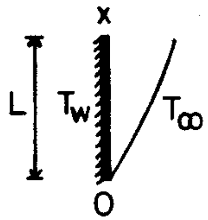
$Nu_x = 1$
$Nu_x = 0.21(GrPr)^{0.25}$
$Nu_x = 0.075(GrPr)^{0.333}$

Vertical parallel plates
$Gr < 2\times10^3$
$2\times10^3 < Gr < 2.1\times10^5$
$2.1\times10^5 < Gr < 1.1\times10^7$

$Nu_x = 1$
$Nu_x = 0.20(GrPr)^{0.25}$
$Nu_x = 0.071(GrPr)^{0.333}$

TABLE 2 continued

For air a simpler form of these equations is given below where the parameters are defined in the figure to the right (reference 7)



Free Convection To Air	laminar flow $10^4<GrPr<10^9$	turbulent flow $GrPr>10^9$
from vertical plane or large vertical cylinder	$h=1.42(\Delta T/L)^{0.25}$	$h=0.95(\Delta T)^{0.333}$
from a horizontal cylinder	$h=1.32(\Delta T/d)^{0.25}$	$h=1.24(\Delta T)^{0.333}$
from a horizontal plate, hot side up or cold side down	$h=1.32(\Delta T/L)^{0.25}$	$h=1.43(\Delta T)^{0.333}$
from a horizontal plate, hot side down or cold side up	$h=0.61(\Delta T/L^2)^{0.2}$	$h=0.61(\Delta T/L^2)^{0.3}$

where **h** is the heat transfer coefficient in W/m^2C.

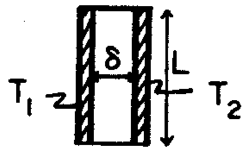
To correct these values to pressures lower than 1 atmosphere, multiply **h** by $(p/101.32)^{0.5}$ for laminar flow and by $(p/101.32)^{-0.667}$ for turbulent flow where **p** is in kilonewtons/m^2

For an enclosed airspace, the effective thermal conductivity between the two walls is given by (reference 7):

$$k_e = k_{air}C(GrPr)^n(L/\delta)^m$$

where

$$Gr = g\beta(T_1-T_2)\delta^3/\nu^2 = k_{effective}$$



and values for **GrPr**, **L/δ**, **C**, **n**, **m**, are given by

	GrPr	L/δ	C	n	m
Vertical isothermal plate or cylinder	6000-200,000	11-42	0.197	0.25	-0.111
	2×10^5-1×10^7	11-42	0.073	0.33	-0.111
Horizontal isothermal plate heated from below	1700-7000	---	0.059	0.40	0
	7000-3.2×10^5	---	0.212	0.25	0
	$>3.2\times10^5$	---	0.061	0.33	0

References (2,4,7-8.)

$$s = \left[\frac{n}{n-1}\right]^{0.5} \sigma$$

$$\{\bar{X} \mp (\text{t-value for } \alpha) S_x / \sqrt{10}\}_i$$

LOW POWER PHASE: As rapidly as possible return all cinders and fuel to the fire, relight it, and put the pot in place. Keep the fire power as low as possible yet still maintain the pot temperature within 5°C and preferably 2°C of boiling. Avoid vigorous boiling. Continue for one hour.

Time	Elapsed time	Water Temperatures Pot A	(Pot B)	Remarks
	0	q		No lids are used
	5			
	10			
	15			
	20			
	25	r		
	30			

s. Weight of wood remaining _______________
t. Weight of charcoal remaining ___________
u. Weight of pot A + water ________________
(Weight of pot B + water) _______________

REMARKS:

* The lettering is used to ease the explanation of the performance calculations on the following page. Such lettering is also useful if the results are to be computer coded for analysis, such as with a spread sheet. For convenience, only pot A columns are used here.

** Note that all weights are recorded in kilograms, all temperatures are recorded in degrees celsius. Pot weight includes thermometer.

CALCULATIONS:

High Power Phase

Time to boil: $t_b = j - i =$ ________

Firepower: $P_1 = \dfrac{(1-1.12d)^{*}(h-m)e - 28000^{**}n}{60t_b} =$ ________

$$PHU_1 = \frac{4.184(g-f)(l'-k) + 2260(g-p)}{(1-1.12d)(h-m)e - 28000n}\ (100\%) =$$ ________

Low Power Phase

Firepower: $P_2 = \dfrac{(1-1.12d)^{*}(m-s)e - 28000(t-n)}{1800} =$ ________

$$PHU_2 = \frac{4.184(p-f)(100-r)^{***} + 2260(u-p)}{(1-1.12d)(m-s)e - 28000(t-n)}\ (100\%) =$$ ________

Average Specific Consumption

$$SC_{ave} = \frac{(1-1.12d)(m-s) - 1.5t}{(u-f)} =$$ ________

* The moisture content **d** is assumed here to be given on a wet basis. The value (1.-1.12d) rather than (1-d) is used so as to account for the energy lost in evaporating the water from the wood. The latent heat of vaporization of water 2260 kJ/kg is about 0.12 times the typical calorific value of wood, 18000 kJ/kg.

** The calorific value is assumed here to be 28000 kJ/kg. Tests should be done to determine its value in practice at the site.

*** This assumes that the water temperature is brought back to boiling and that the boiling temperature is 100°C.

Appearance

Ugly	Modern and Attractive

Points ______

Durability, Months

3	6	12	24	48
Short				Long

Points ______

TOTAL ______

Other:

Perceived fire risk
Ability to cook different foods
Ability to accept different pot sizes
Amount of light provided by stove to cook or work by/need for an alternative light source
Stability/rigidity of the stove when stirring food
Ability of the stove to accept any fuel size or type
Portability of the stove
Amount of stove maintenance required
Amount of training needed to learn how to properly use the stove
Ability of the stove to provide space heat or remove heat from the kitchen.

* Adapted from Reference (10)

** Note that the point scale is not necessarily linear with the parameter being judged. Thus, a reduction in efficiency of 20% costs 100 points on this particular scorecard, while an increase in efficiency of 25% only gains 50 points. This is simply trying to illustrate the "law of diminishing returns" as it applies to people's perceptions of the usefulness of different features of a stove.

*** This index might be better expressed as minutes/liter to reduce scale effects (with large pots).

TABLE 5 continued

Heat Capacity

1 Btu/hr°F = 0.5274 W/°C	1 W/°C = 1.8961 Btu/hr°F

Heat Per Unit Mass (internal energy or enthalpy)

1 Btu/lb = 2325.9 J/kg	1 J/kg = 4.2994×10^{-4} Btu/lb 1 cal/g = 4.184 kJ/kg

Heat Flow

1 Btu/hr = 0.2931 W 1 Btu/s = 1055.1 W	1 W = 3.411 Btu/hr 1 kW = 0.9478 Btu/s

Heat Flux

1 Btu/hrft^2 = 3.1537 W/m^2	1 W/m^2 = 0.31709 Btu/hrft^2

Heat Transfer Coefficient

1 Btu/hrft^2°F = 5.677 W/m^{2}K 1 Btu/hrft^2°F = =4.882 kcal/hrm^2°C	1 W/m^2°C = 0.1761 Btu/hrft^2°F

Length

1 in = 2.54 cm 1 ft = 0.3048 m 1 mi = 5280 ft = 1.60934 km 1 nautical mile = 1.852 km	1 cm = 0.3937 in 1 m = 39.3701 in = 3.280 ft 1 km = 0.62137 mi

Mass

1 oz = 28.35 g 1 lb = 16 oz 1 lb = 0.4536 kg 1 slug = 14.594 kg 1 ton = 1 short ton (american ton) = 2000 lb = 907.19 kg 1 long ton (Imperial ton) = = 1016.2 kg	1 g = 15.432 grains = 3.527×10^{-2} oz 1 kg = 2.2046 lb 1 metric ton = 1 mt = 10^3 kg = = 1.10231 short tons = = 0.98420 long tons

Mass Flow Rate

1 lb/hr = 1.26×10^{-4} kg/s 1 lb/s = 0.4536 kg/s	1 kg/s = 7.94 lb/hr 1 kg/s = 2.2046 lb/sec

TABLE 5 continued

Mass Flux

1 lb/ft^2hr = 1.356×10^{-3} kg/m^2s	1 kg/m^2s = 737.3 lb/ft^2hr
1 lb/ft^2s = 4.882 kg/m^2s	1 kg/m^2s = 0.2048 lb/ft^2s

Power

1 Btu/hr = 0.2931 W	1 W = 3.411 Btu/hr
1 Btu/hr = 3.93×10^{-4} hp	
1 Btu/s = 1.0551 kW	1 kW = 0.94778 Btu/s
1 hp = 550 ftlb/s	1 kW = 1.35961 metric horsepower
1 hp = 745.7 W	1 kW = 1.34102 Imperial horsepower
1 ftlb/s = 1.3558 W	

Pressure

1 lb_f/in^2 = 1 psi = 6894.76 Pa	1 Pa = 1 N/m^2 = 1.45×10^{-4} Psi
1 lb_f/ft^2 = 47.880 Pa	1 bar = 10^5 Pa
1 atm = 14.696 lb_f/in^2	1 atm = 1.01325×10^5 Pa
1 atm = 2116.2 lb_f/ft^2	
1 in H_2O = 249.1 Pa	1 mm H_2O = 9.80665 Pa
	1 mm Hg = 133.3 Pa

Specific Heat

1 Btu/lb°F = 4.1868 kJ/kgK	1 J/g°C = 0.23885 Btu/lb°F
1 Btu/lb°F = 1 kcal/kgK	1 kcal/kgK = 1 cal/g°C

Speed

1 ft/s = 0.3048 m/s	1 m/s = 3.2808 ft/s
1 mi/hr = 1.4667 ft/s	1 m/s = 2.237 miles/hr
1 mi/hr = 0.44704 m/s	1 km/hr = 0.62137 mi/hr
1 knot = 0.51444 m/s	1 km/hr = 0.27778 m/s

Temperature

T(°F) = 1.8(K-273.15)+32	T(K) = T(°R)/1.8
T(°F) = 1.8(°C)+32	T(K) = T(°C)+273.15
T(°F) = T(°R)-492	T(°C) = T(K)-273.15
	T(°C) = [T(°F)-32]/1.8
	T(°C) = [T(°R)-492]/1.8

Thermal Conductivity

1 Btu/hrft°F = 1.7303 W/m°C	1 W/m°C = 0.5779 Btu/hrft°F
1 Btu/hrft°F = 0.4132 cal/sm°C	

TABLE 5 continued

Viscosity, dynamic

1 lb/fts = 1.4882 Ns/m^2	1 poise = 1 g/cms
1 lb/fts = 14.882 poise	1 poise = 10^2 centipoise
1 lb/fthr = 0.4134×10^{-3} kg/ms	1 poise = 241.9 lb/fthr
	1 centipoise = 1 cP = 1×10^{-3} Ws/m^2

Viscosity, kinematic

	1 centistoke = 10^{-6} m^2/s

Volume

1 in^3 = 16.387 cm^3	1 cm^3 = 0.06102 in^3
1 oz (U.S. fluid) = 29.573 cm^3	1 cm^3 = 1 milliliter = 1 ml
1 ft^3 = 0.0283168 m^3	1 m^3 = 35.315 ft^3
1 ft^3 = 28.3168 liters	1 liter = $1\times10^{-3}m^3$
	1 m^3 = 3.923 yd^3
1 American gallon = 1 gal(U.S.) = 3.7854 liters	1 liter = 0.946 quarts (U.S.)
	1 liter = 0.219969 imperial gallons
1 gal (U.S.) = 0.13368 ft^3	
1 imperial gallon = 1 gal (U.K.) = 4.546 liters	1 liter = 0.26417 American gallons
	1 liter = 0.035315 ft^3
1 gallon = 4 quarts = 8 pints = = 16 cups	
1 gallon (U.S.) = 128 fl. oz.	1 m^3 = 264.172 U.S. gallons = 6.28981 American barrels
1 barrel = 1 bbl (U.S.) = = 42 gallons (U.S.)	

Volumetric Flow Rate

1 ft^3/min = 0.472 liter/s	1 liter/s = 2.119 ft^3/minute
1 US gal/minute = 0.06301 liter/s	1 liter/s = 15.87 US gal/minute
1 UK gal/minute = 0.07577 liter/s	1 liter/s = 13.20 US gal/minute

Worksheet 1 continued

LOW POWER PHASE:

Place the pot back on the stove and close the door.

Time	Elapsed Time	Water Temperature	Remarks
____	0	____	____
____	5	____	____
____	10	____	____
____	15	____	____
____	20	____	____
____	25	____	____
____	30	____	____

Weight of pot and water (lid and thermometer) ____________________
Weight of stove and charcoal ____________________

REMARKS:

Worksheet 4 continued

Are there rites associated with the traditional stove or its use? ________

____

What fuels are used for cooking in the household? ________

____

What else are these fuels used for in this household? food drying, cloth dyeing, pottery making, blacksmithing, beer making, commercial food preparation, etc.? ________

____

How is the fire lit? (kerosene, paper straw, etc.) ________
Does the family buy or collect wood fuel? ________
If collected, who does the collecting? ________
and how much time (distance) from the house? ________
How long does a single collection of wood last? ________
Are special trips made to collect wood or is it done in going to and from the fields? ________
If bought, how much does it cost? ________
How often is it purchased? ________
How is it transported? ________
Are fuels available only during certain seasons? ________

What is most annoying to the cook?

________ the heat or burns
________ smoke
________ the bent position
________ watching and controlling the fire
________ watching the food
________ scrubbing the blackened pots
________ fetching the fuelwood
________ other

What types and sizes of pots are used? (list and sketch below)

How long does it take to prepare each meal? ________
Where is the cooking done ? Dry season ________
Wet season ________
Winter ________

If the family is chosen to participate in this study, will they permit the tester to enter daily to weigh the wood or charcoal? ________

Comments:

WORKSHEET 7
OBSERVABLES
(Direct observations to be made by the interviewer
at the beginning and end of the survey, or as needed)

Where is the stove(s) placed (inside, outside, by a protected wall)? ______

What is the stove type: (1 pot/2 pot, chimney/chimneyless?) ______

What is the construction material: (sand/clay, cement, fired clay, metal)

______

Dimensions:
- pot to wall ______
- pot to grate/ground ______
- pot to baffle ______
- chimney height/diameter inside/outside ______
- tunnel size between pots and to chimney ______
- amount of pot surface exposed ______
- do pots seat well? ______
- grate dimensions, number of holes, size, etc. ______

Condition:
- cracks? ______
- repairs made? ______
- air holes blocked with sand or ashes? ______
- chimney plugged? ______

Stove use:
- warm or not? ______
- new or old ashes inside? ______
- sooting over door? ______
- surrounded by debris? ______
- does stove burn fuel cleanly? easily? much smoke? ______

Pots:
- size of pots present? type of pots? shape? material? ______
- which pots fit the stove? ______
- pot to wall gaps? ______
- which pots are used? ______
- are pots protected with a mud covering? ______
- are pots heavily sooted or kept relatively clean? ______
- are there lids for the pots? are they used? ______

Fuel:
- type of fuel around? ______
- size of fuel? ______
- manner of fuel storage, protection from rain, etc.? ______
- cost of fuel? ______
- how is fuel collected? ______

Worksheet 7 continued

Kitchen: Is cooking done inside or out? ______________

If outside, is the stove well protected? ______________

Condition of kitchen? ______________

Diagram of Stove:

Diagrams of Pots

Worksheet 4 continued

Are there rites associated with the traditional stove or its use? ________

____

What fuels are used for cooking in the household? ________________

____

What else are these fuels used for in this household? food drying, cloth dyeing, pottery making, blacksmithing, beer making, commercial food preparation, etc.? ________________________________

____

How is the fire lit? (kerosene, paper straw, etc.) ________________
Does the family buy or collect wood fuel? ________________________
If collected, who does the collecting? ___________________________
   and how much time (distance) from the house? ________________
How long does a single collection of wood last? ________________
Are special trips made to collect wood or is it done in going to and from
   the fields? ____
If bought, how much does it cost? ______________________________
How often is it purchased? __________________________________
How is it transported? ______________________________________
Are fuels available only during certain seasons? ________________

What is most annoying to the cook?

- ________ the heat or burns
- ________ smoke
- ________ the bent position
- ________ watching and controlling the fire
- ________ watching the food
- ________ scrubbing the blackened pots
- ________ fetching the fuelwood
- ________ other

What types and sizes of pots are used? (list and sketch below)

How long does it take to prepare each meal? ________________
Where is the cooking done ? Dry season ________________
Wet season ________________
Winter ________________

If the family is chosen to participate in this study, will they permit the tester to enter daily to weigh the wood or charcoal? ________________

Comments:

WORKSHEET 5
WEEKLY SURVEY/FINAL FOLLOWUP
(West Africa Example)

Date: ______________________________
Name of Interviewer: ____________________
Name and Surname of Head of Household: __________________________

OBSERVABLES (to be observed directly by the interviewer):
(Specify the following for both old and new stoves)
Is the stove in use or has it been in use recently? __________
What fuel is being used, size, etc.? ____________________
What pots are in use? ______________________________
What is the physical condition of the stove? _______________
Are the airholes blocked with sand, ashes? _________________
Where is the stove being used (inside, outside, etc.)? ________

QUESTIONS (to be asked of the family):
When was the stove last used? ________________________________

Which of these problems have you had or noticed when compared to the use of other stoves?

Burns the cook? ________________
Blackens pots? _________________
Unstable for stirring? __________
Burns the food? ________________
Gives too much smoke? ___________
Heats slowly? __________________
Hard to light? _________________
Uses too much wood? _____________
Does not leave charcoal for tea or or ironing, etc.? _____________
Too hot to be near? _____________
Hard to keep clean? _____________
Does not fit pot? _______________

Does not give light to cook by? __________________ and
Is a kerosene lamp then used? _____
Goes out easily? ________________
Cracks easily? _________________
Too expensive? _________________
Looks ugly? ____________________
Too fragile? ___________________
Melts in rain? _________________
Does not heat kitchen in winter? ___________________
Does not give enough smoke to repel mosquitoes, etc.? _______

REMARKS:

Note: All these questions could also be rephrased in a positive sense--as advantages of the improved stove compared to traditional ones. This might best be done in the final followup to reduce biasing the results.

WORKSHEET 7

OBSERVABLES

(Direct observations to be made by the interviewer at the beginning and end of the survey, or as needed)

Where is the stove(s) placed (inside, outside, by a protected wall)? ______

What is the stove type: (1 pot/2 pot, chimney/chimneyless?) ______

What is the construction material: (sand/clay, cement, fired clay, metal) ______

Dimensions:
- pot to wall ______
- pot to grate/ground ______
- pot to baffle ______
- chimney height/diameter inside/outside ______
- tunnel size between pots and to chimney ______
- amount of pot surface exposed ______
- do pots seat well? ______
- grate dimensions, number of holes, size, etc. ______

Condition:
- cracks? ______
- repairs made? ______
- air holes blocked with sand or ashes? ______
- chimney plugged? ______

Stove use:
- warm or not? ______
- new or old ashes inside? ______
- sooting over door? ______
- surrounded by debris? ______
- does stove burn fuel cleanly? easily? much smoke? ______

Pots:
- size of pots present? type of pots? shape? material? ______
- which pots fit the stove? ______
- pot to wall gaps? ______
- which pots are used? ______
- are pots protected with a mud covering? ______
- are pots heavily sooted or kept relatively clean? ______
- are there lids for the pots? are they used? ______

Fuel:
- type of fuel around? ______
- size of fuel? ______
- manner of fuel storage, protection from rain, etc.? ______
- cost of fuel? ______
- how is fuel collected? ______

Worksheet 7 continued

Kitchen: Is cooking done inside or out? ____________________

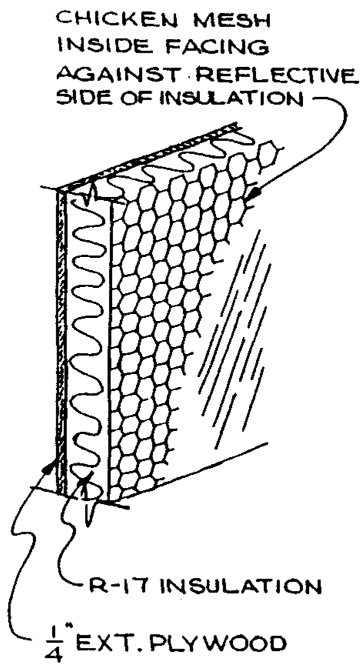
If outside, is the stove well protected? ____________________

Condition of kitchen? ____________________

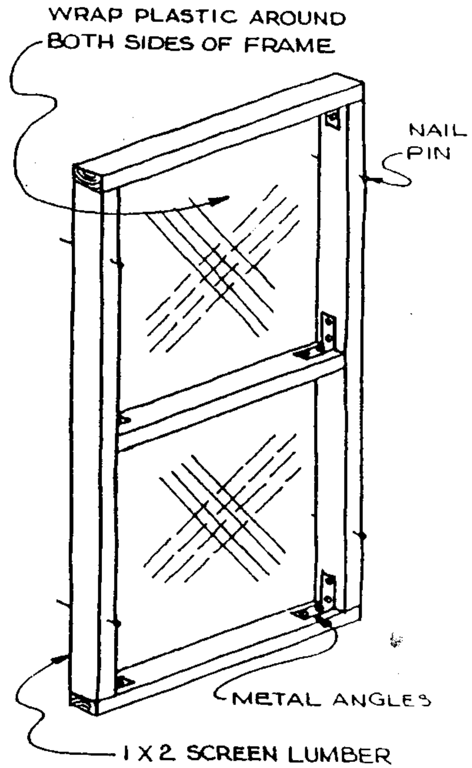
Diagram of Stove:

Diagrams of Pots

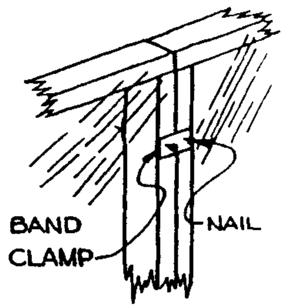
FRAME CONSTRUCTION



DETAIL- SIDE & TOP PANELS



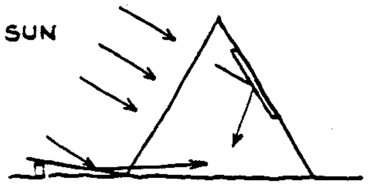
DETAIL-FRAME CONSTRUCTION



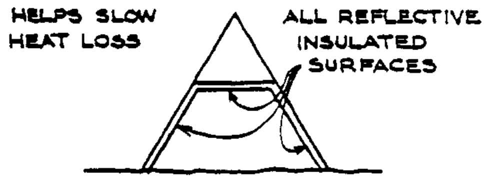
GALVANIZED NAILS
DRIVEN THROUGH
PRE-DRILLED HOLES
IN FRAMES. EXTEND
THROUGH BAND-
CLAMPS ON BOTH
SIDES.

DETAIL-FASTENING
FRAMES TOGETHER

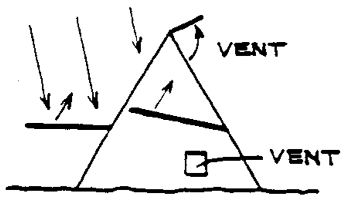
A-FRAME GREENHOUSE



SUNNY WINTER DAY

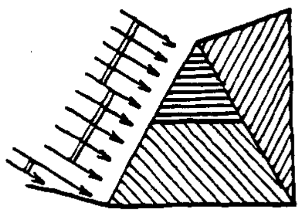


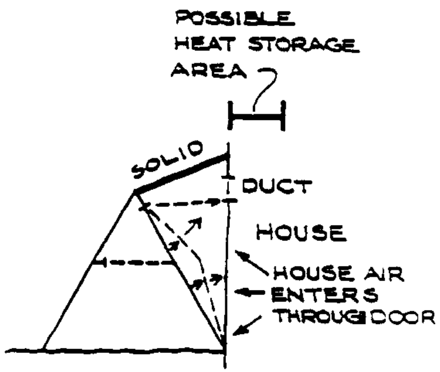
WINTER NIGHT



SUMMER-FULL SHADE POSSIBLE

SEASONAL EFFICIENCY IS BASED ON CHANGING VOLUME OF GREENHOUSE, COUPLED WITH EXPANDABLE COLLECTOR & REFLECTOR AREA.

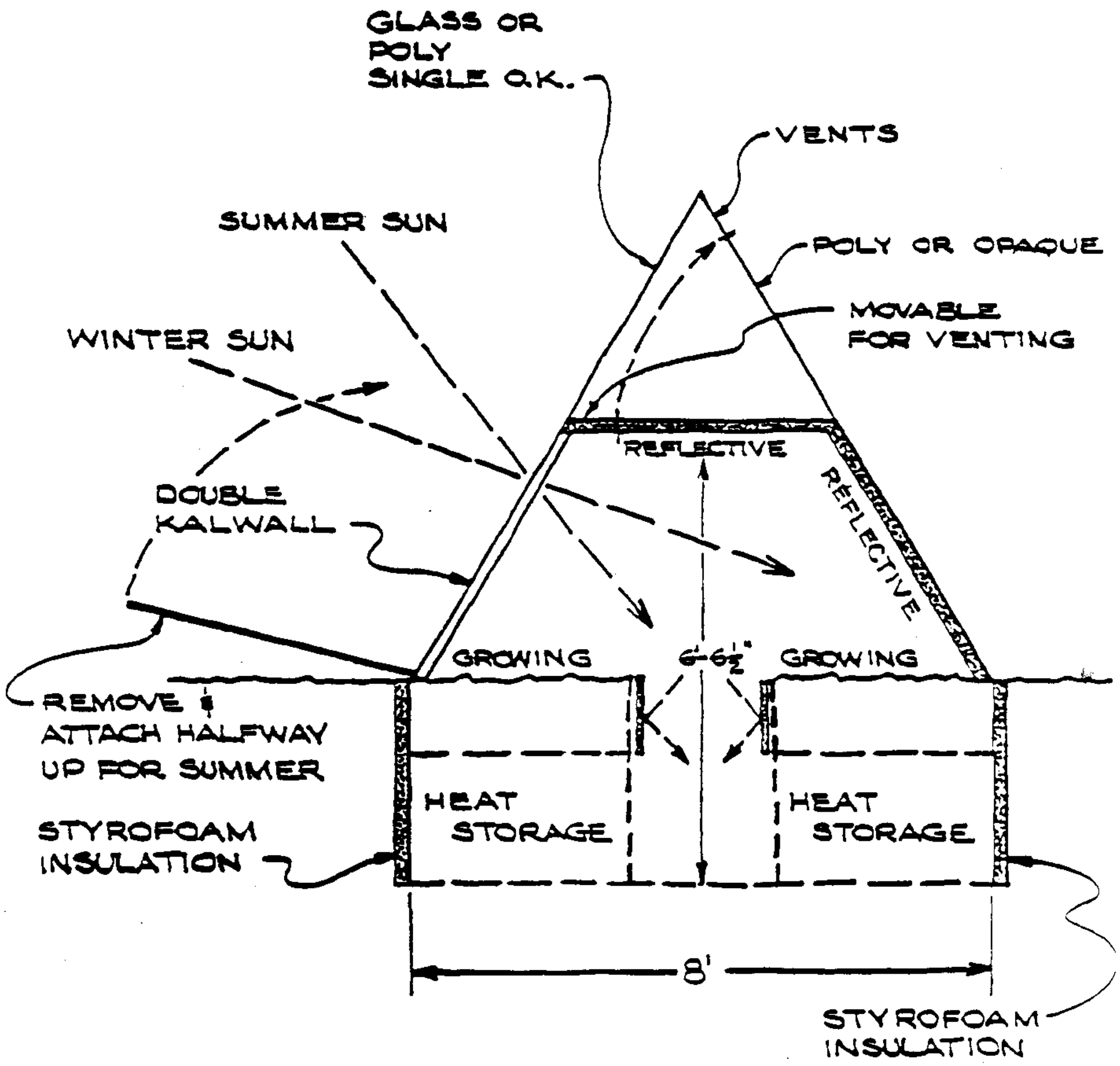




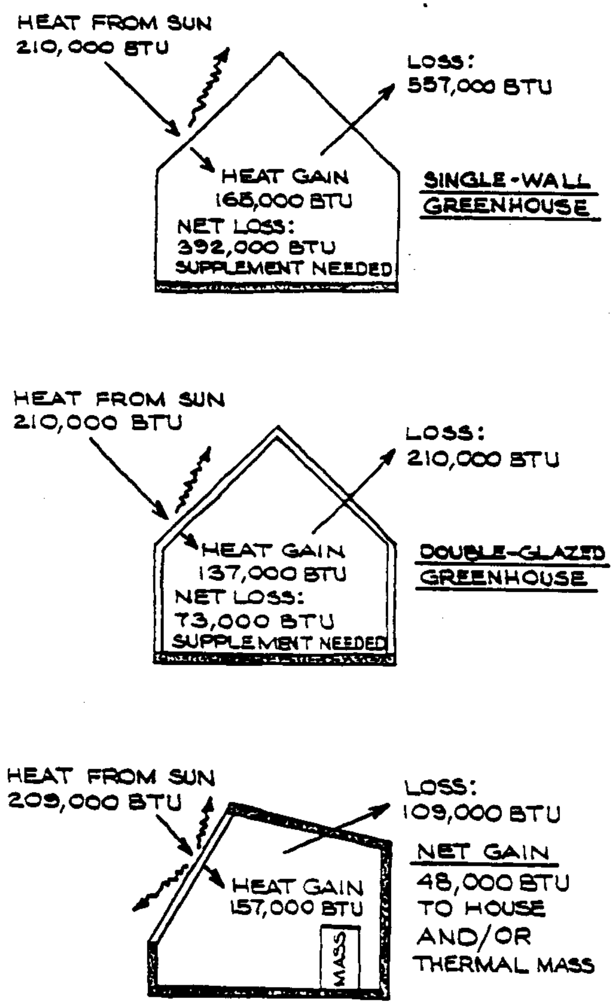
NORTH WALL PANELS HINGED; PULLED DOWN TO A-FRAME IN WINTER, PUSHED BACK AGAINST HOUSE IN SUMMER.

A-FRAME GREENHOUSE

CONSTRUCTION: 2X4 OR 2X3, GUSSETED



TYPICAL HEAT GAINS AND LOSSES FROM SOLAR GREENHOUSES



ADD NIGHTSHADES: 100,000+ NET GAIN

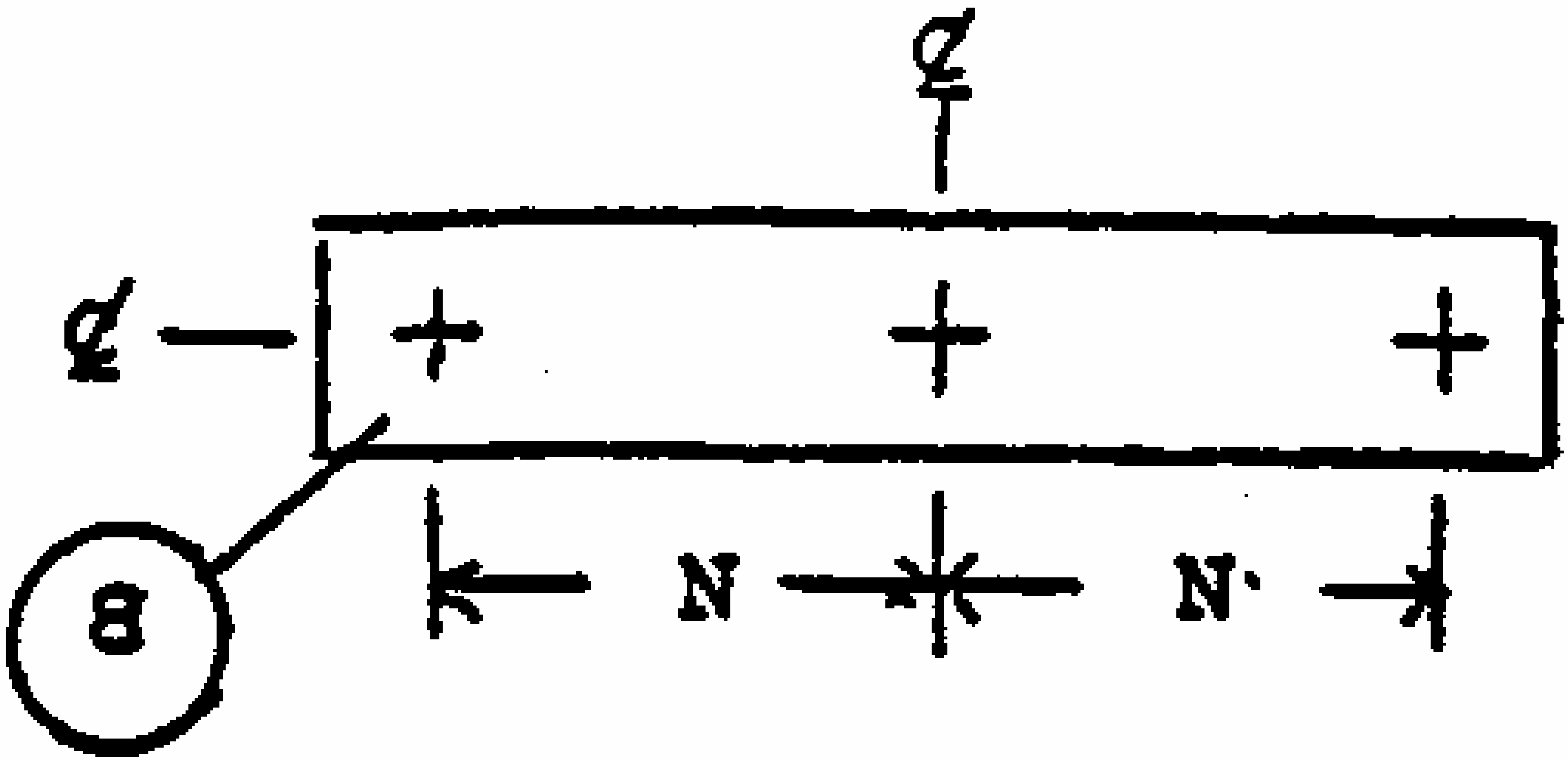


FIGURE 6

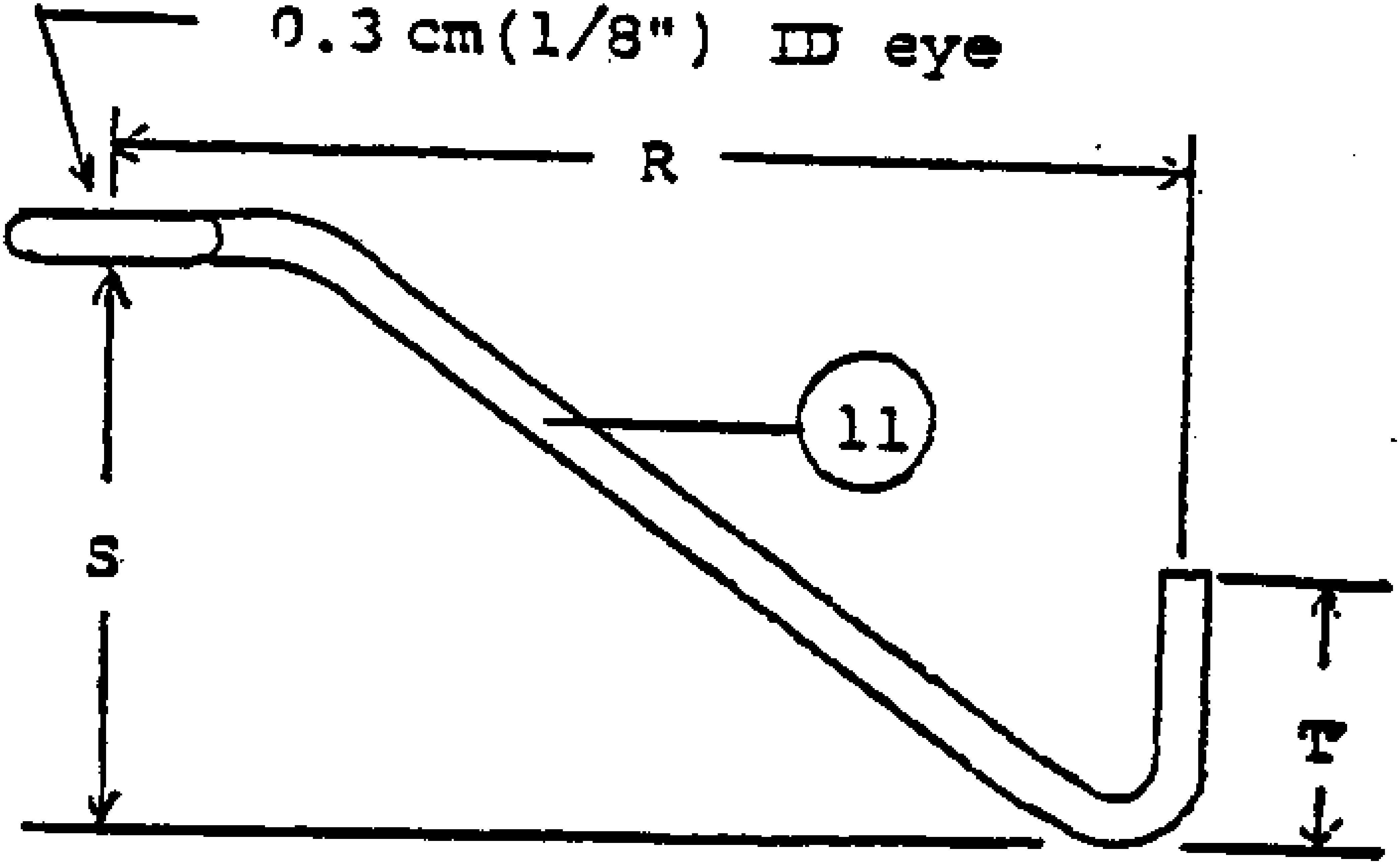


FIGURE 7

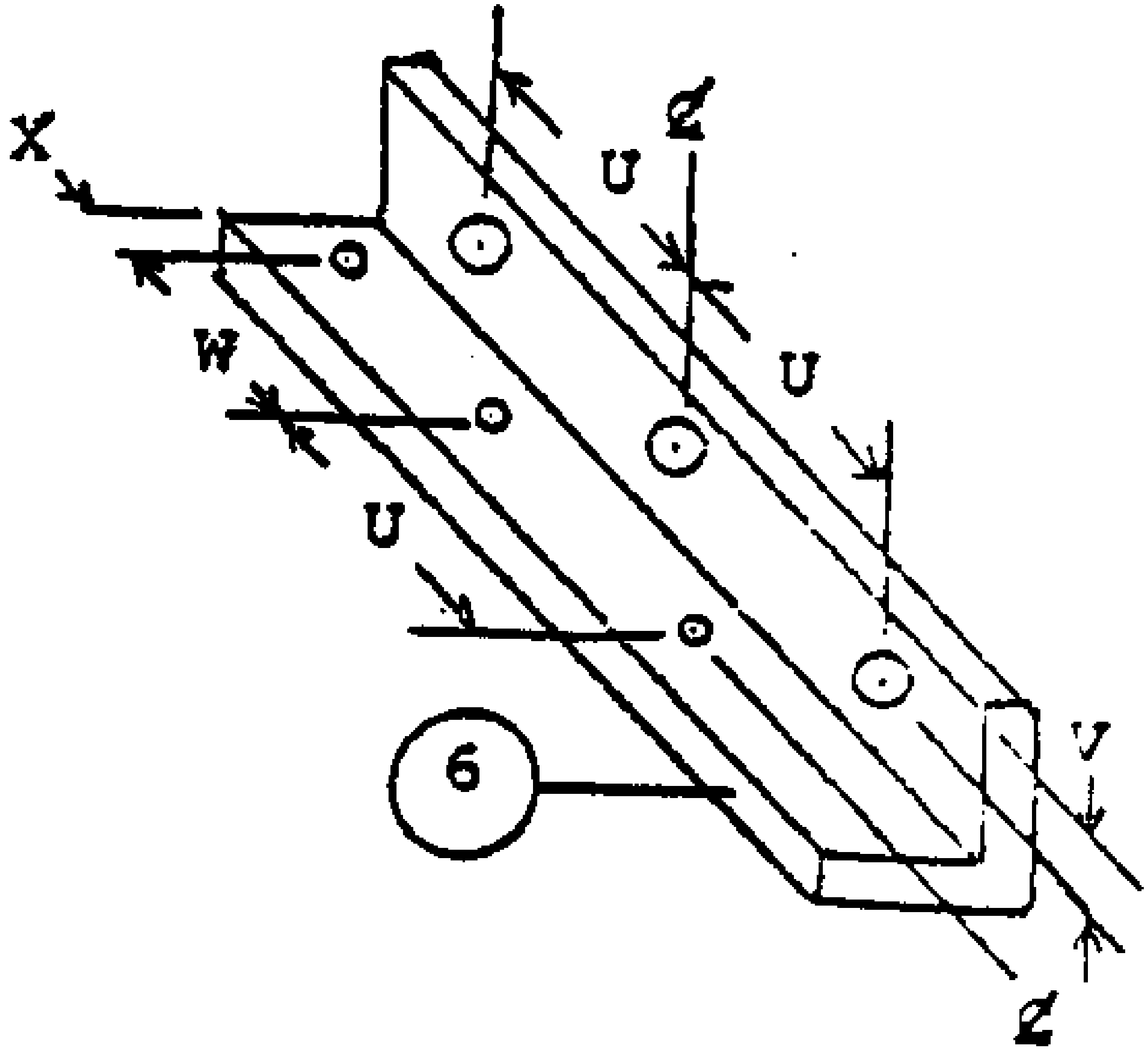


FIGURE 8

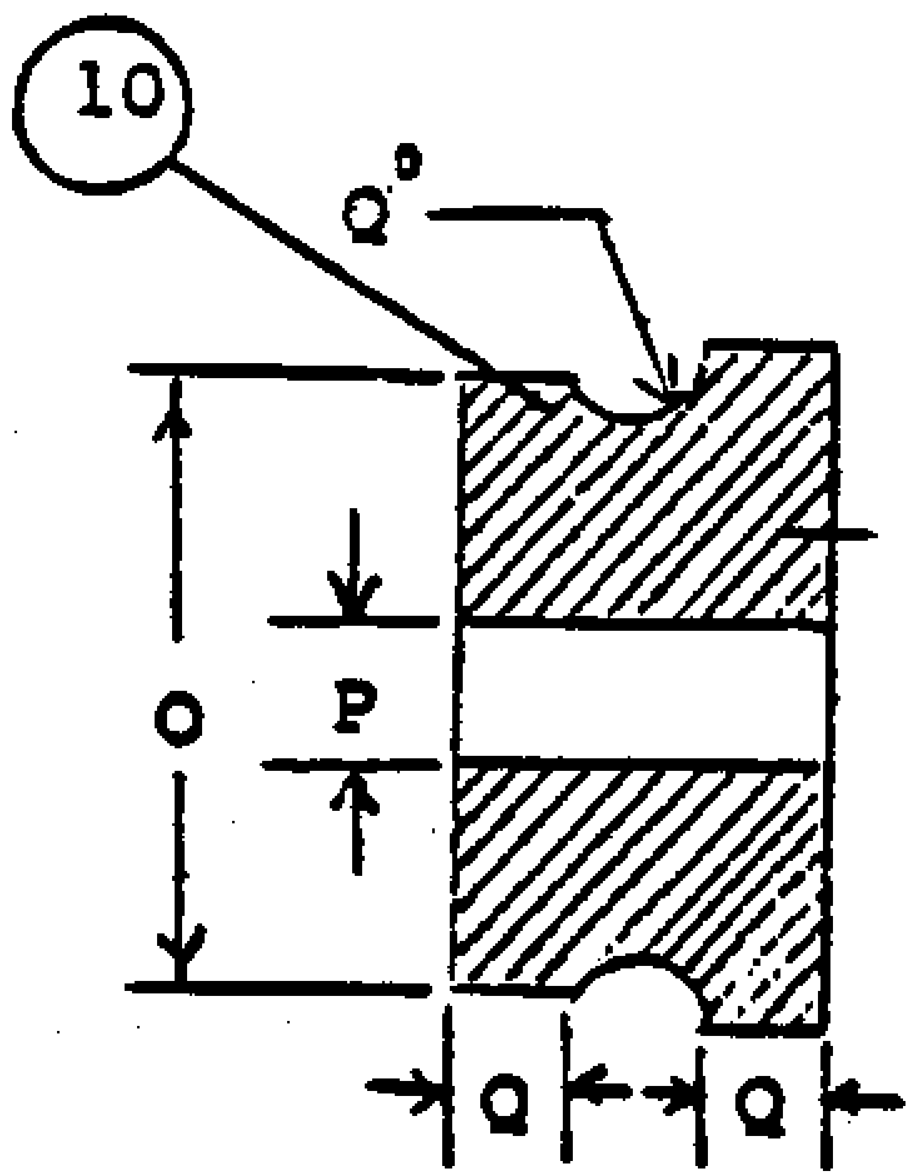


FIGURE 9

DIMENSION	CENTIMETERS	INCHES
N	5	2
O	3.2	1 1/4
P	1.7	43/64
Q	0.6	1/4
R	8.9	3 1/2
S	5	2
T	2.5	1
U	4.4	1 3/4
V	1.6	5/8
W	3.5	1 3/8
X	1.2	1/2

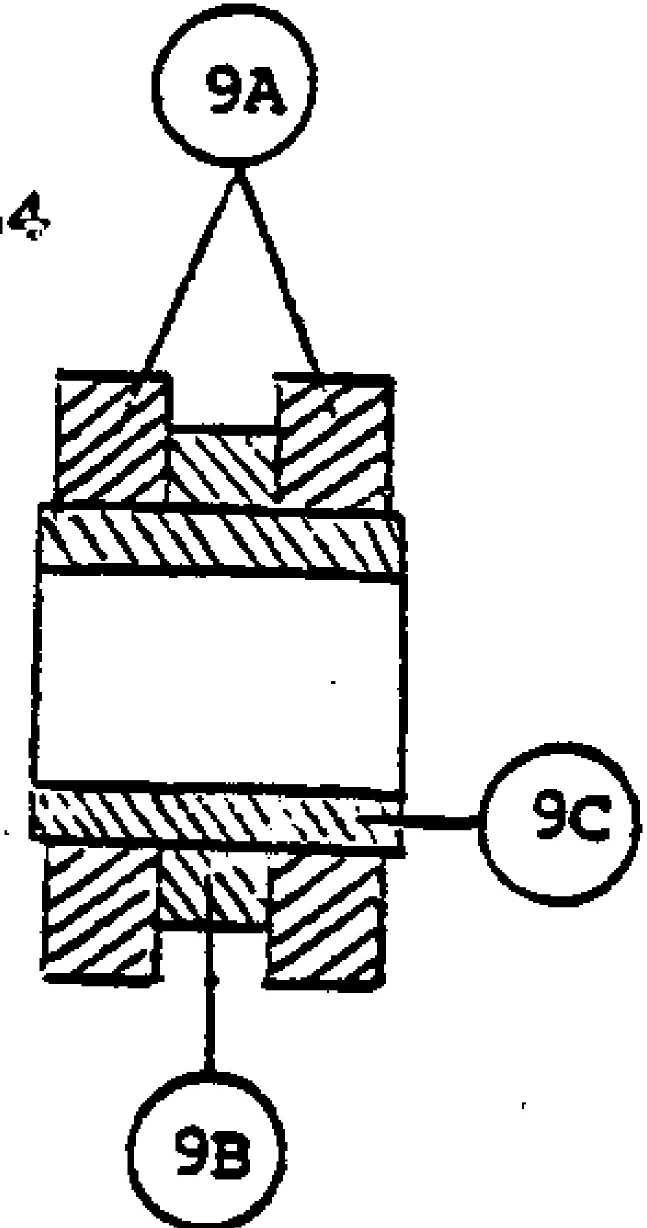


FIGURE 10

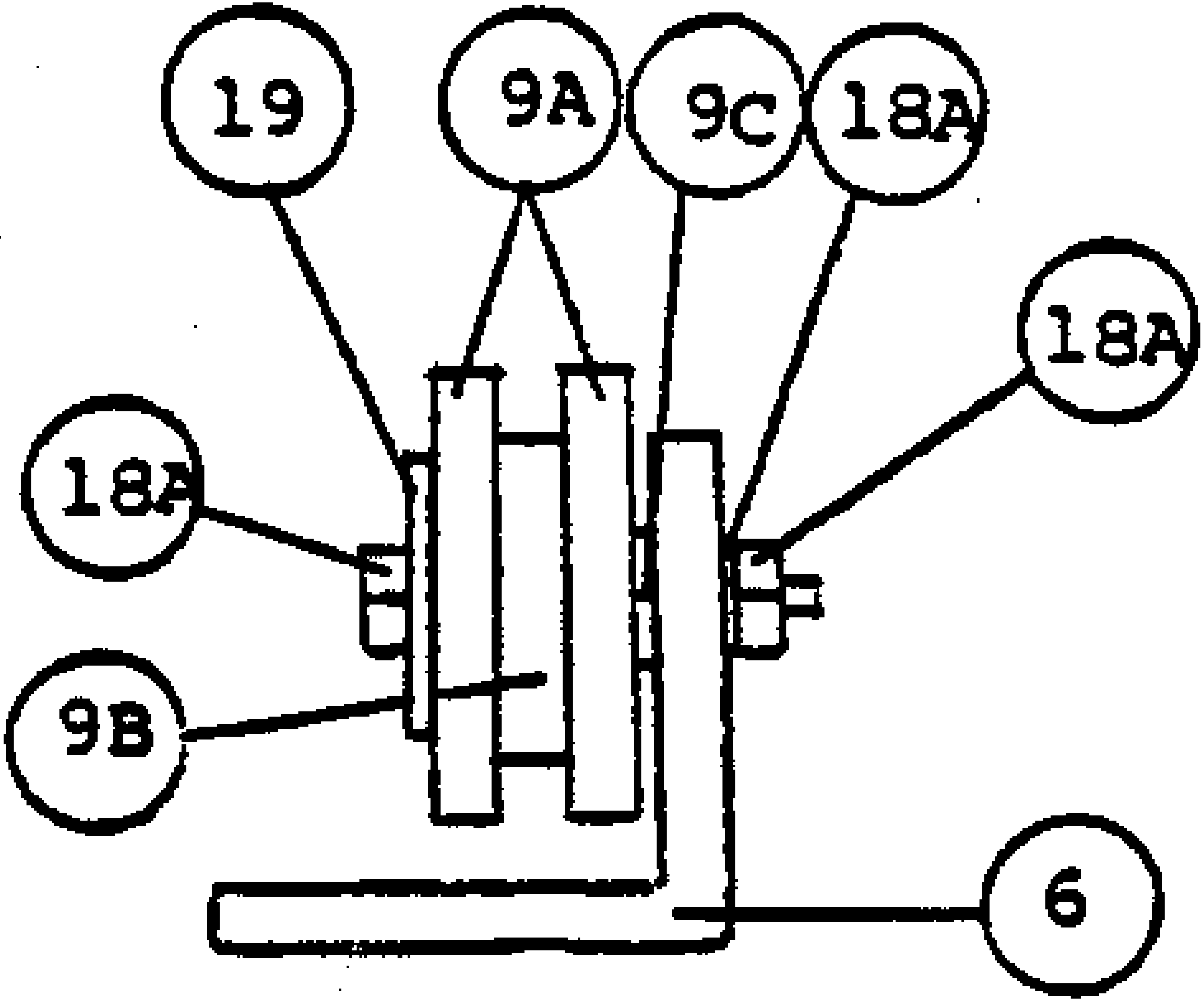


FIGURE 12

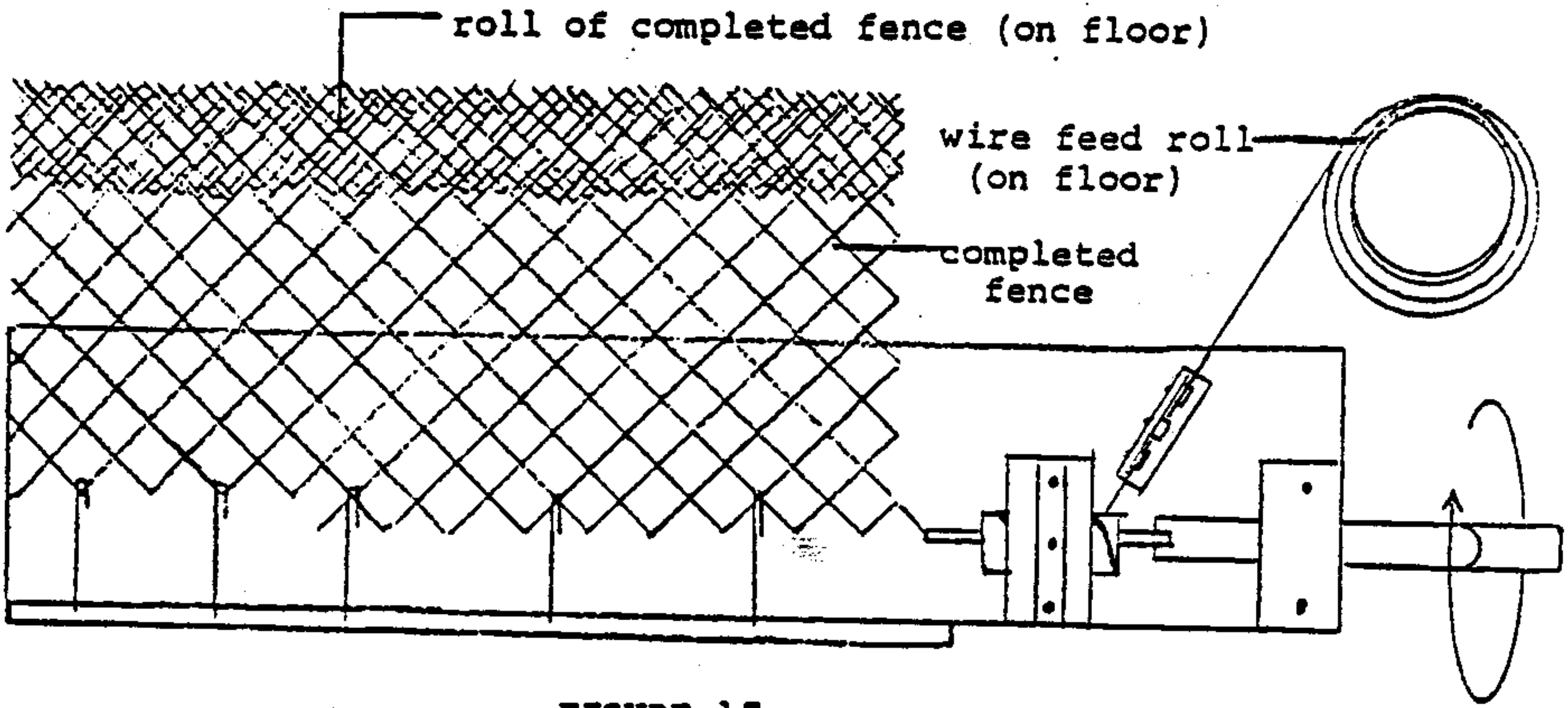

roll of completed fence (on floor)
wire feed roll
(on floor)
completed
fence

FIGURE 17

CHAIN-LINK FENCE MAKING MACHINE

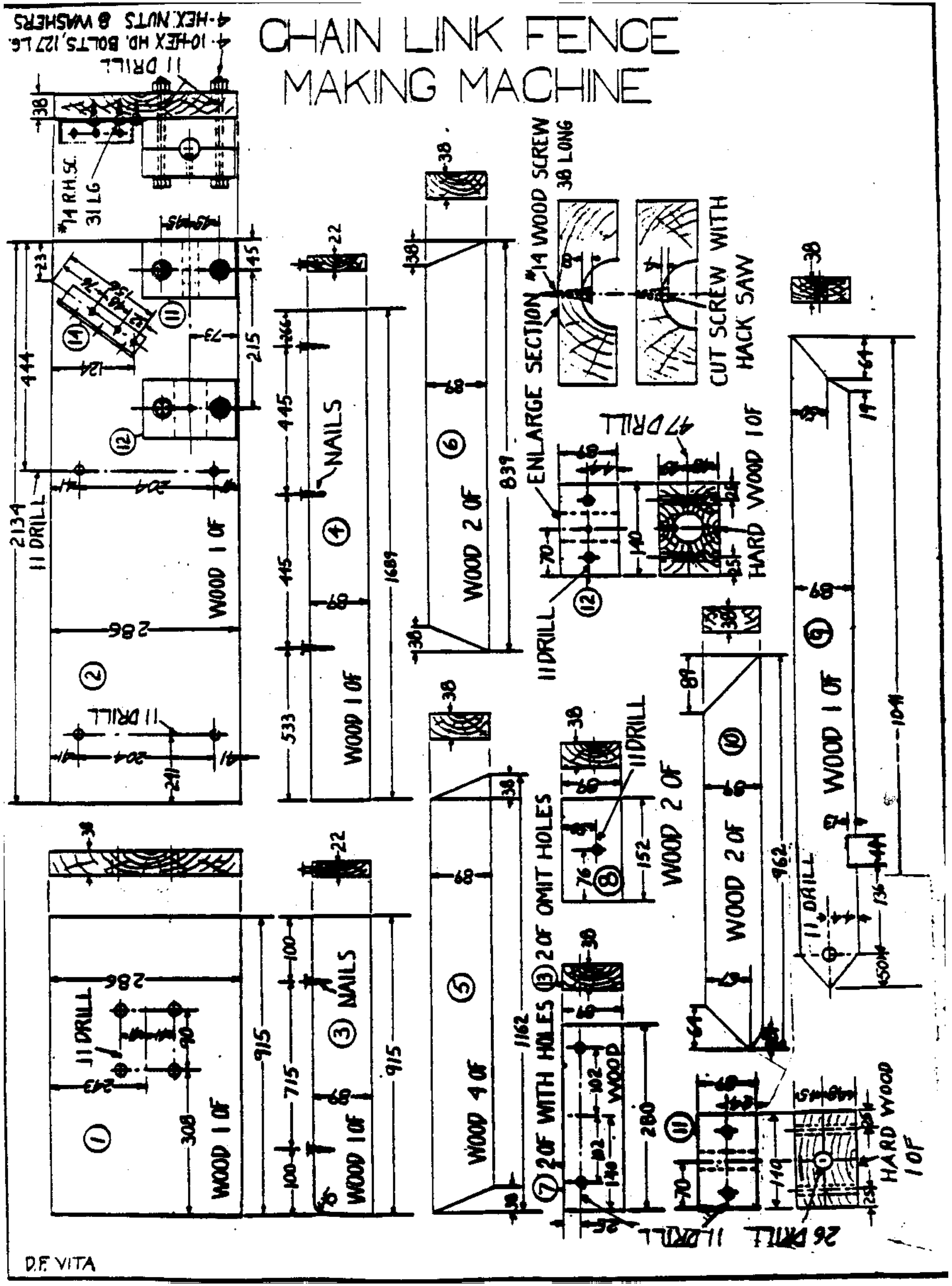
TOOLS

- Ruler
- Saw (for wood and metal)
- Drill (for wood and metal)
- Screwdriver
- Hammer

MATERIAL

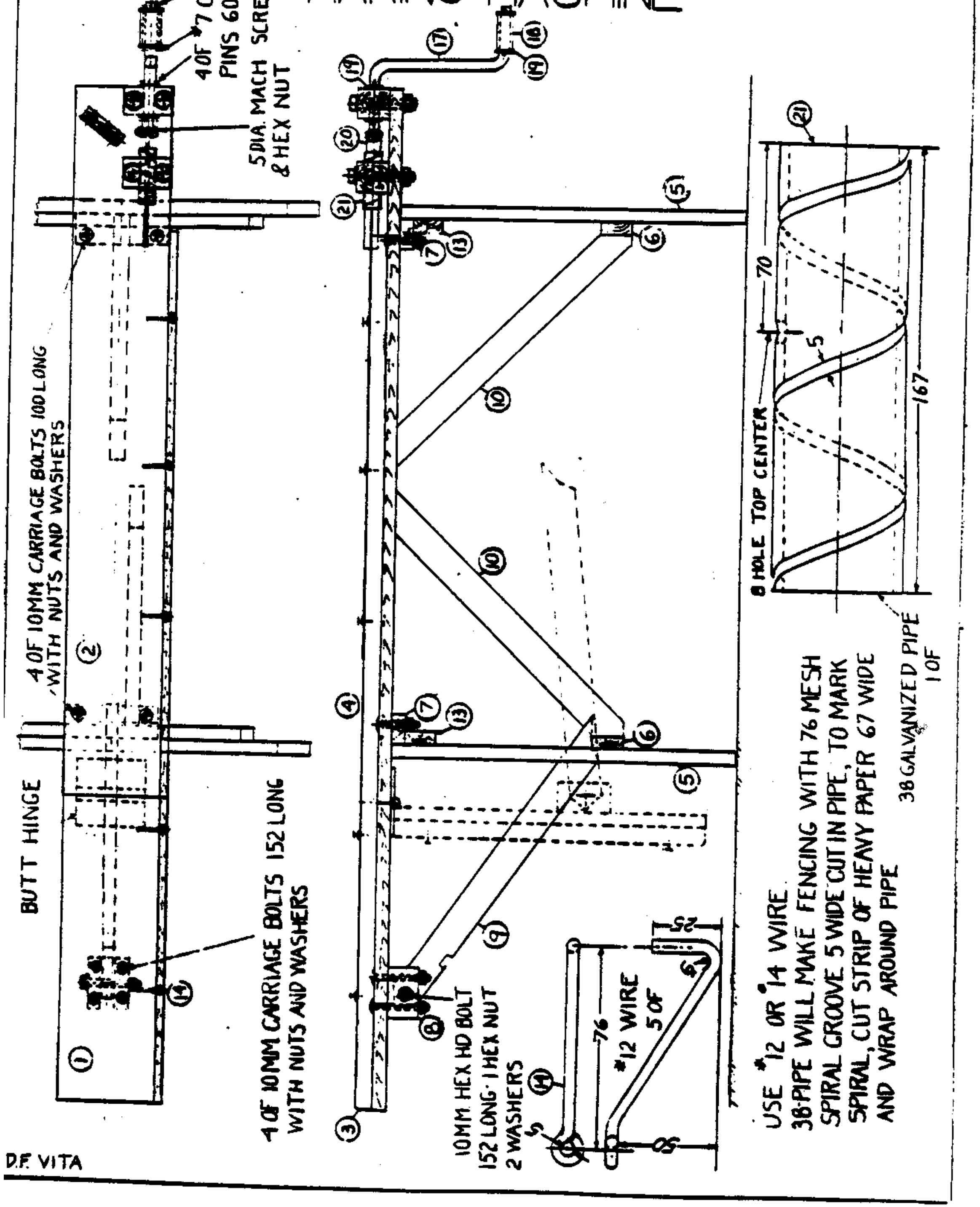
ITEM	PIECES	DESCRIPTION	CENTIMETERS	INCHES
Wooden Parts				
1	4	Wood	5 x 10 x 15	2 x 4 x 6
2	1	Wood	4 x 30 x 305	1 1/2 x 12 x 120
3	1	Wood	2.5 x 10 x 262	1 x 4 x 103
Metal Parts				
4	1	Steel plate	0.3 x 5 x 35	1/8 x 2 x14
5	1	Iron rod	2.5 dia x 78 lng	1 dia x 31 lng
6	1	Angle iron	4 x 4 x 14 lng x 0.3 thk	1 1/2 x 1 1/2 x 5 1/2 lng x 1/8 thk
7	1	Steel pipe	5 ID x 6 OD x 17 lng	2 ID x 2 3/8 OD x 6 5/8 lng
8	1	Strap iron	0.3 x 2.5 x 15	1/8 x 1 x 6
*9A	6	Steel washers	2.2 ID x 3.5 OD x 0.6 thk	7/8 ID x 1 3/8 OD x 1/4 thk
*9B	3	Steel washers	2.2 ID x 2.9 OD x 0.6 thk	7/8 ID x 1 1/8 OD x 1/4 thk
*9C	3	Steel pipes	1.3 ID x 2.2 OD x 2.1 lng	1/2 ID x 7/8 OD x 13/16 lng
*10	3	Steel rod	3.5 dia x 1.8 lng	1 3/8 dia x 3/4 lng
11	1	Steel pipe	2.5 ID x 3.5 OD x 12 lng	1 ID x 1 3/8 OD x 5 lng
Metal Fasteners				
12	5	#12 wire	0.2 dia x 15 lng	.08 dia x 6 lng
13	4	Round/hex-head bolts with 4 nuts, 4 flat washers and 4 lockwashers	0.6 dia x 16 lng	1/4 dia x 6 lng
14	5	Round/hex-head bolts with 6 nuts, 3 flat washers and 3 lockwashers	0.6 dia x 5 lng	1/4 dia x 2 lng
15	4	Flat washers	2.5 ID x 3.5 OD x 0.2 thk	1 ID x 1 3/8 OD x 1/16 thk
16	4	#12 wire	0.2 dia x 5 lng	.08 dia x 2 lng
17	24	Common nails	5 lng	2 lng
*18A	3	Round/hex-head bolts with 3 nuts and 3 lockwashers	1.3 dia x 3.8 lng	1/2 dia x 1 1/2 lng
*18B	3	Round/hex-head bolts with 3 nuts and 3 lockwashers	1.6 dia x 1.9 lng shank & 1.3 dia x 1.6 lng thread	5/8 dia x 13/16 lng shank & 1/2 dia x 5/8 lng thread
19	3	Washers	3.2 OD x 1.3 ID x 0.2 thk	1 1/4 OD x 1/2 ID x 1/16 thk

10

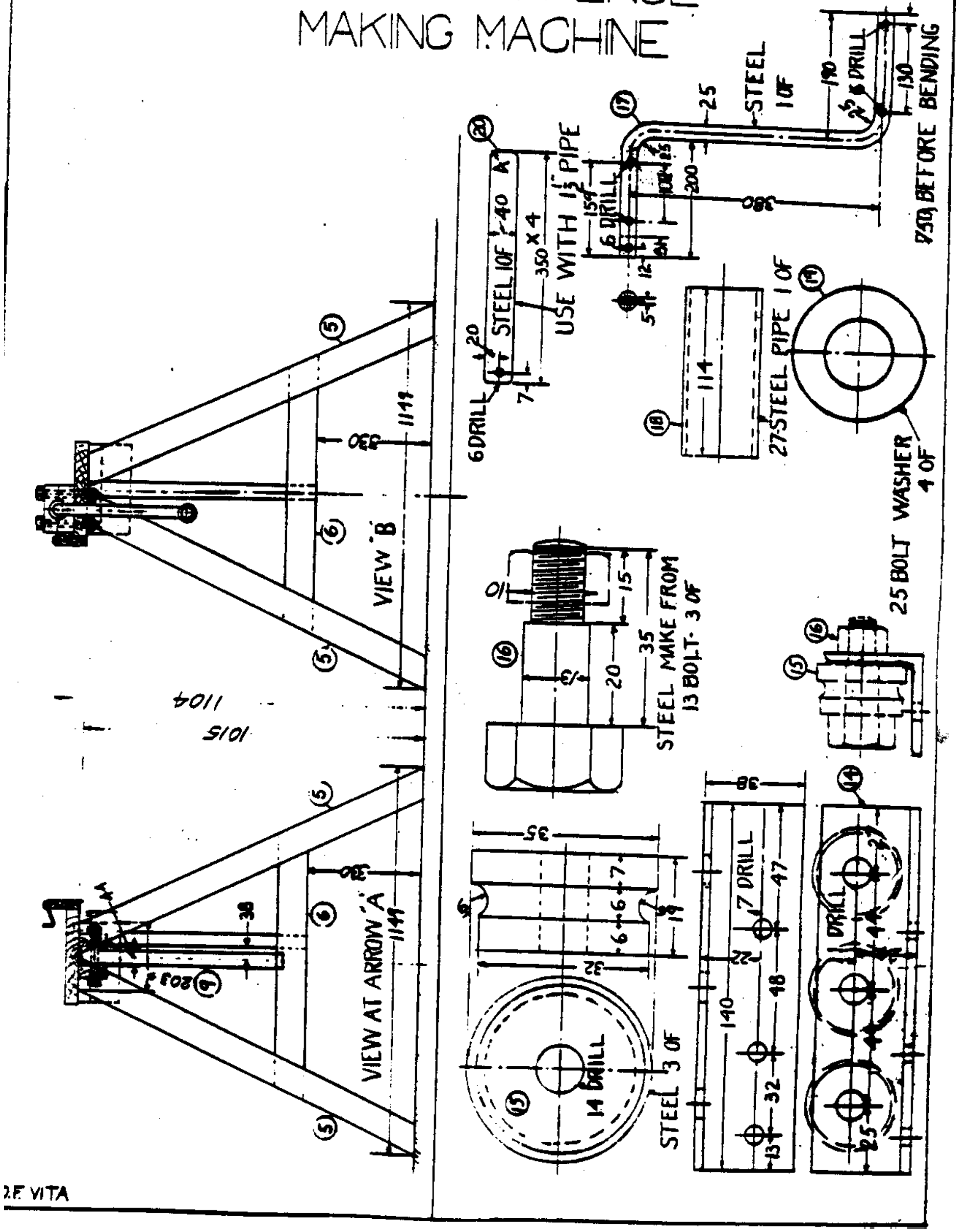


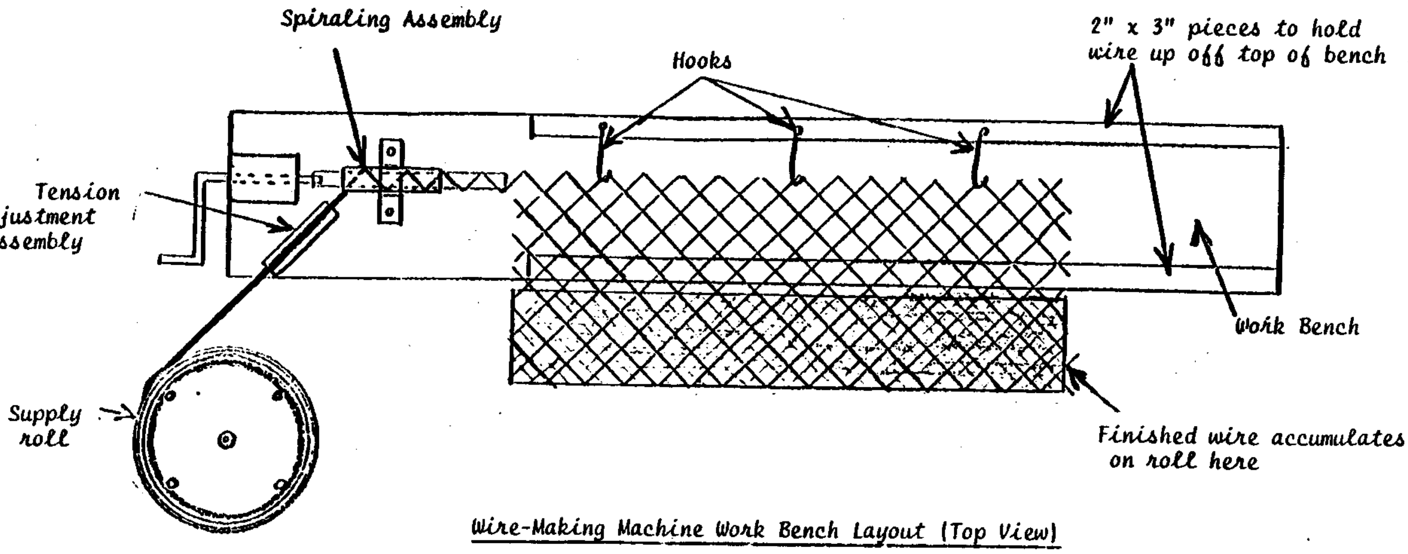
CHAIN LINK FENCE
MAKING MACHINE
4-10-HEX HD. BOLTS, 127 LG.
4-HEX. NUTS 8 WASHERS
11 DRILL
#14 R.H.SC. 31 LG
#14 WOOD SCREW 38 LONG
ENLARGE SECTION
CUT SCREW WITH HACK SAW
47 DRILL
HARD WOOD 1 OF
11 DRILL
WOOD 1 OF
WOOD 2 OF
NAILS
WOOD 1 OF
WOOD 2 OF
2 OF OMIT HOLES
2 OF WITH HOLES
WOOD 2 OF
WOOD 1 OF
WOOD 4 OF
WOOD 1 OF
26 DRILL
HARD WOOD 1 OF
D.F. VITA

CHAIN LINK FENCE MAKING MACHINE



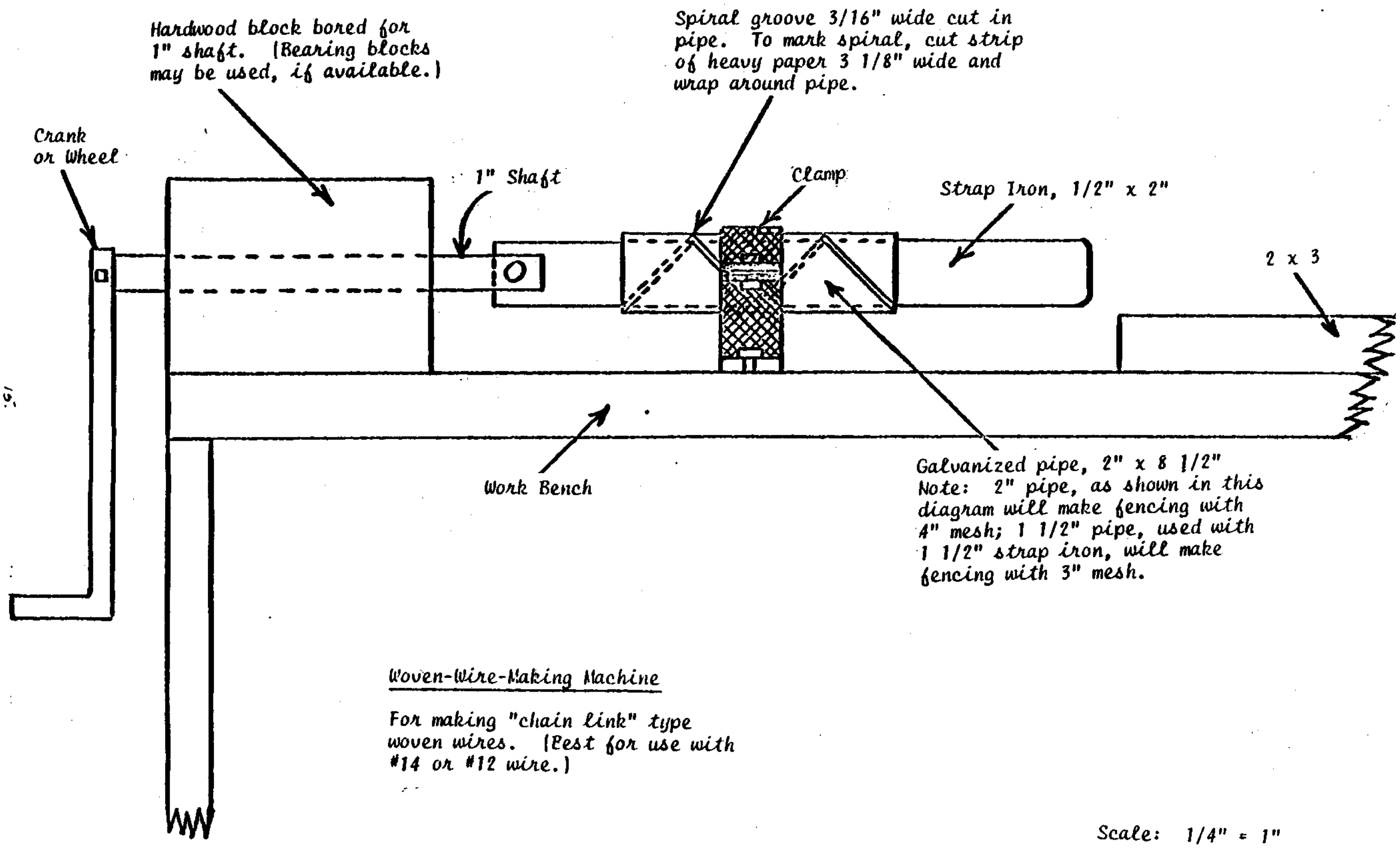
CHAIN LINK FENCE MAKING MACHINE





Wire-Making Machine Work Bench Layout (Top View)

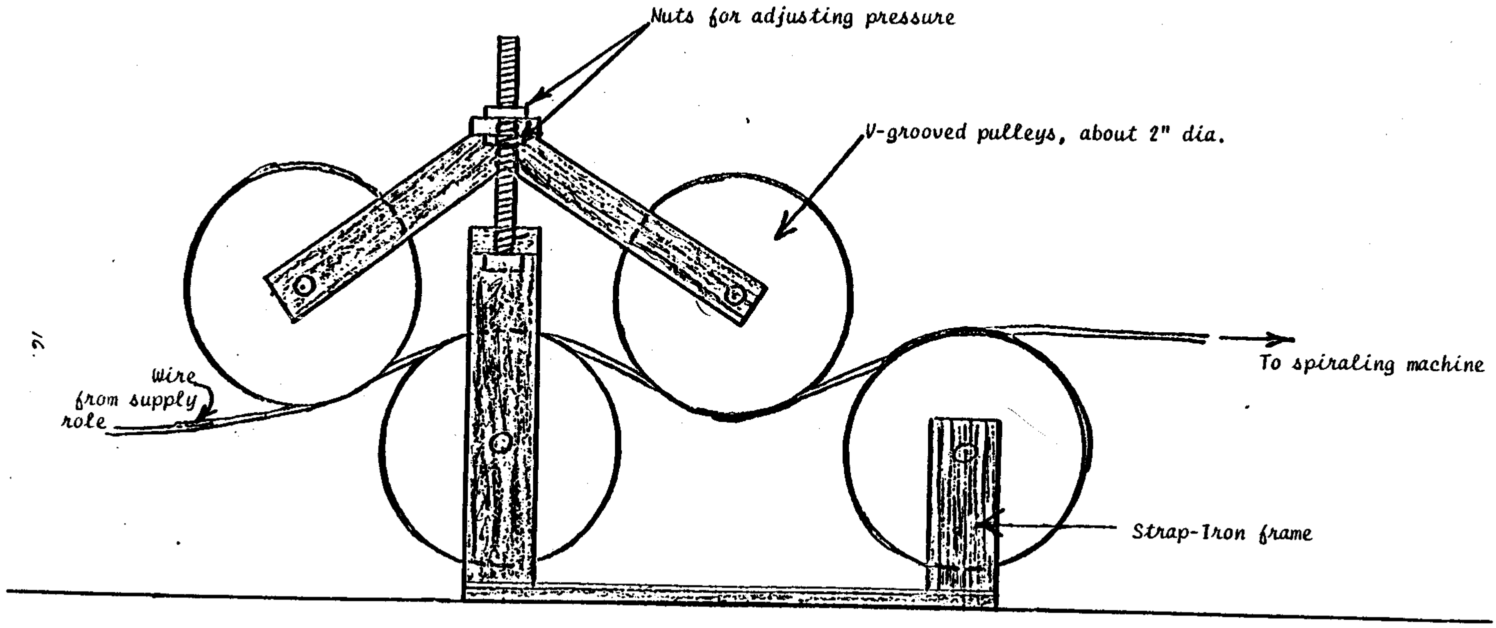
Additional Note: It is advisable to lubricate both the spiraling assembly and the tension-adjustment assembly occasionally with a strong solution of soap and water.



Woven-Wire-Making Machine

For making "chain link" type woven wires. (Best for use with #14 or #12 wire.)

Scale: 1/4" = 1"

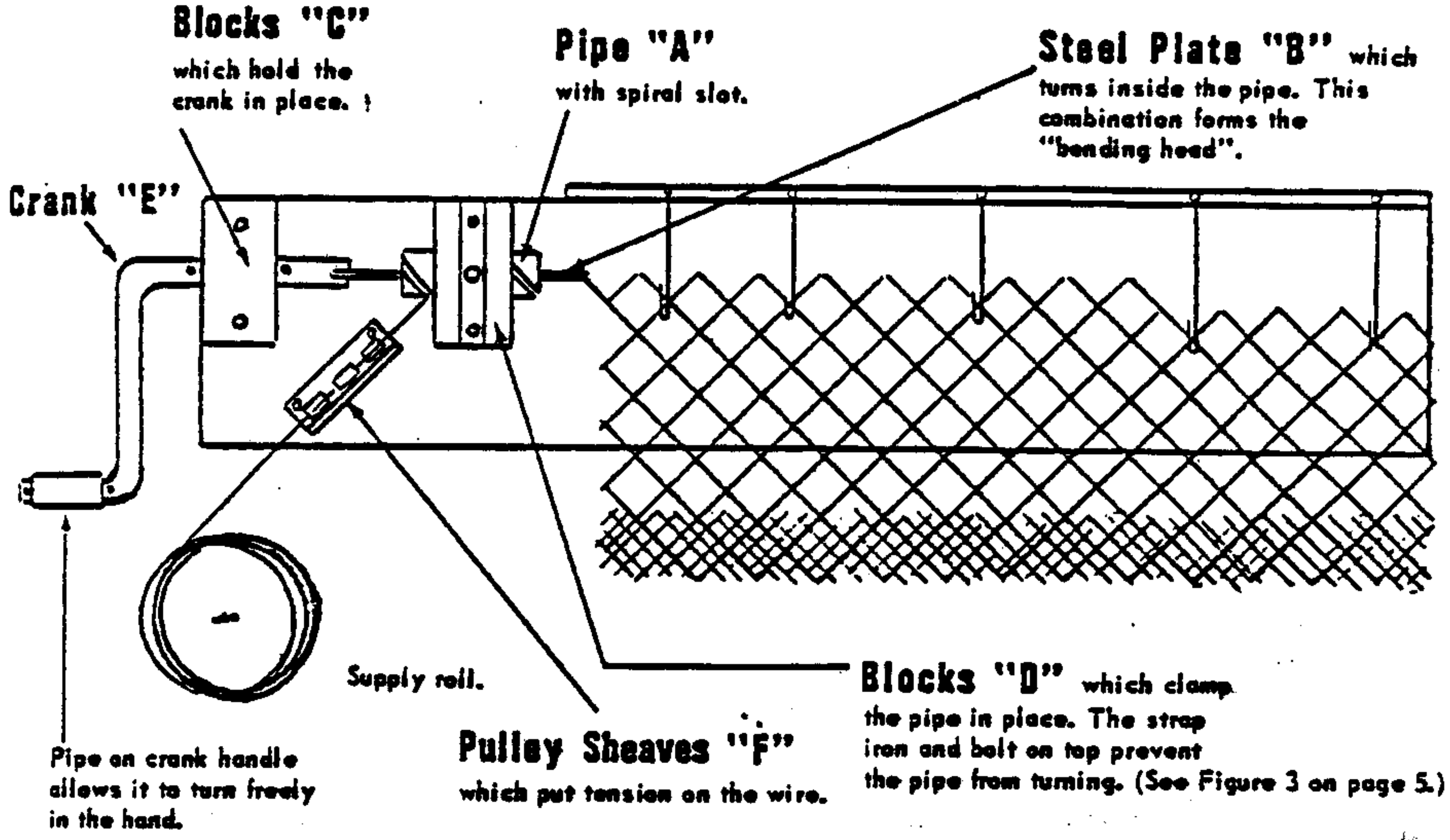


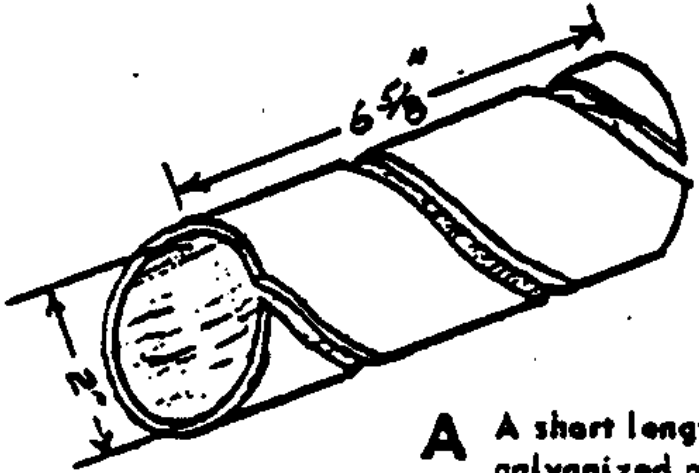
<u>Tension-Adjustment Assembly for use with Wire-Making Machine</u>

(Any system which puts tension on the wire as it feeds from the supply roll into the machine would be satisfactory. It has occurred to me that it might be simpler to pass the wire between two boards faced with rubber and pressed together.)

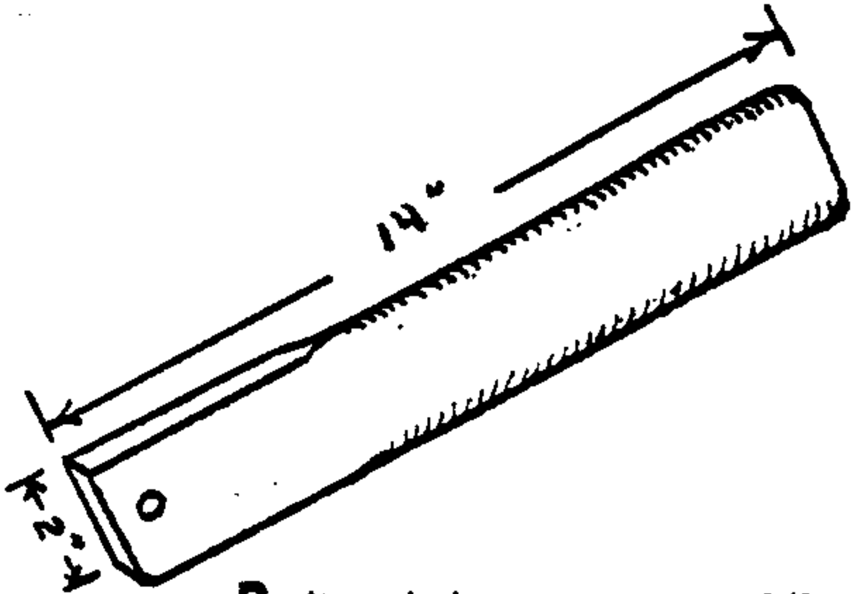
FIGURE 2: This Is How You Assemble The Parts.
(Top View)

Note the Corresponding Positions of the Parts Pictures in Figure 1.

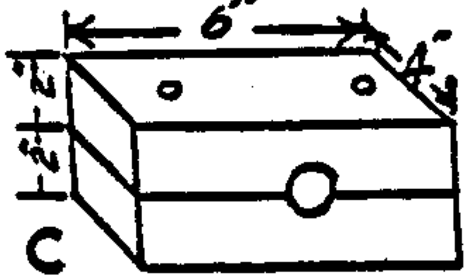




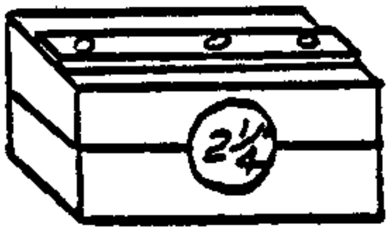
A A short length of galvanized pipe, on which you will cut a spiral.



B A steel plate or strap iron, 1/8 inch thick, with the corners rounded off and a hole drilled near one end.



C

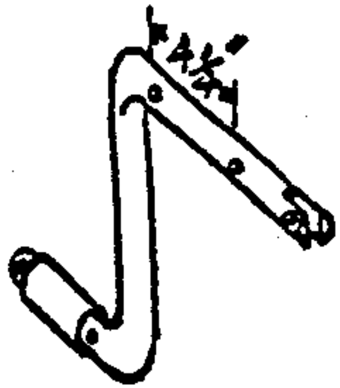


D

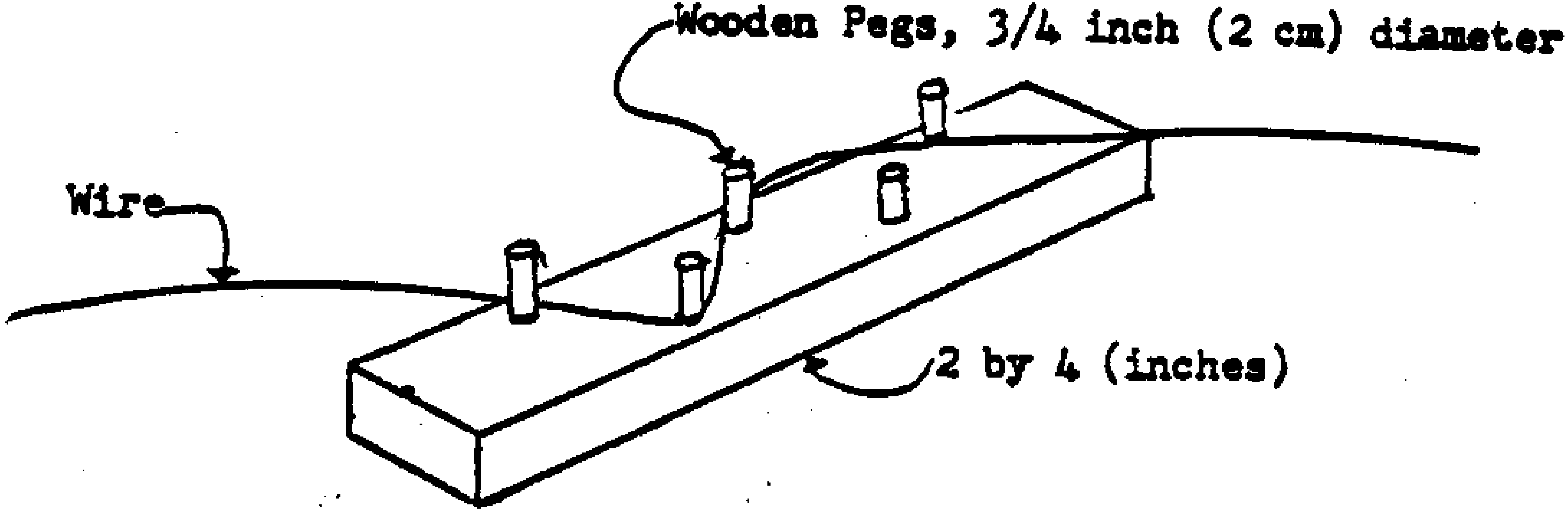
D = 3/4"

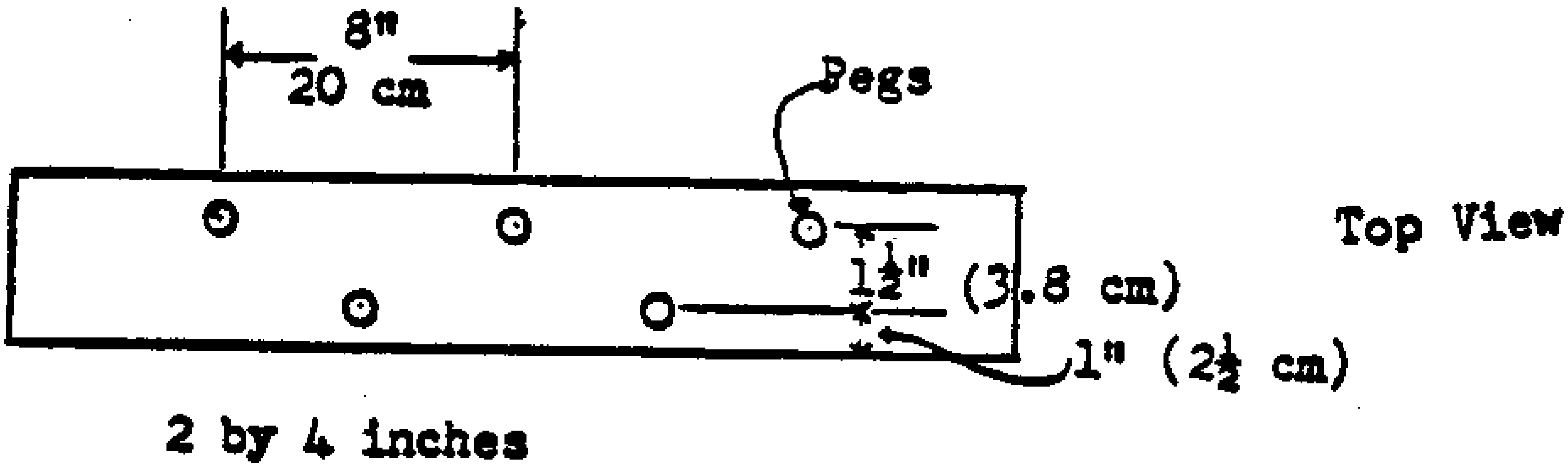
Four blocks of wood, for use in mounting the parts on a work bench.

A crank for twisting the wire into a spiral. **E**

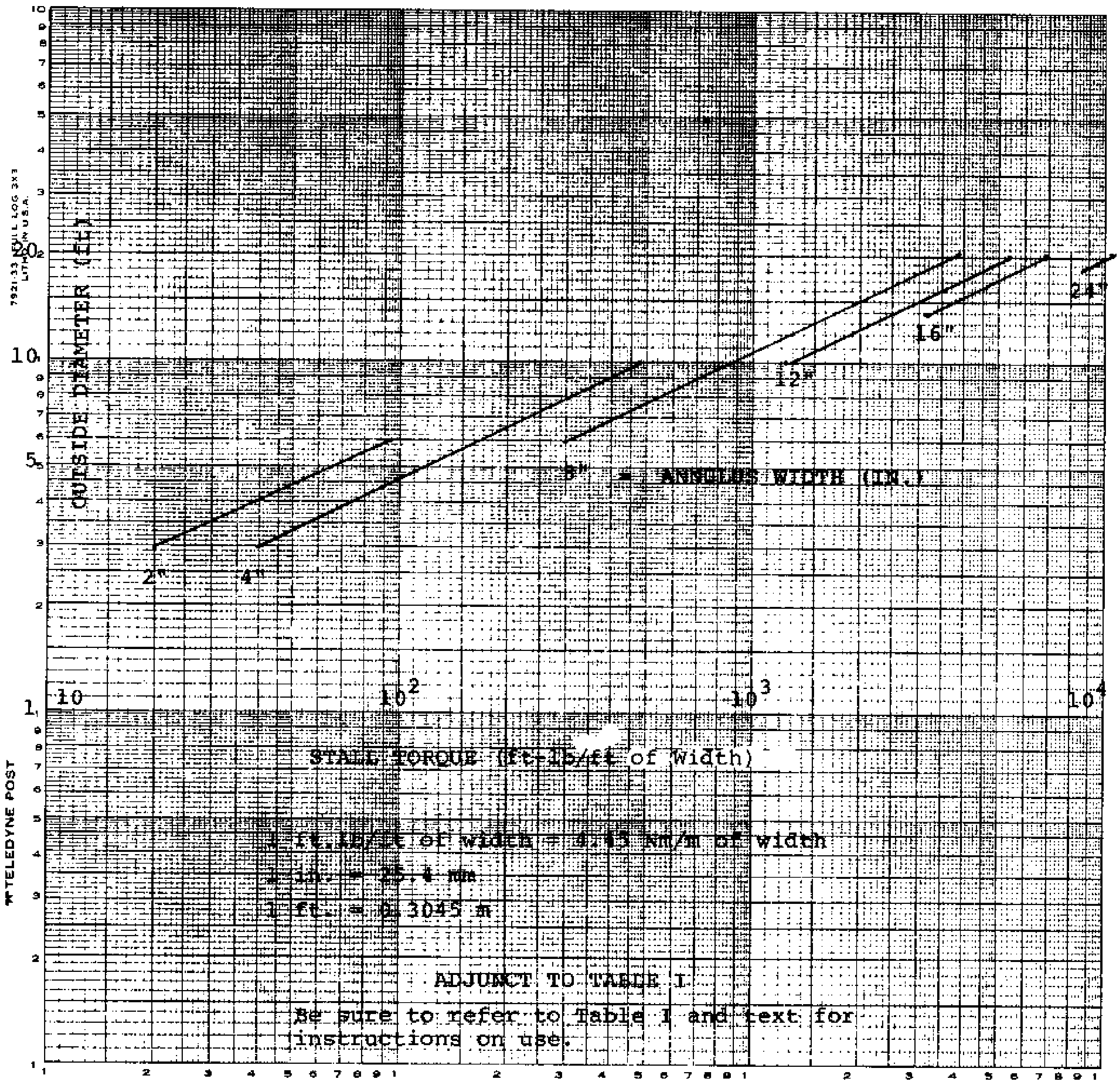


F Three small pulley sheaves, arranged in a row, to put tension on the wire as it feeds off the roll.

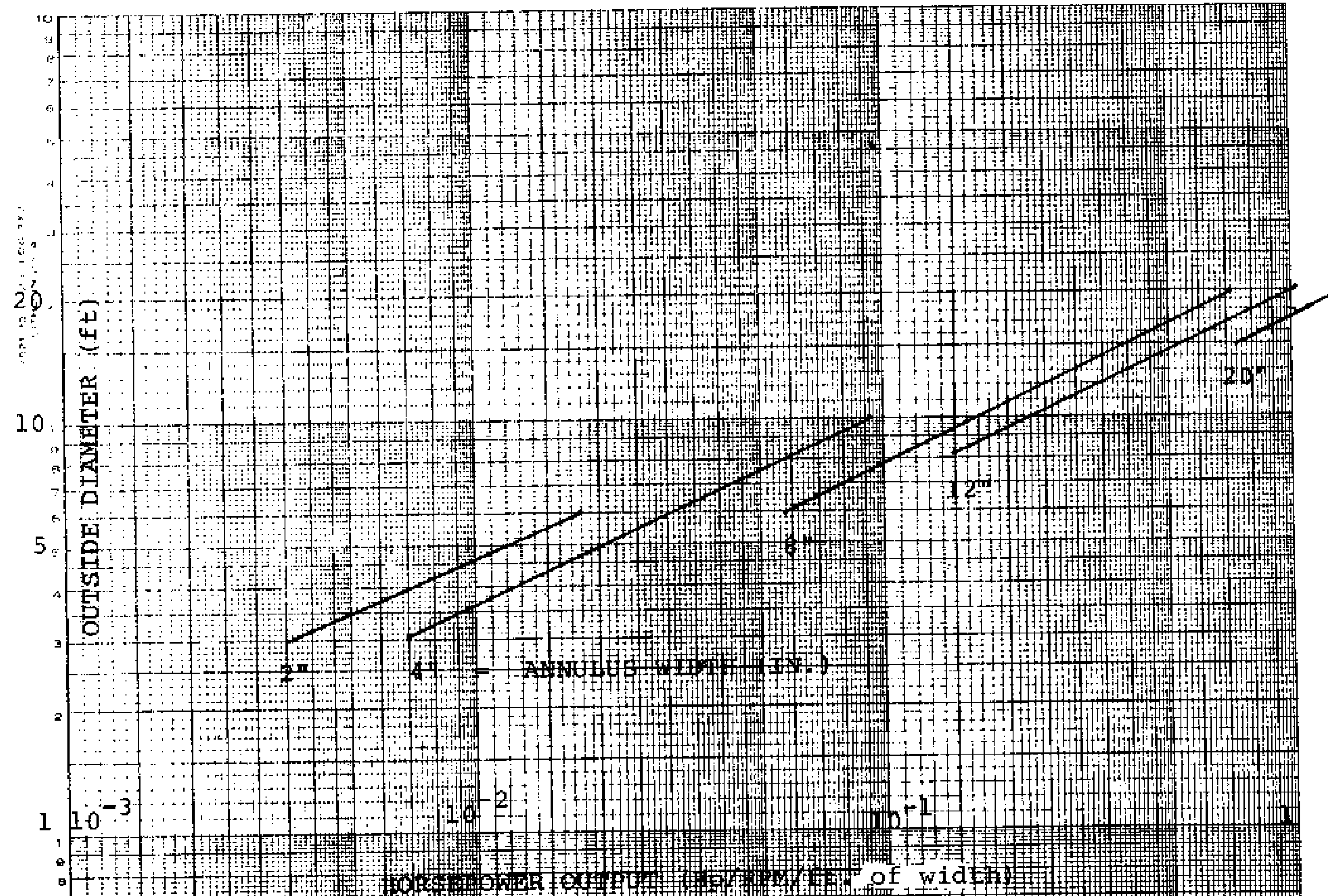

Wooden Pegs, 3/4 inch (2 cm) diameter
Wire
2 by 4 (inches)


8"
20 cm
Pegs
$1\frac{1}{2}$" (3.8 cm)
1" ($2\frac{1}{2}$ cm)
Top View
2 by 4 inches

Len Doak/Cover potter by Sam Baldwin



OUTSIDE DIAMETER (FT.)
20
10
5
1
2"
4"
8" = ANNULUS WIDTH (IN.)
12"
16"
24"
10
10^2
10^3
10^4
STALL TORQUE (ft-lb/ft of Width)
1 ft.-lb/ft of width = 4.45 Nm/m of width
1 in. = 25.4 mm
1 ft. = 0.3045 m
ADJUNCT TO TABLE I
Be sure to refer to Table I and text for instructions on use.
TELEDYNE POST



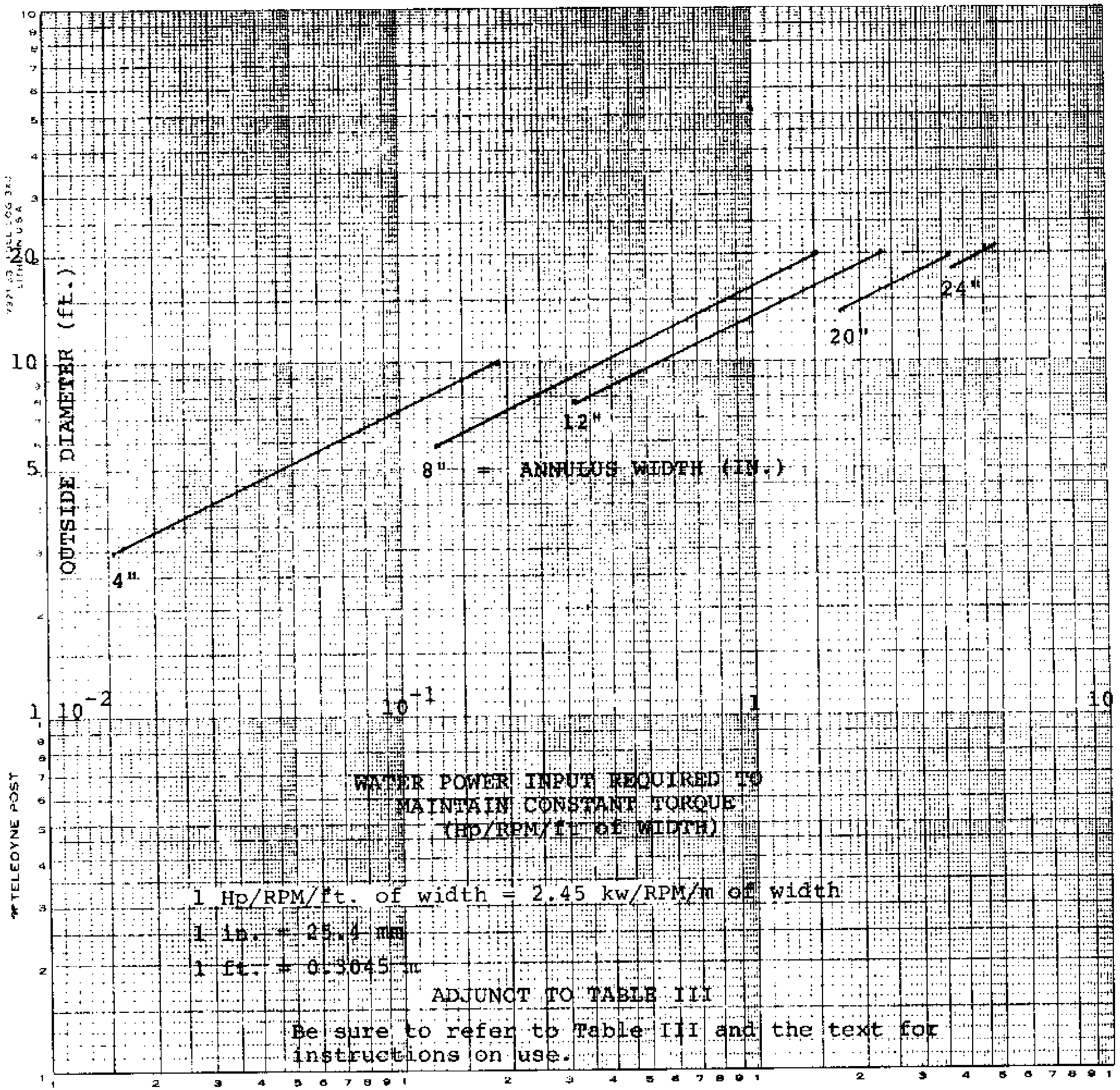
1 Hp/RPM/Ft of width = 2.45 kW/RPM/m of width

1 in. = 25.4 mm

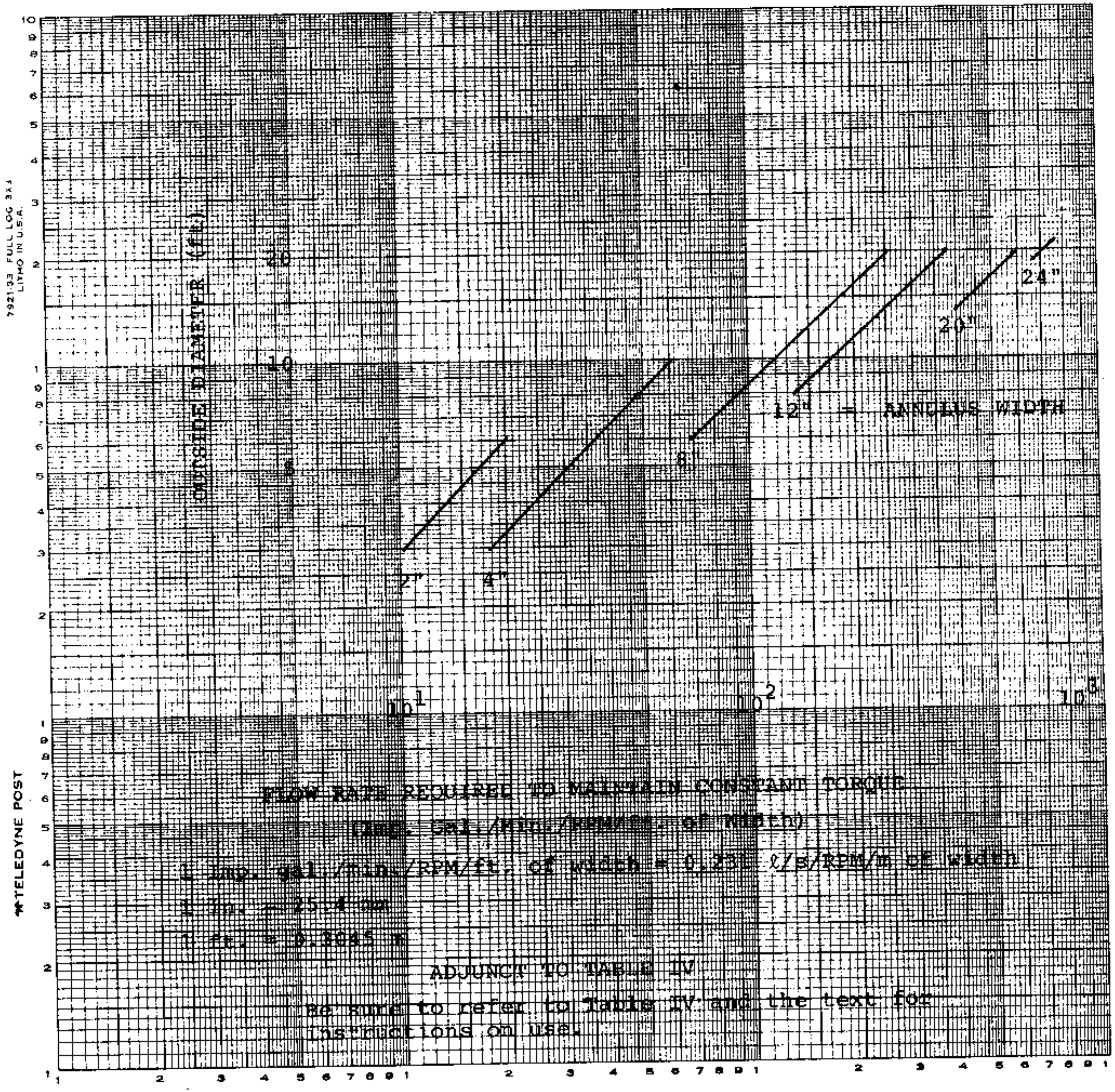
1 ft. = 0.3045 m

ADJUNCT TO TABLE II

Be sure to refer to Table II and text for instructions on use.



OUTSIDE DIAMETER (ft.)
4"
8" = ANNULUS WIDTH (IN.)
12"
20"
24"
20
10
5
1
10^{-2}
10^{-1}
1
10
WATER POWER INPUT REQUIRED TO MAINTAIN CONSTANT TORQUE (Hp/RPM/ft of WIDTH)
1 Hp/RPM/ft. of width = 2.45 kw/RPM/m of width
1 in. = 25.4 mm
1 ft. = 0.3045 m
ADJUNCT TO TABLE III
Be sure to refer to Table III and the text for instructions on use.
TELEDYNE POST



FLOW RATE REQUIRED TO MAINTAIN CONSTANT TORQUE

(Imp. Gal./Min./RPM/ft. of Width)

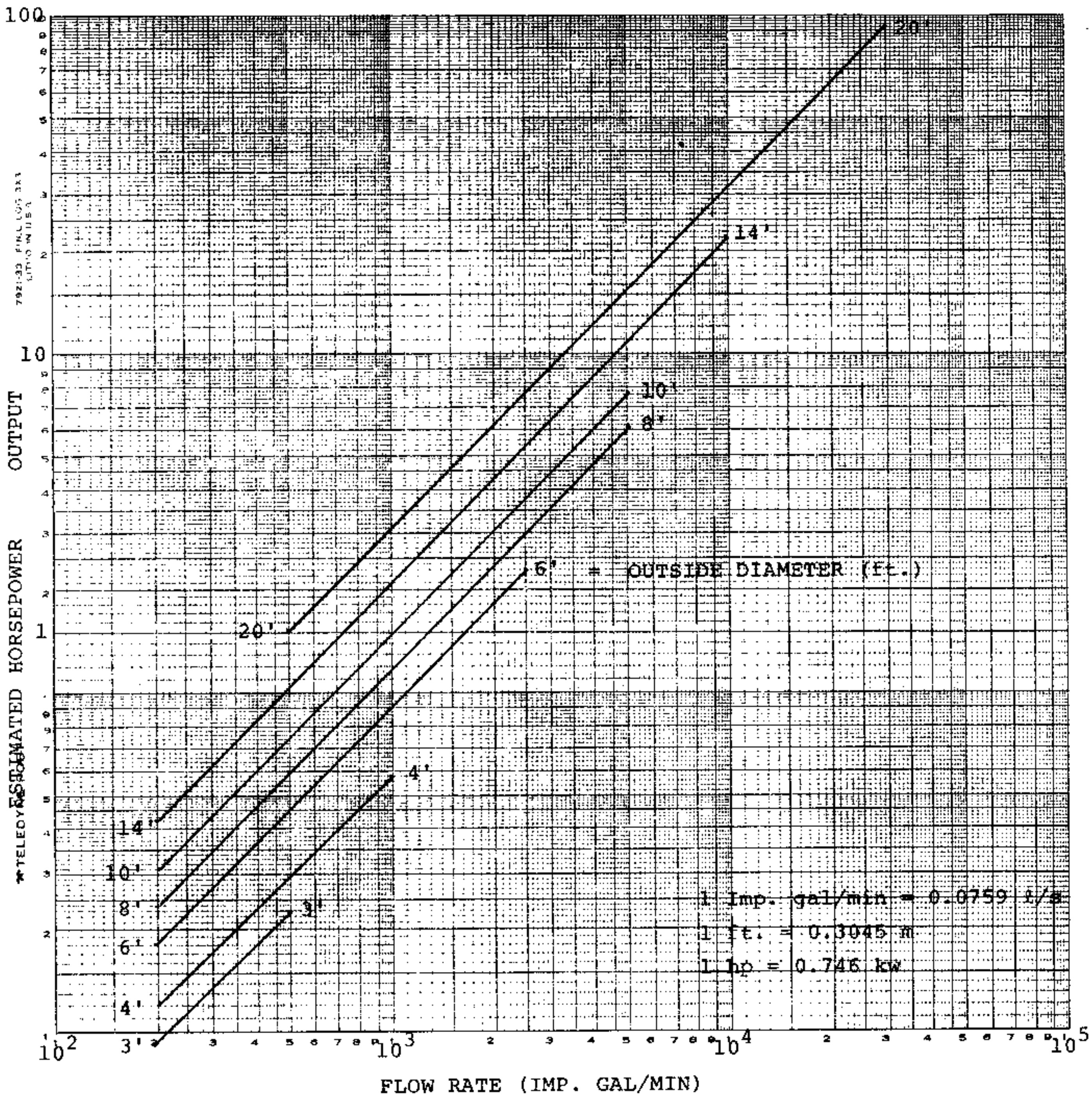
1 Imp. gal./min./RPM/ft. of width = 0.231 ℓ/s/RPM/m of width

1 in. = 25.4 mm

1 ft. = 0.3045 m

ADJUNCT TO TABLE IV

Be sure to refer to Table IV and the text for instructions on use.

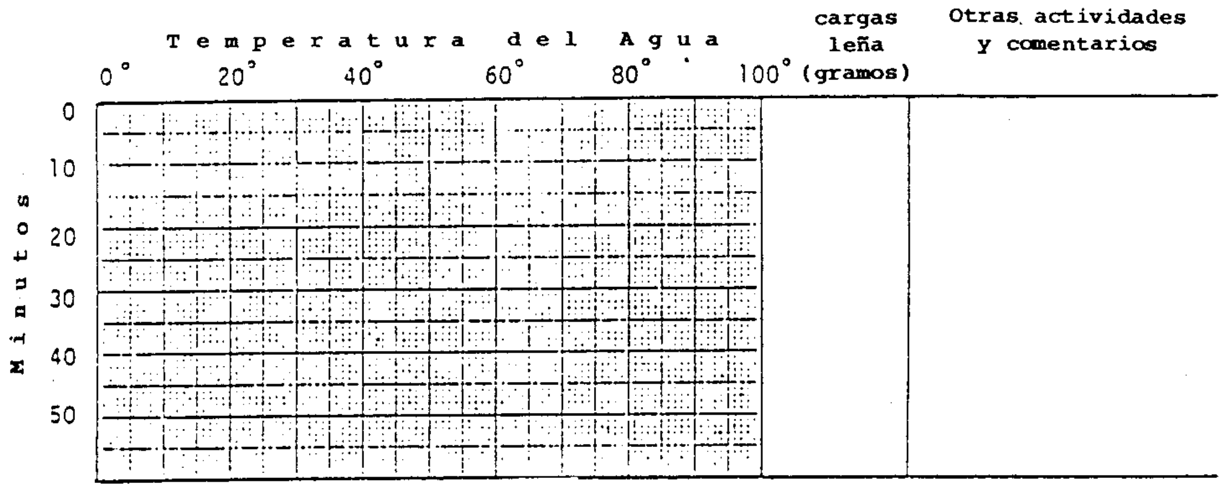


ADJUNCT TO TABLE V

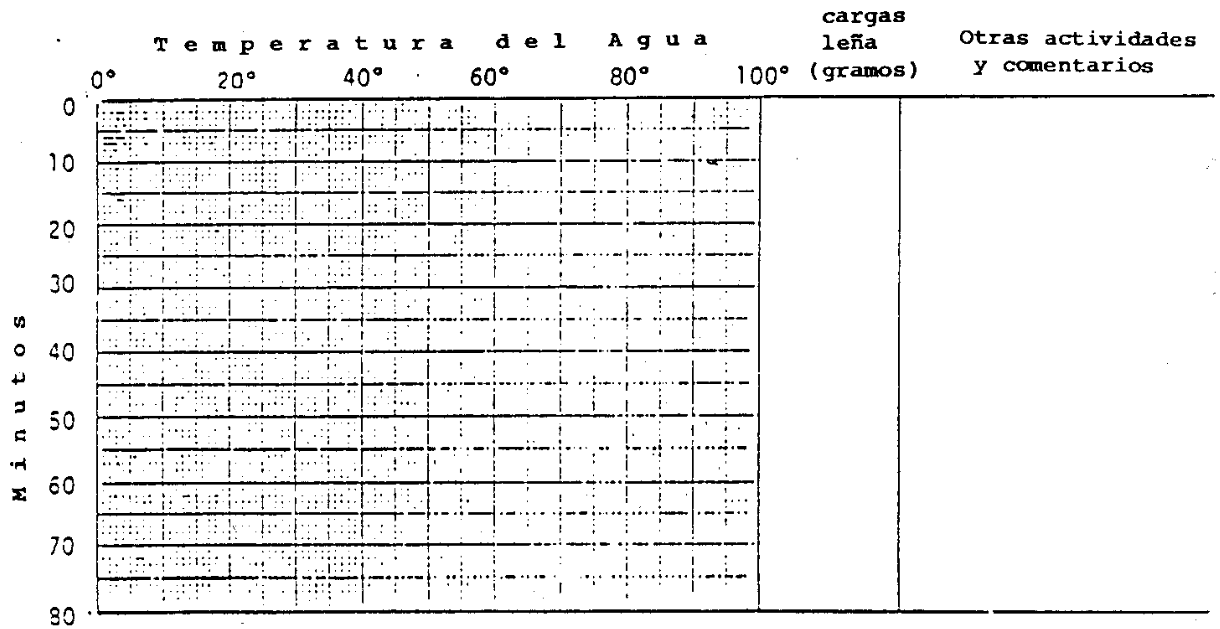
Be sure to refer to Table V and the text for instructions on use.

Formulario de Datos y Cálculos del EAH, continuación

GRAFICA TIEMPO/TEMPERATURA



Ensayo a Alta Potencia



Ensayo a Baja Potencia

Nombre y origen de la estufa ______________________________

____

Nombre(s) del (los) constructor(es) de la estufa ______________

Fecha de construcción ____________ Materiales usados ____________

____

Localización y condición de la estufa ______________________

____

VISTA EN PLANTA

PERSPECTIVA

VISTA DE CORTE CON OLLAS

VISTA FRONTAL

OLLAS		OLLA #1	OLLA #2	OLLA #3
	Peso (vacía)	______ kg	______ kg	______ kg
	Capacidad máxima	______ l	______ l	______ l
	Diámetro al borde	______ cm	______ cm	______ cm
	Composición	______	______	______

Detalles de la construcción de la estufa ______________________

____

____

____

Formulario para reportar series de ECC, continuación

Descripción de la comida estándard ______________________________

____

____

Procedimientos definidos para cocinar la comida ________________

____

____

____

____

____

Resumen de comentarios del cocinero(a), estufa #1 ________________

____

____

____

____

____

____

____

Resumen de comentarios del cocinero(a), estufa #2 ________________

____

____

____

____

____

____

____

Formulario para reportar series de ECC, continuación

Nombre y origen de la estufa ______________________________

____

Nombre(s) del (los) constructor(es) de la estufa ______________

Fecha de construcción ____________ Materiales usados ____________

____

Localización y condición de la estufa ______________________

____

VISTA EN PLANTA

PERSPECTIVA

VISTA DE CORTE CON OLLAS

VISTA FRONTAL

OLLAS		OLLA #1	OLLA #2	OLLA #3
	Peso (vacía)	______kg	______kg	______kg
	Capacidad máxima	______l	______l	______l
	Diámetro al borde	______cm	______cm	______cm
	Composición	______	______	______

Detalles de la construcción de la estufa ______________________

____

____

C. Tipo de estufa o situación de cocina 2: ____________________

____

Ensayo #	Fecha	Resultados para el ensayo del parámetro primario	Resultados para el ensayo del parámetro secundario
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________
____	____	____________	____________

Número de ensayos (n_2)	____________	____________
Valor de la media para el parámetro de ensayo (X_2)	____________	____________
Desviación estándard para el parámetro de ensayo (S_1)	____________	____________
Coeficiente de variación (CDV_2)	____________	____________
Error estándard ($S_2/\sqrt{N_2}$)	____________	____________
Intervalo de confianza del 95%; ($\overline{X}_2 \pm 2S_2$)	____________	____________

Otros comentarios o cálculos ______________________________________

____

____

D. Comparación de resultados:

Diferencia entre medias ($\overline{X}_1 - \overline{X}_2$)	____________	____________
Porcentaje de ahorros ($\overline{X}_1 - \overline{X}_2$) / X_1	____________	____________
Estadístico t $(\overline{X}_1 - \overline{X}_2) \left[\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2} \right]^{1/2}$	____________	____________
Grados de libertad ($n_1 + n_2 - 2$)	____________	____________
Nivel de significancia (el más pequeño α en la tabla t) para el cual el estadístico t es mayor que el valor en la tabla t.	____________	____________

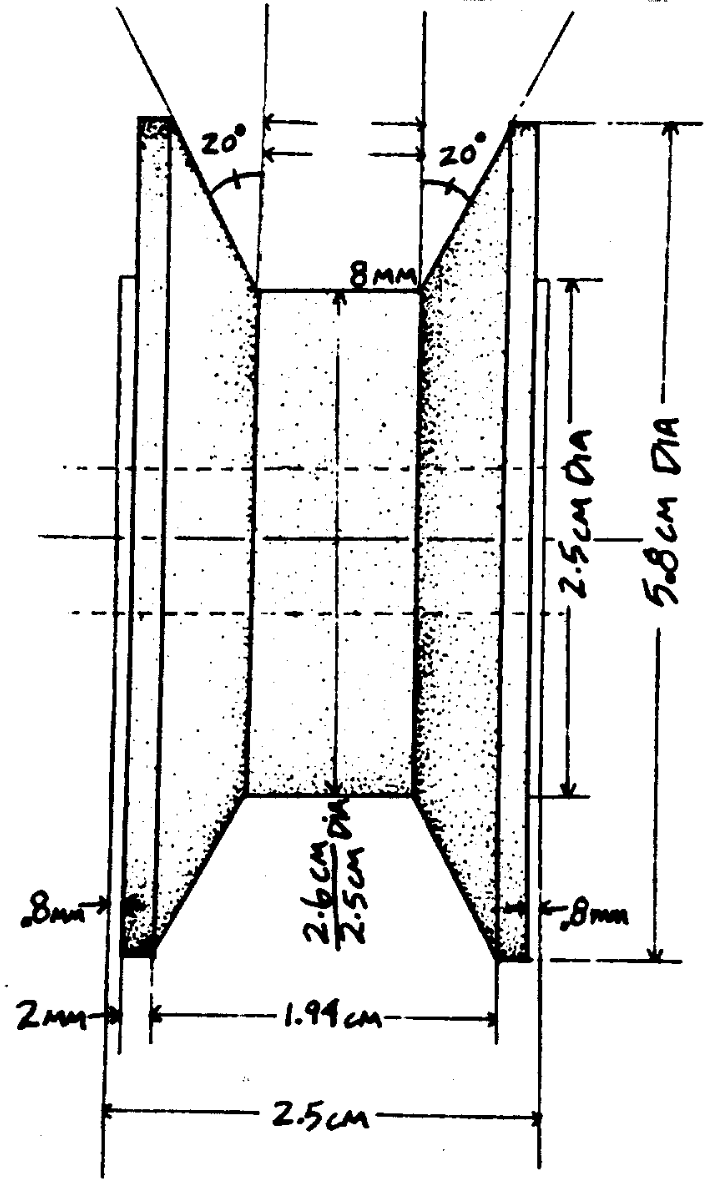


Figure 5. Roller (side view)

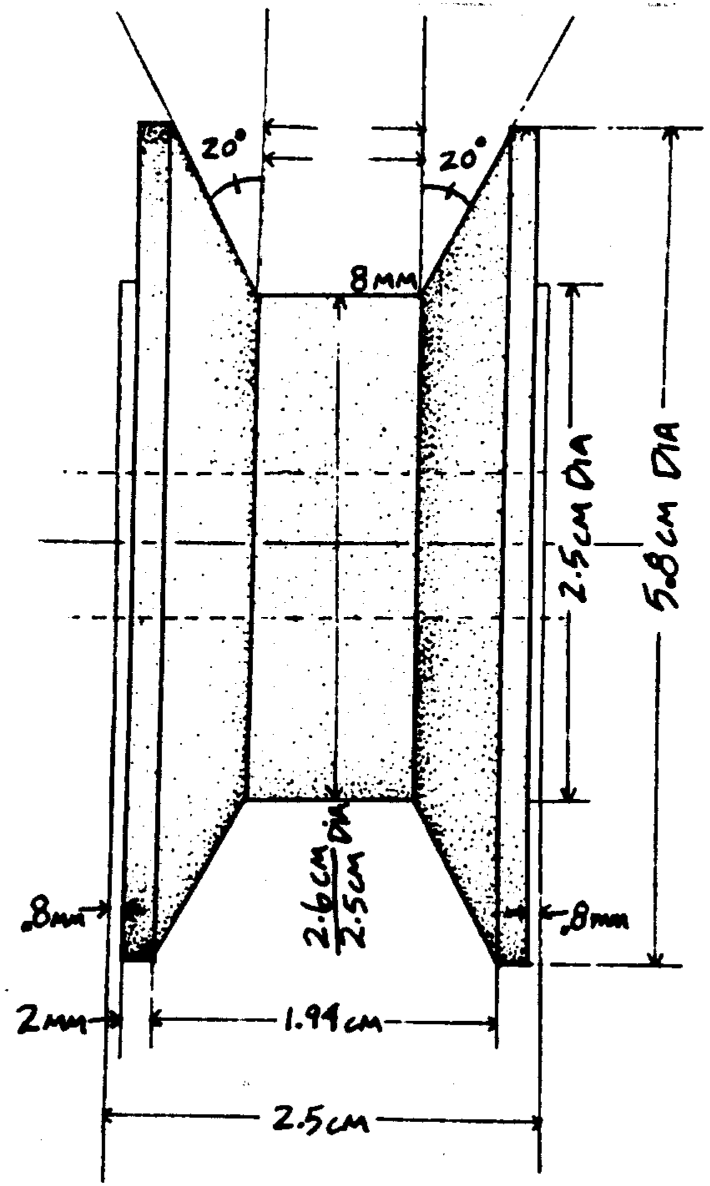


Figure 5. Roller (side view)

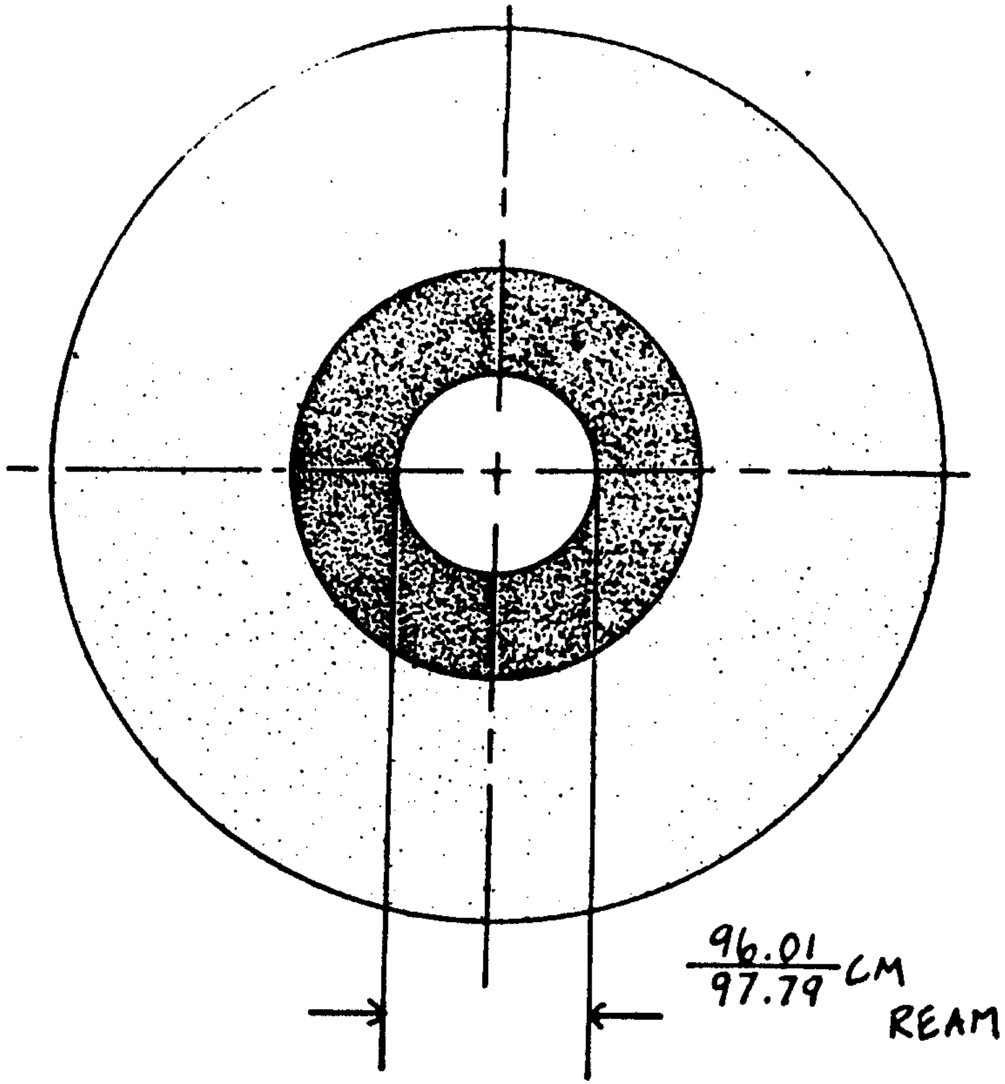


Figure 6. (top view)

PLANNING TO MEET VILLAGE/HOUSEHOLD ENERGY NEEDS

Household
- cooking
- space heat
- water heat
- light
- refrigeration
- water pumping
- transport

Agricultural Processing
- land clearing, plowing, tilling.
- fertilizers
- water pumping, drainage
- grinding
- threshing
- drying

Commercial, Industrial, and Public Services
- loom/machine drive
- firing: kiln, smithing
- space heat
- water heat
- process steam and heat
- light

Transport

→

Kinds of Energy
- heat
- light
- mechanical power

→

Energy Sources

Inanimate

wind	solar
water	biomass
direct sunlight	fossil fuel

Animate
- people
- draft animals

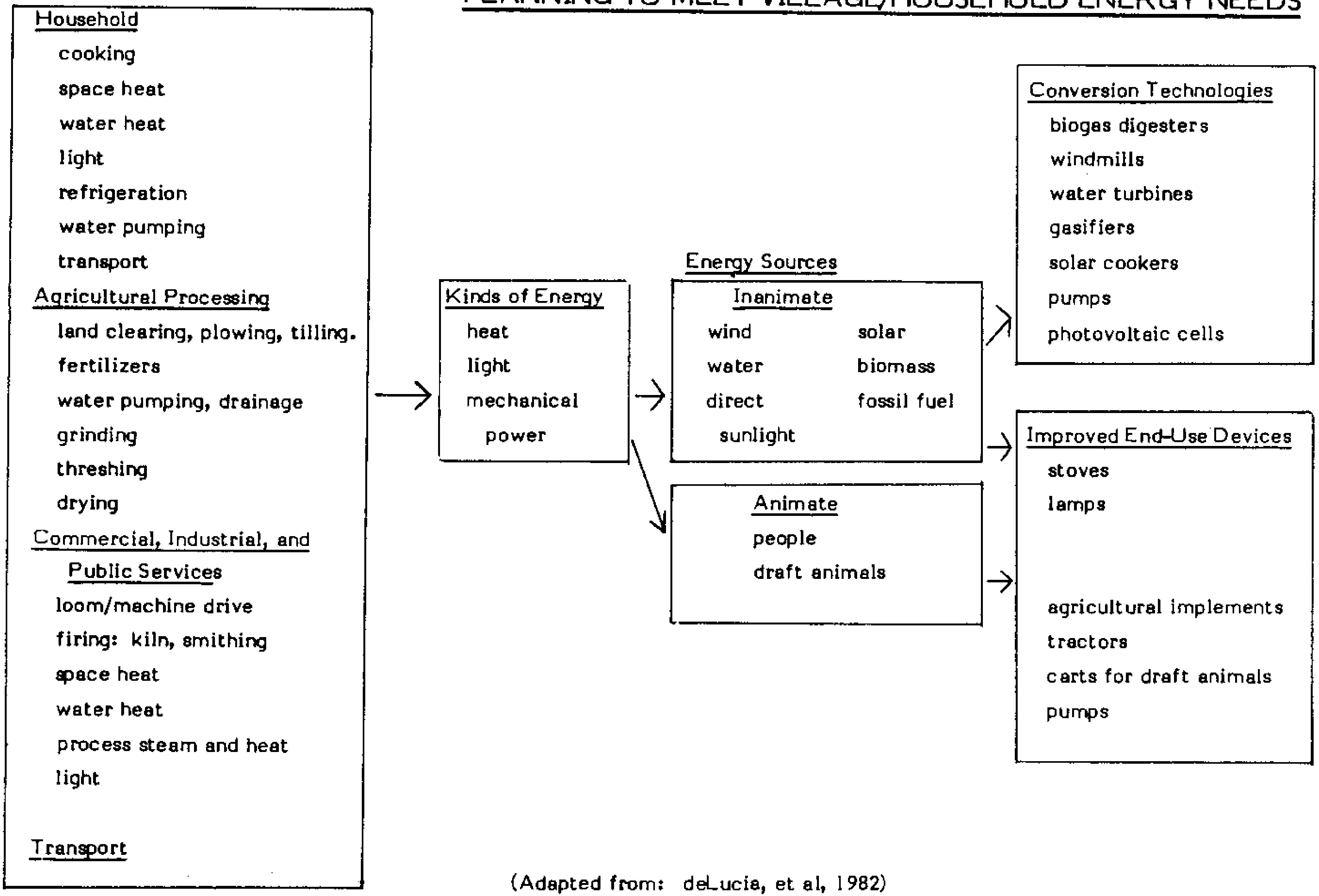
→

Conversion Technologies
- biogas digesters
- windmills
- water turbines
- gasifiers
- solar cookers
- pumps
- photovoltaic cells

Improved End-Use Devices
- stoves
- lamps
- agricultural implements
- tractors
- carts for draft animals
- pumps

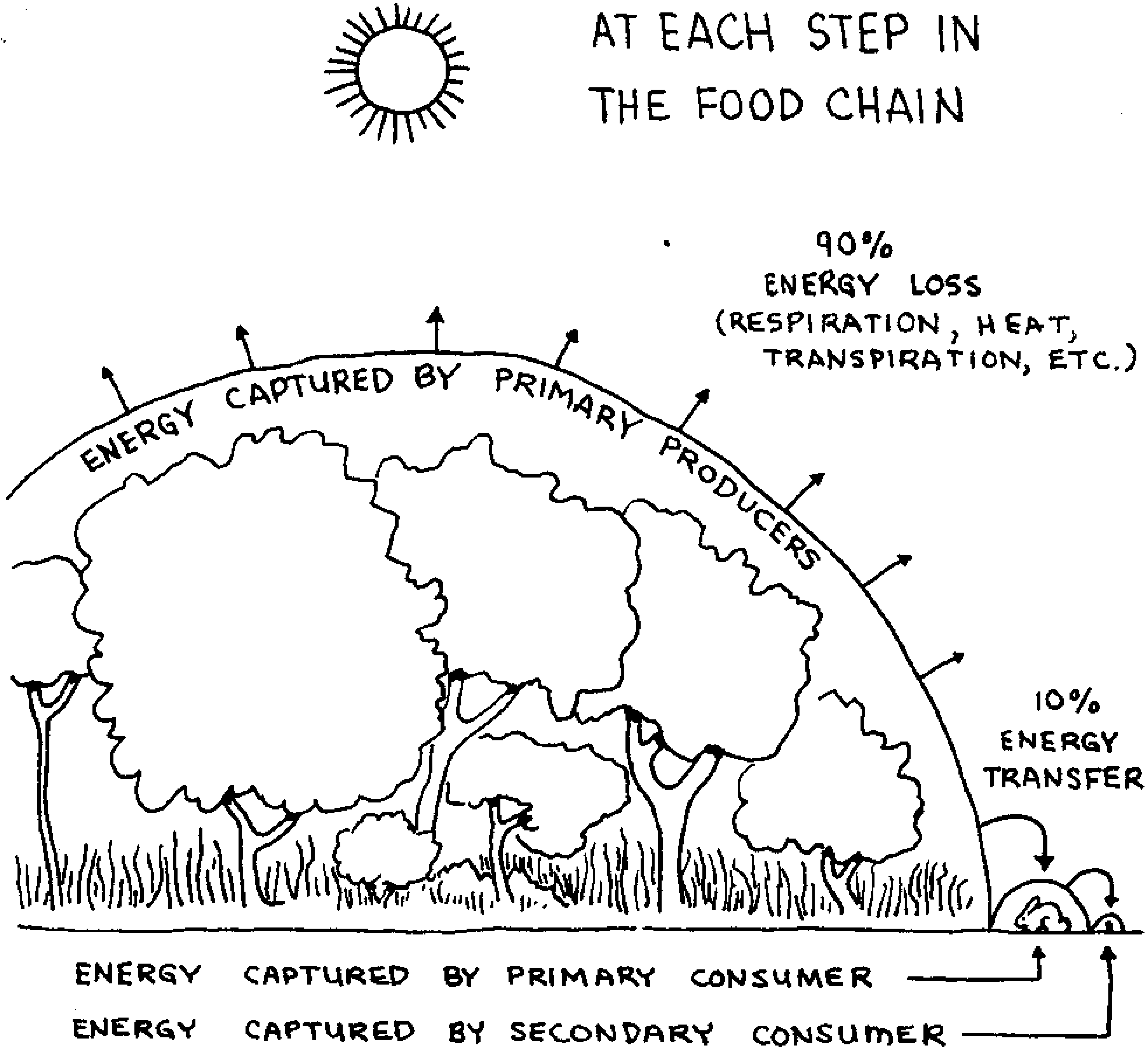
(Adapted from: deLucia, et al, 1982)

PLANNING TO MEET VILLAGE/HOUSEHOLD ENERGY NEEDS



(Adapted from: deLucia, et al, 1982)

ENERGY LOSS OCCURS AT EACH STEP IN THE FOOD CHAIN



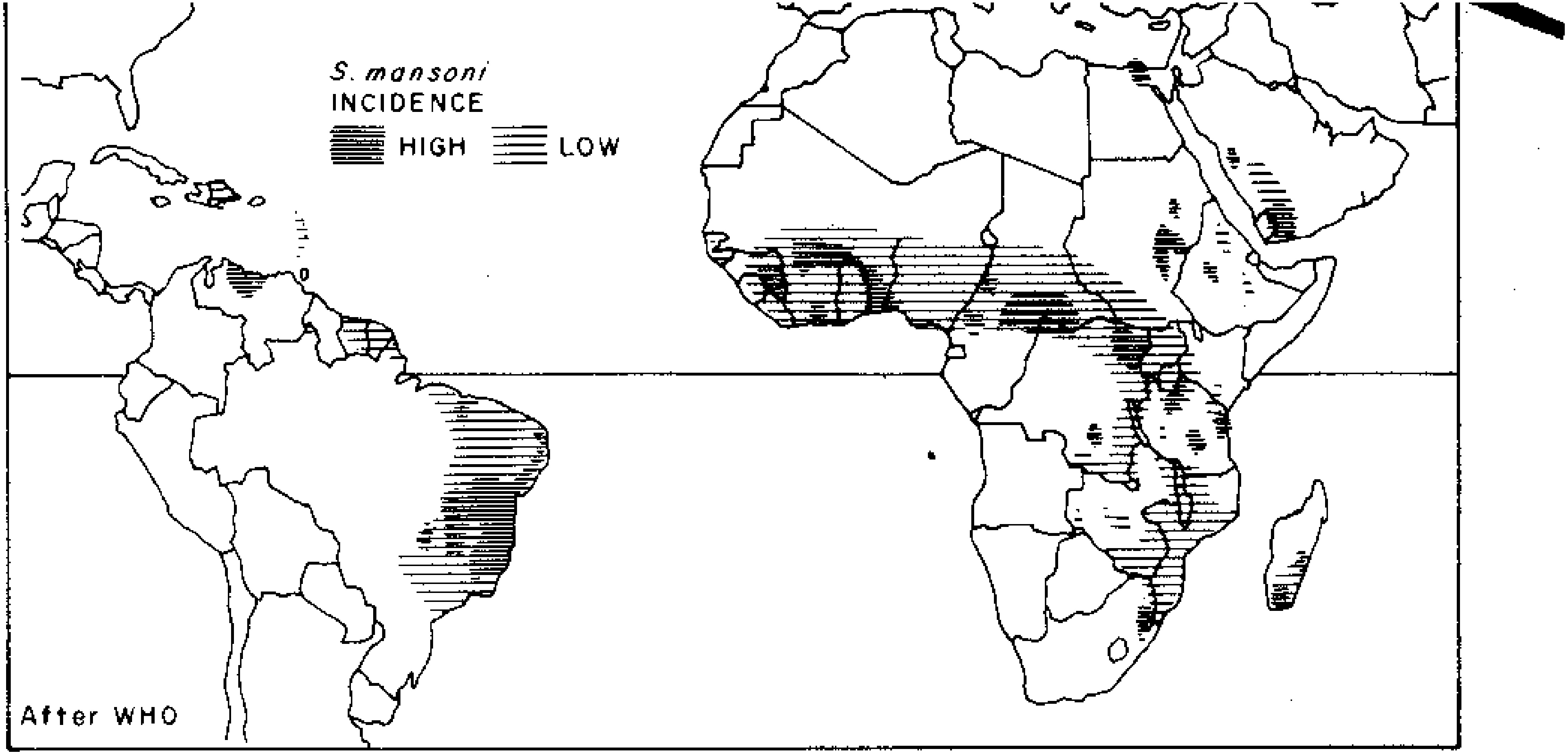


Figure 3. World Distribution of S. mansoni

(after, McJunkin, 1975)

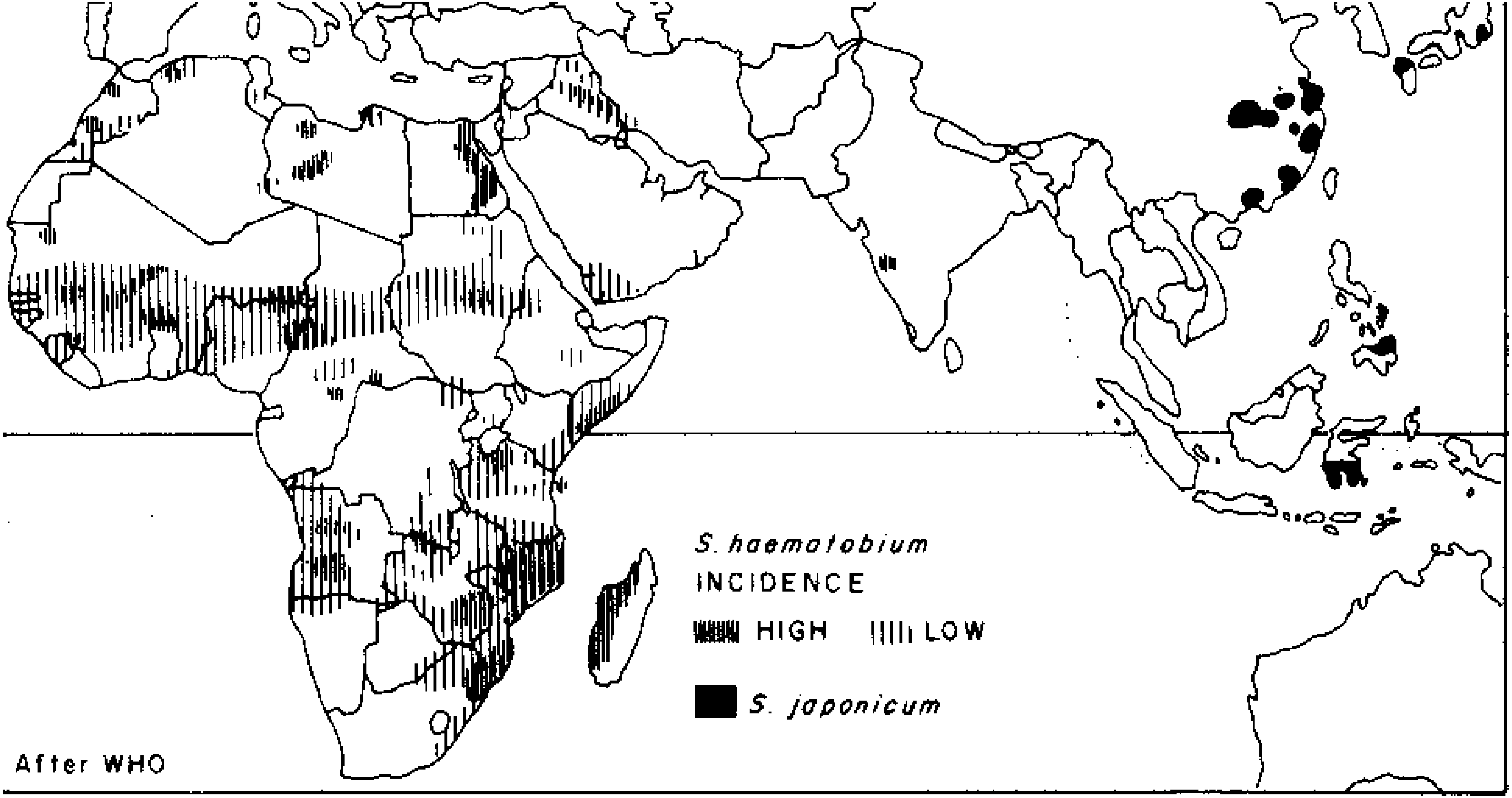


Figure 4. World Distribution of <u>S. haematobium</u> and <u>S. japonicum</u> (after McJunkin, 1975)

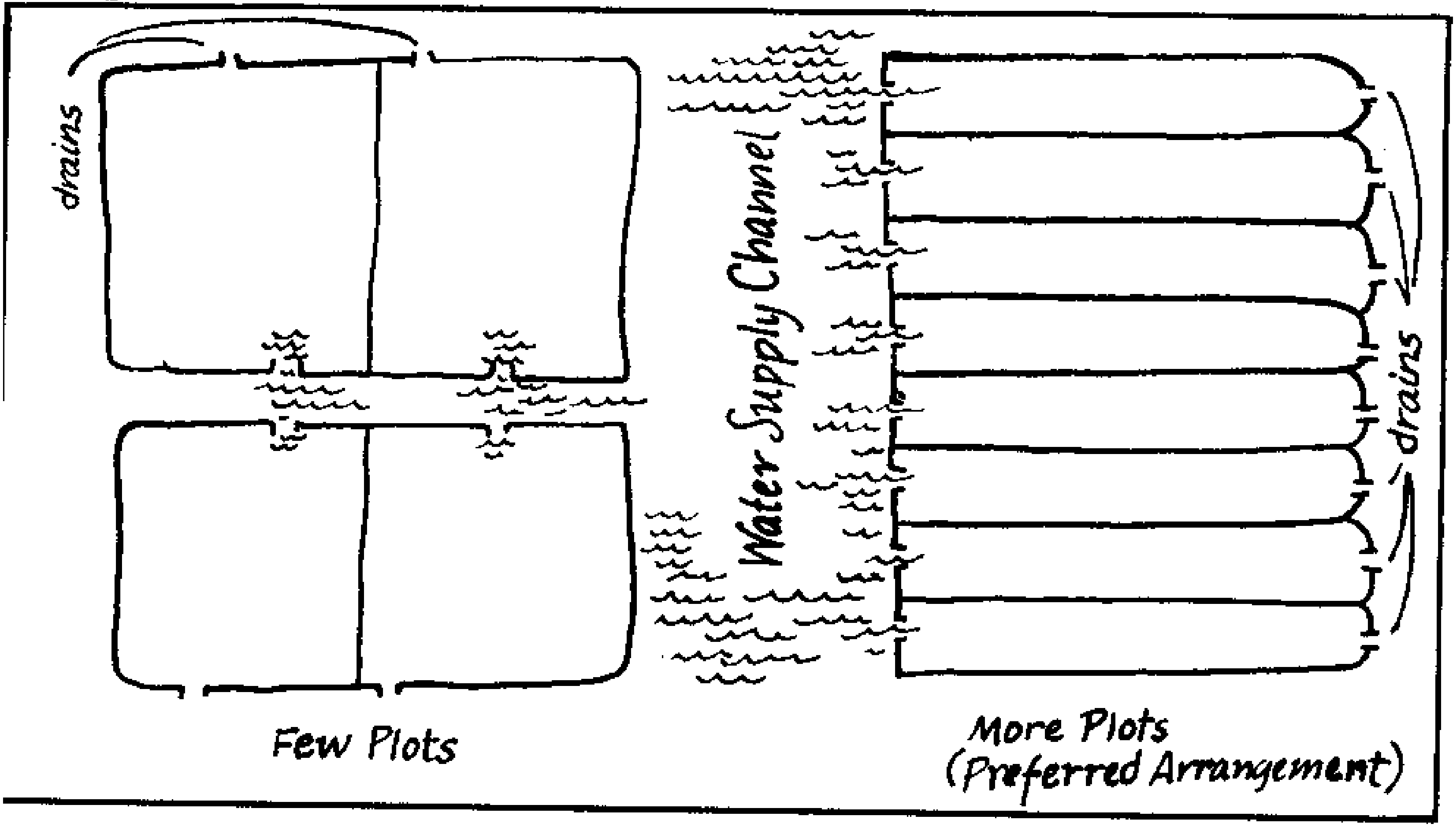


Figure 25. Basin Arrangement

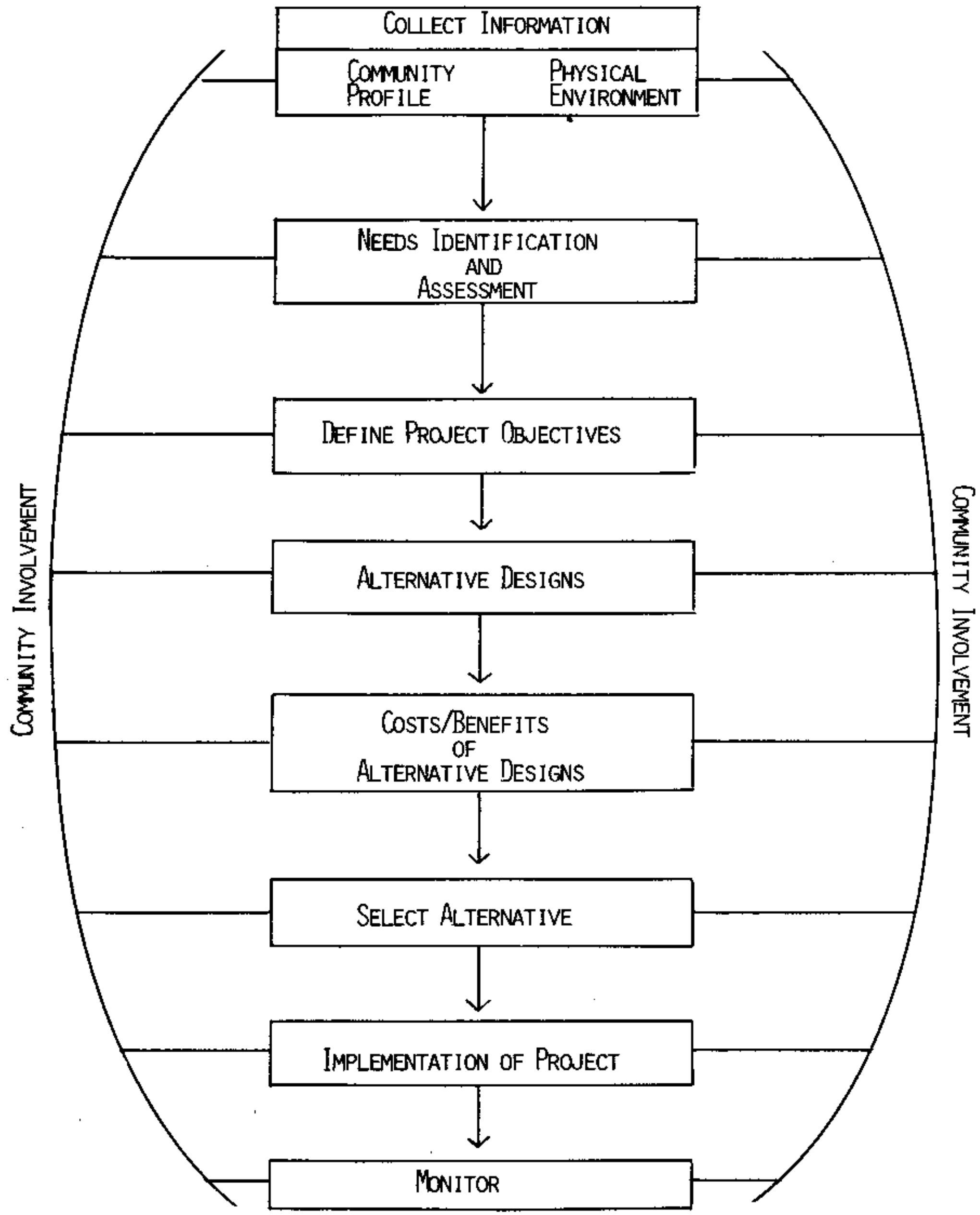


Figure 27. A Planning Process

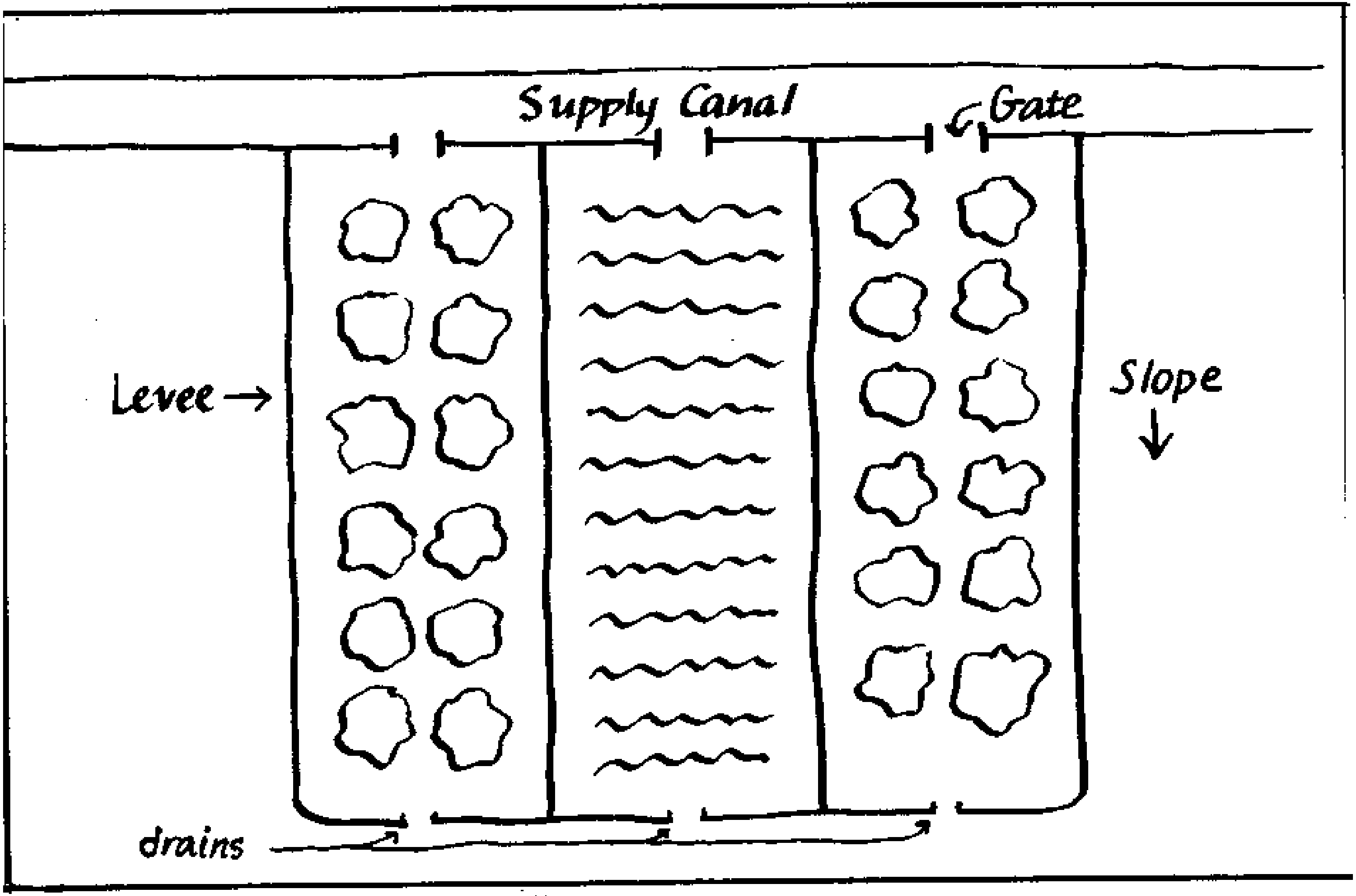


Figure 26. Border Irrigation

Social Returns. Rank high projects which can be shown to bring cultural and social gains to the community. Move toward lower end as social and cultural gains become less clear and/or the effects of the effort seem likely to be socially or culturally descriptive. Rank high a project which enables residents to participate with least risk. Move toward the lower end of the scale as it becomes clear that participants run more risk, i.e., as their investment demands a level of commitment which would have serious consequences were the project to fail. Assume for project feasibility that the smaller the degree of change required in local custom, the easier it will be to get the project underway. Rank as high projects which require little change; move lower as more change is required.

NATURAL ENVIRONMENT

Relevance to Guidelines. Rank as high a project which meets all or most of the guidelines for an ecologically sustainable activity. Move lower as the project fails to meet these guidelines.

Alternative Design #1	(Costs) − 1 2 3 4 5 6 7 8 9 10 (Benefits) +
economic returns	
technical resources	
social/cultural	
physical environment	

Alternative Design #2	
economic returns	
technical resources	
social/cultural	
physical environment	

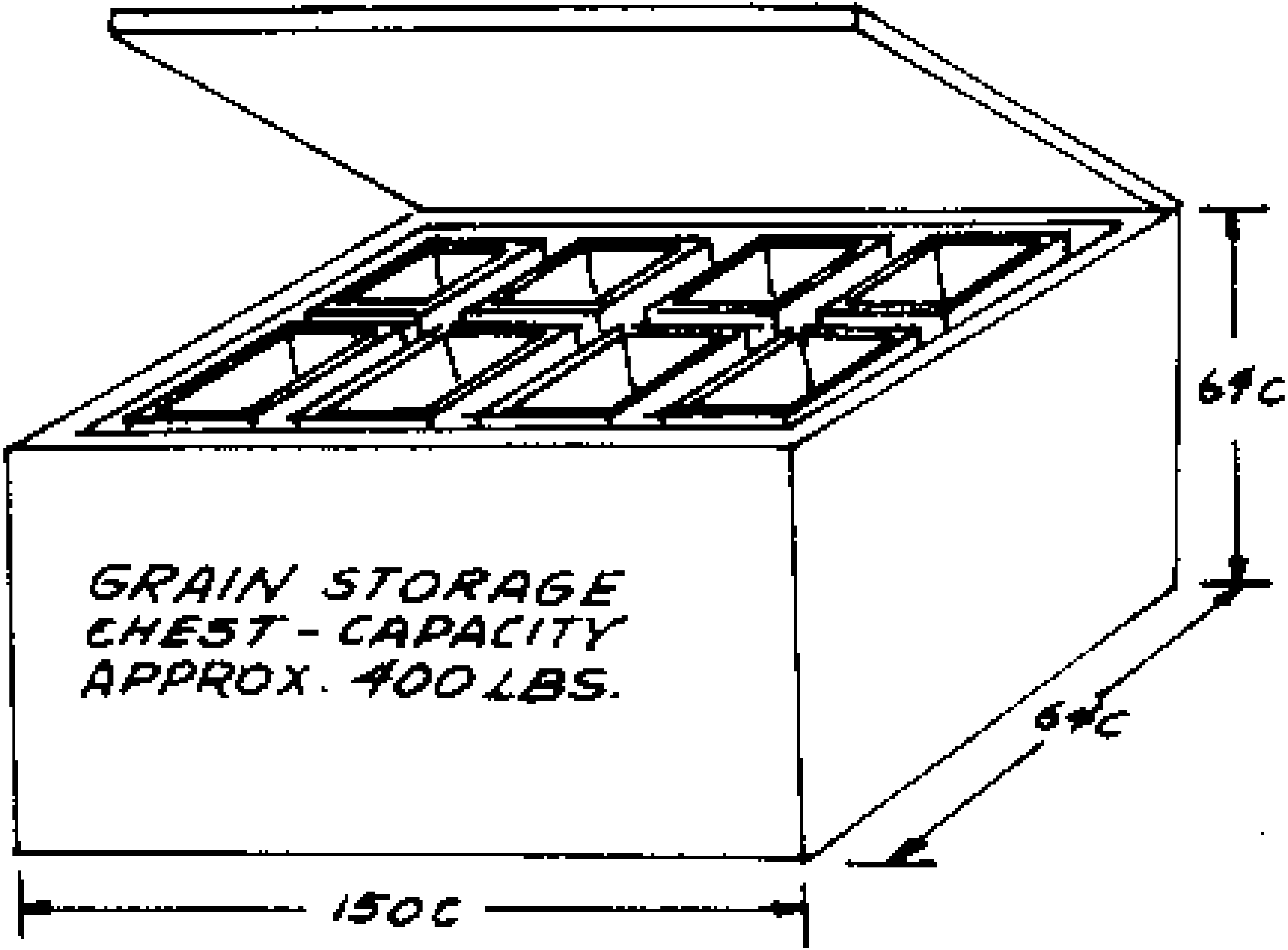


FIGURE 1

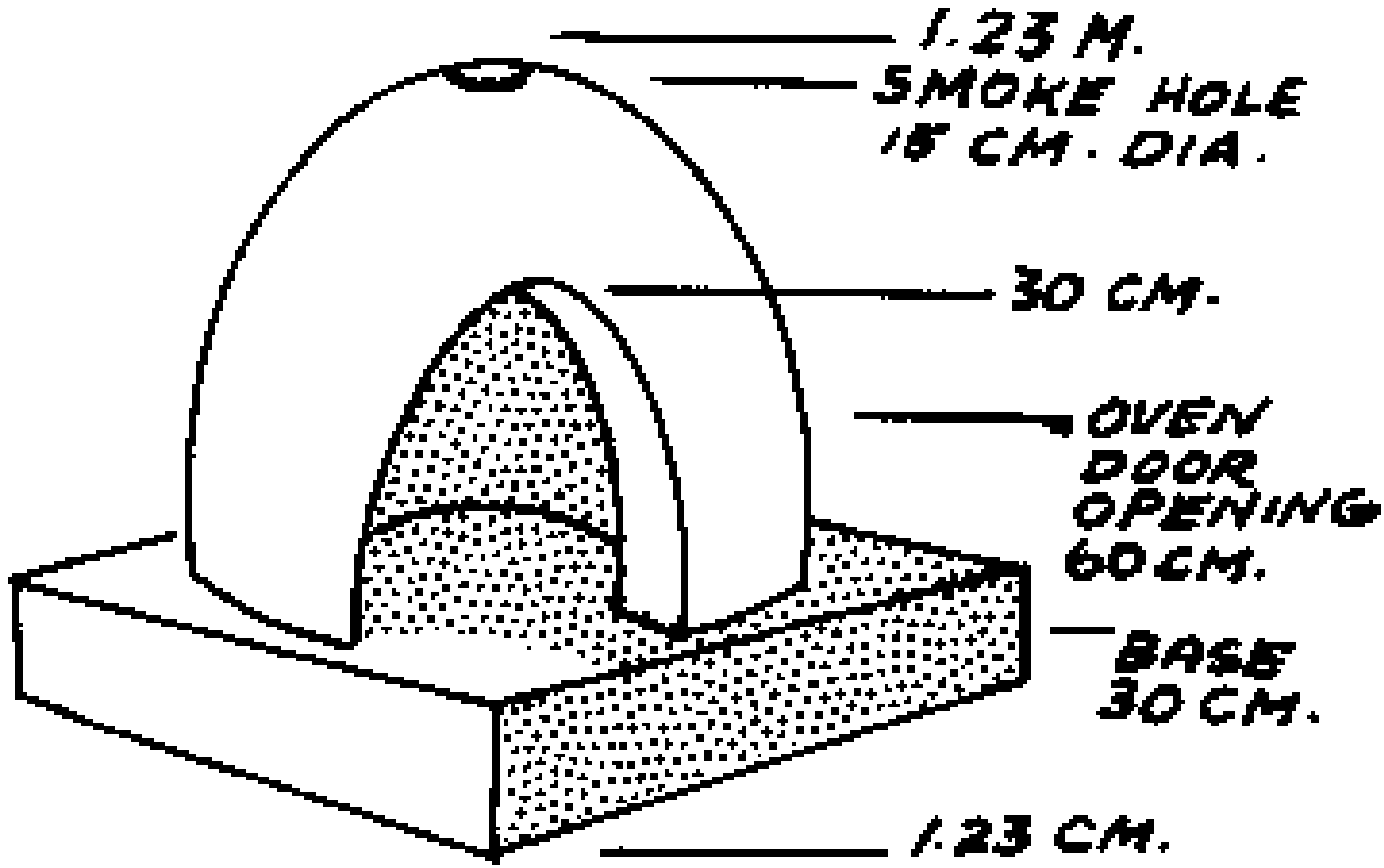


FIGURE 2. THE OUTDOOR OVEN AFTER BEING PLASTERED.

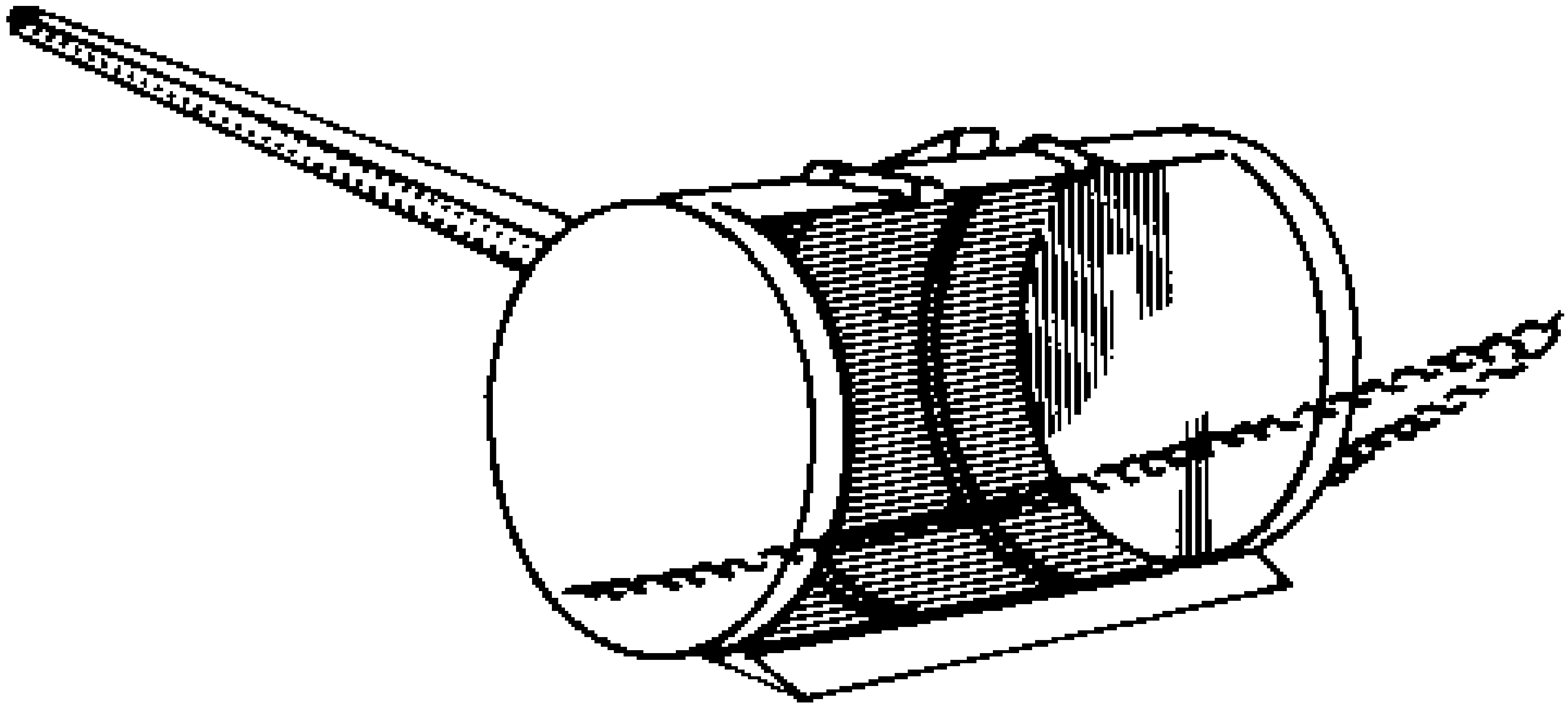


FIGURE 1. BARREL FRESNO SCRAPER

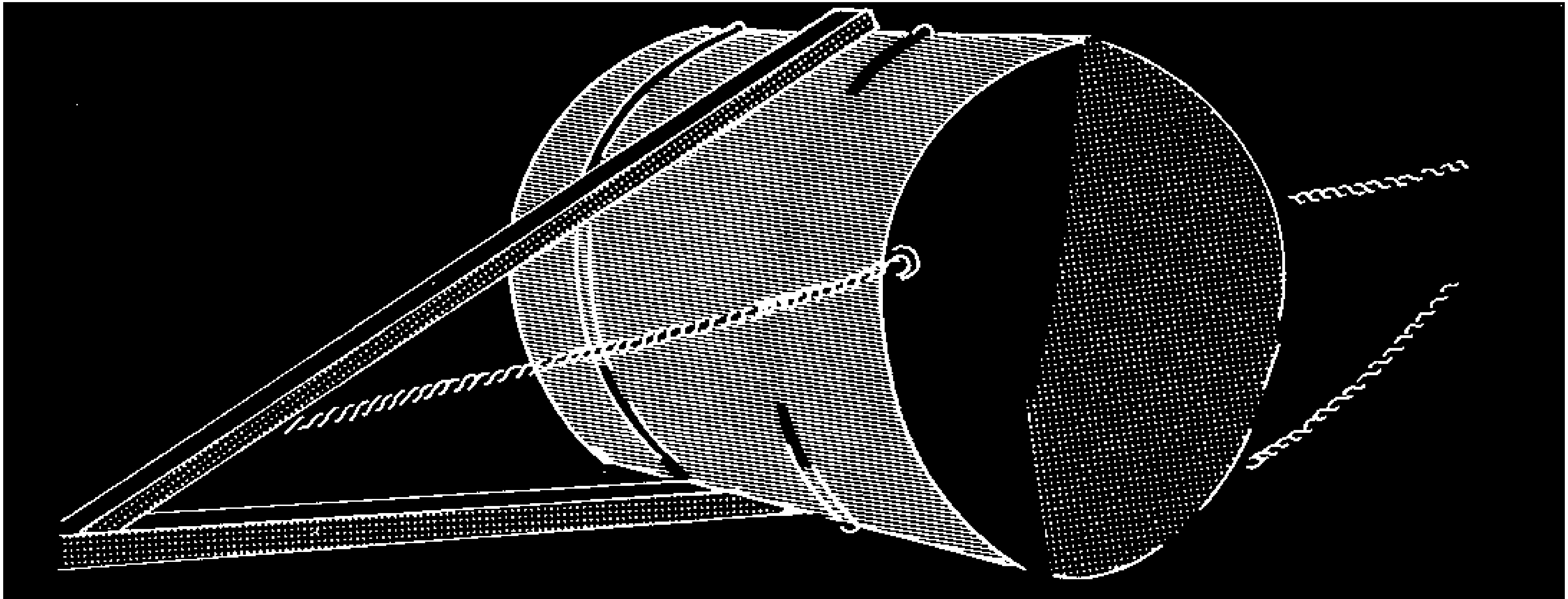
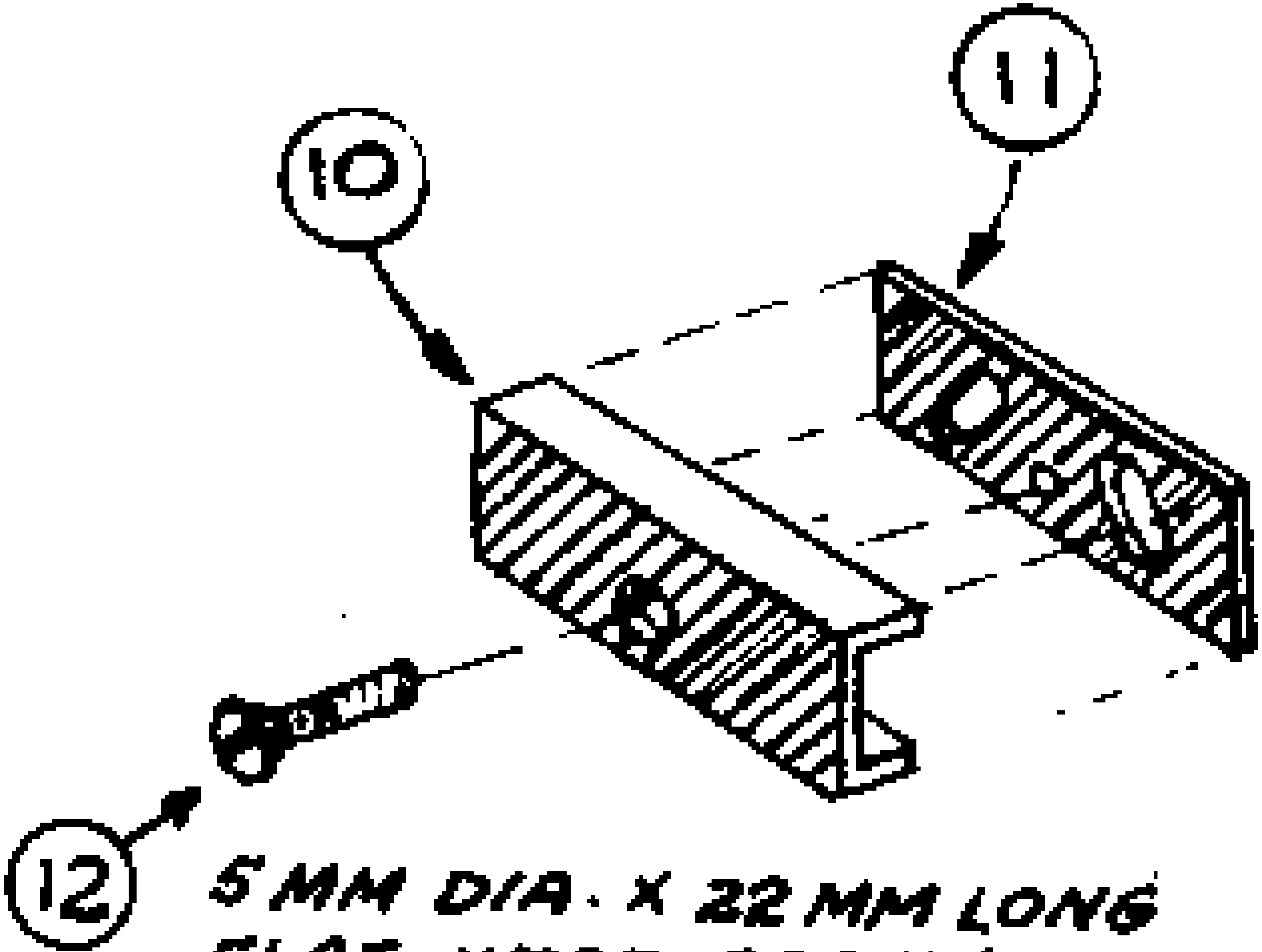
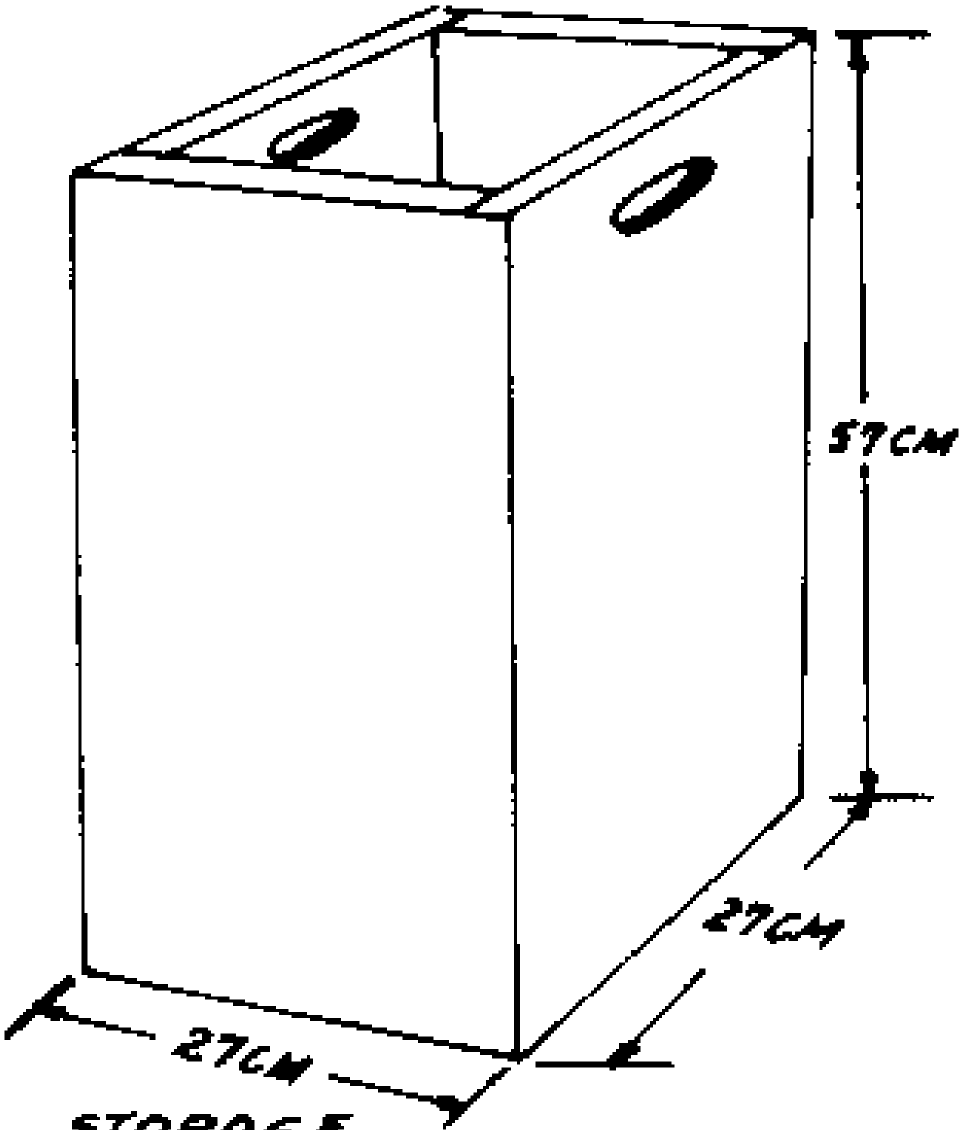


FIGURE 2.



5 MM DIA. X 22 MM LONG
FLAT HEAD SCREW
(2 REQUIRED)

FIGURE 8



STORAGE
CONTAINER
CAP: 35 LITERS - 50LBS.
FIGURE 2

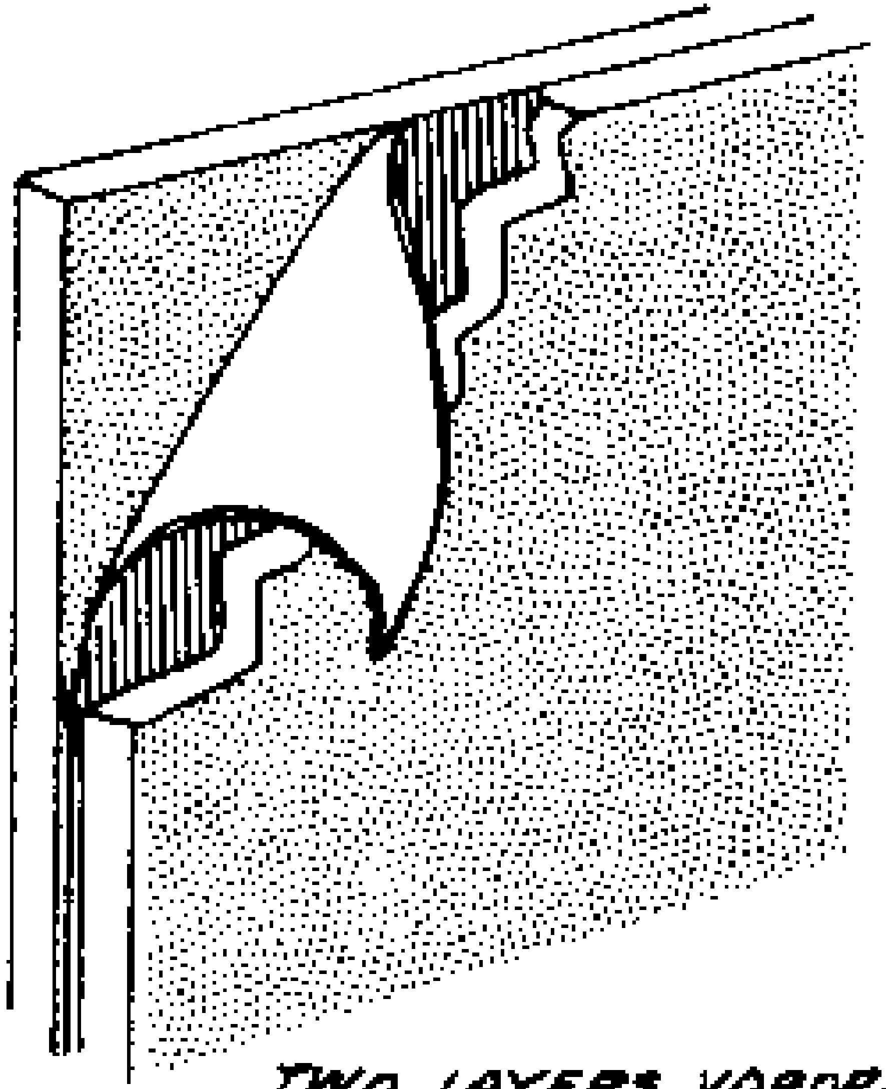


FIGURE 3

TWO LAYERS VAPOR-
BARRIER - IMPREGNATED
BUILDING PAPER

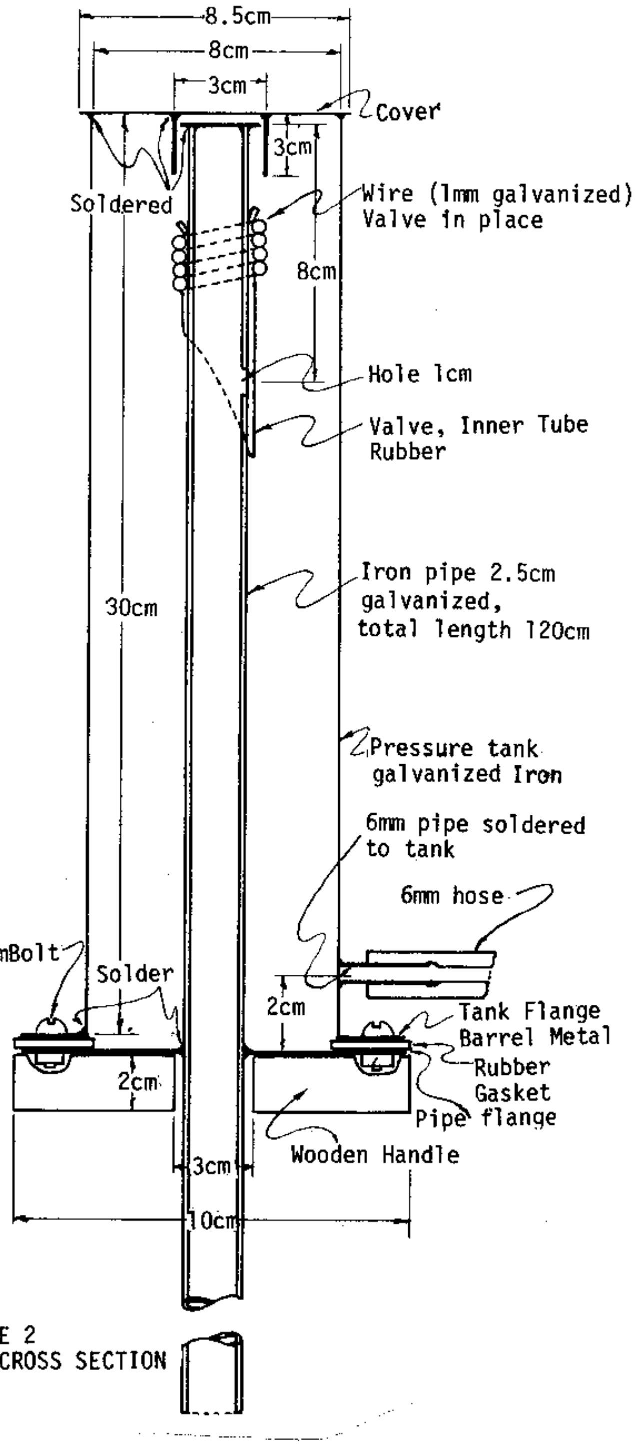


FIGURE 2
PUMP CROSS SECTION

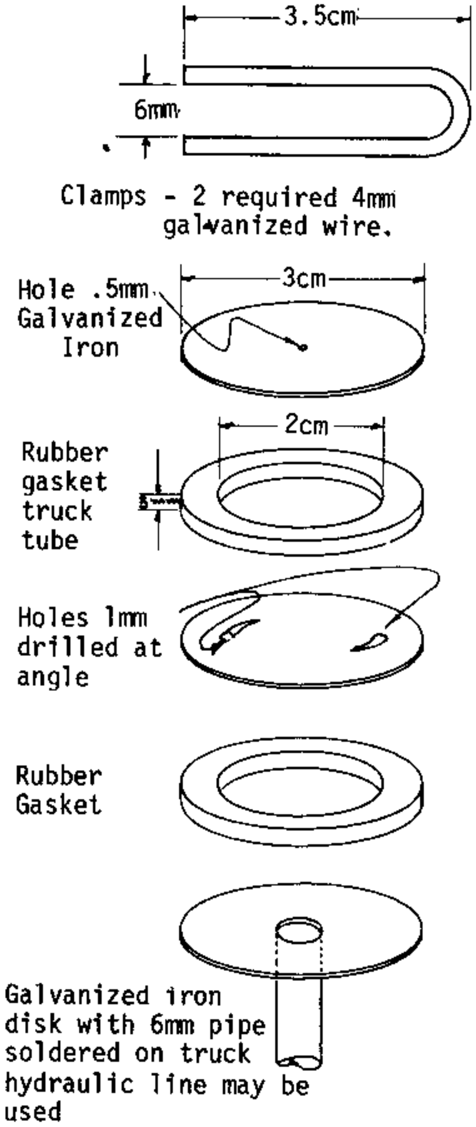


FIGURE 3
DISK NOZZLF

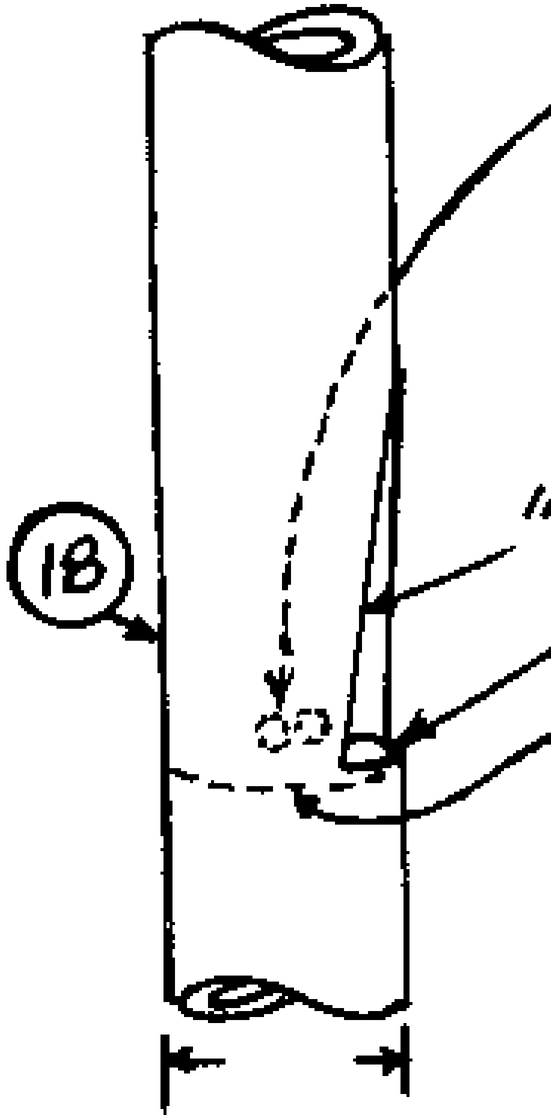


FIG 6. DETAIL OF PIPE, PART 18, SHOWING CONNECTION FOR PART 16, AGITATOR SPRING.

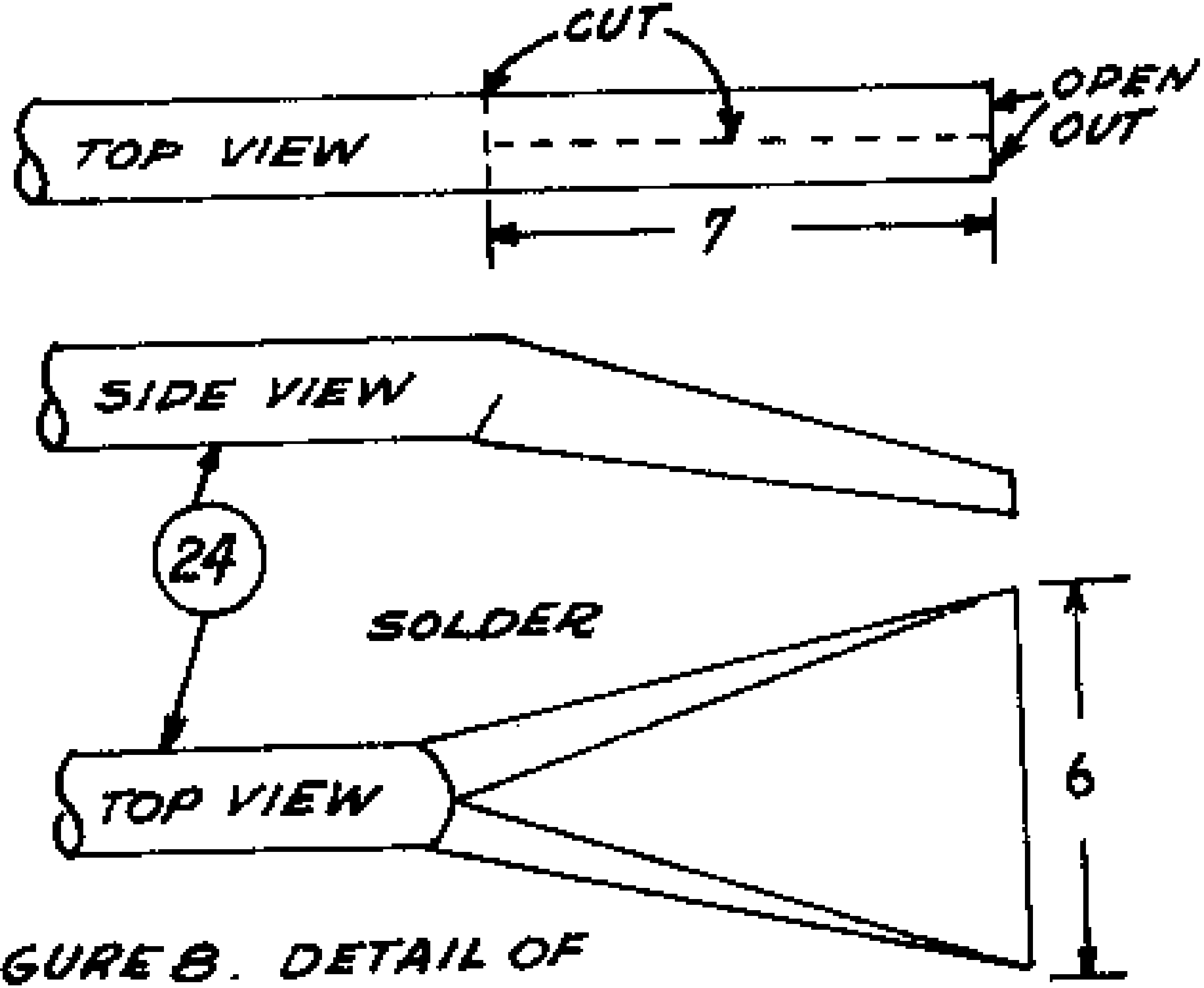


FIGURE 8. DETAIL OF PART 24, PIPE.

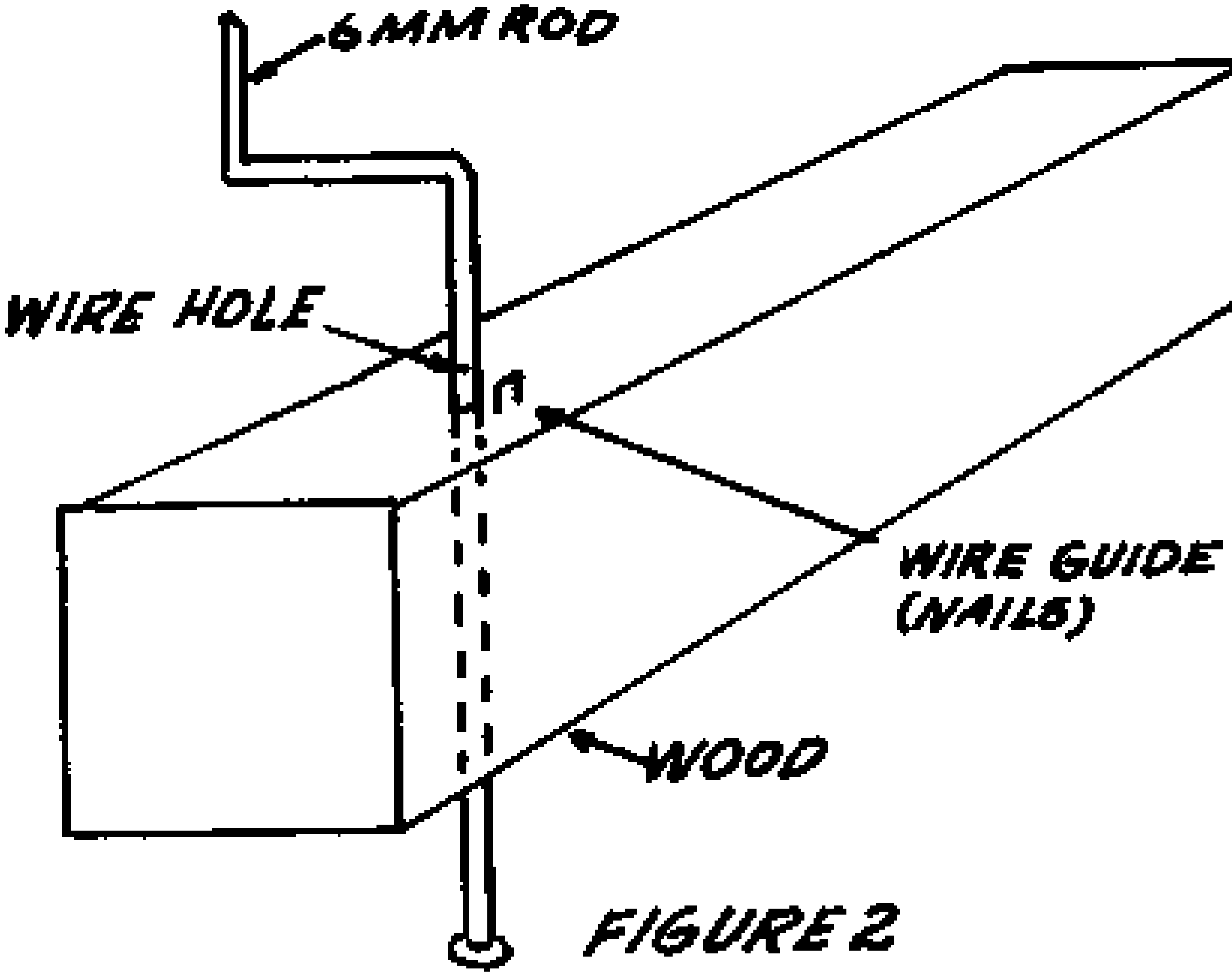
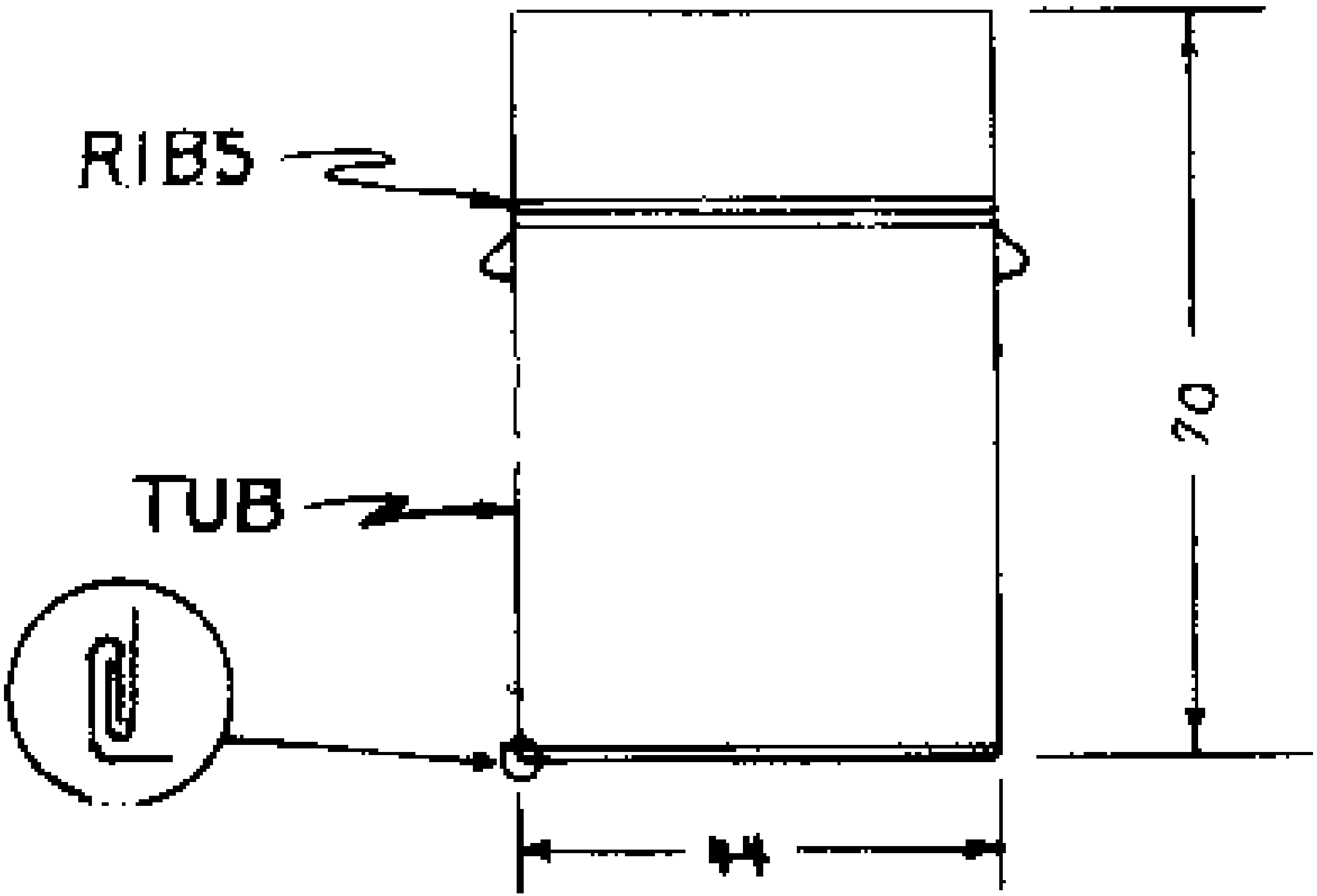


FIGURE 2



DIMENSIONS IN CM.

FIGURE 2

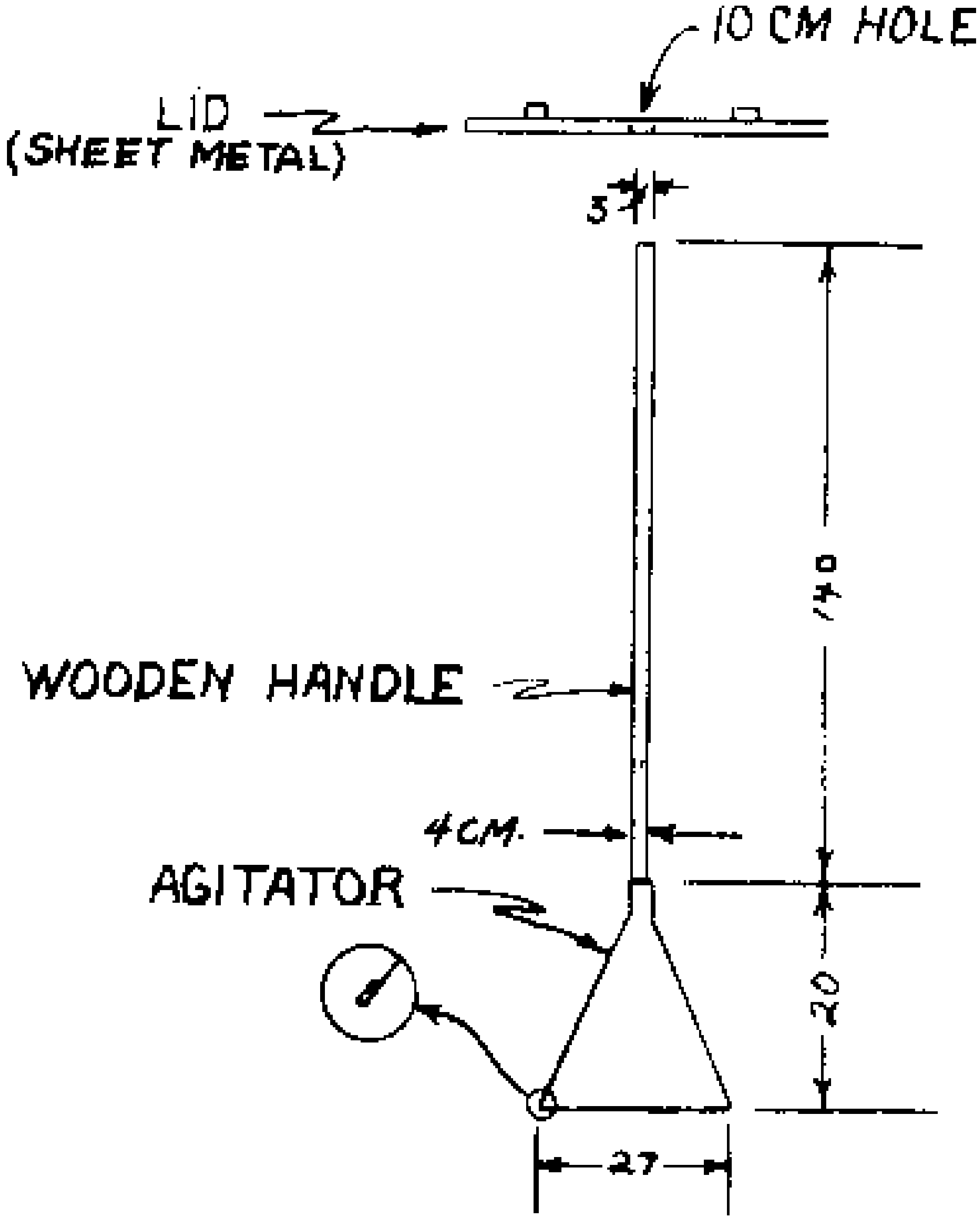

10 CM HOLE
LID
(SHEET METAL)
3
140
WOODEN HANDLE
4CM.
AGITATOR
20
27

FIGURE 3

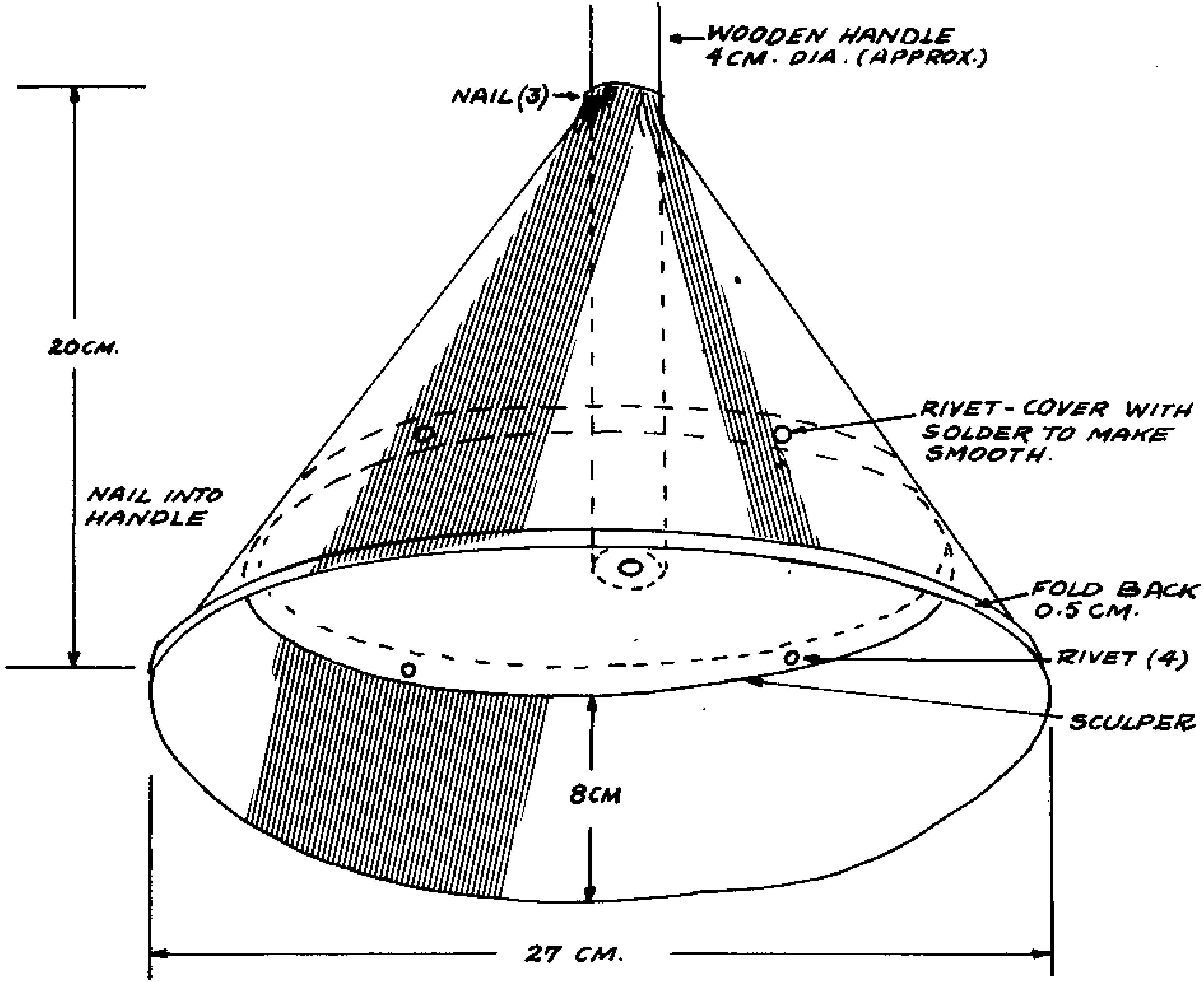

WOODEN HANDLE
4 CM. DIA. (APPROX.)
NAIL (3)
20CM.
NAIL INTO
HANDLE
RIVET - COVER WITH
SOLDER TO MAKE
SMOOTH.
FOLD BACK
0.5 CM.
RIVET (4)
SCULPER
8CM
27 CM.

FIGURE 4

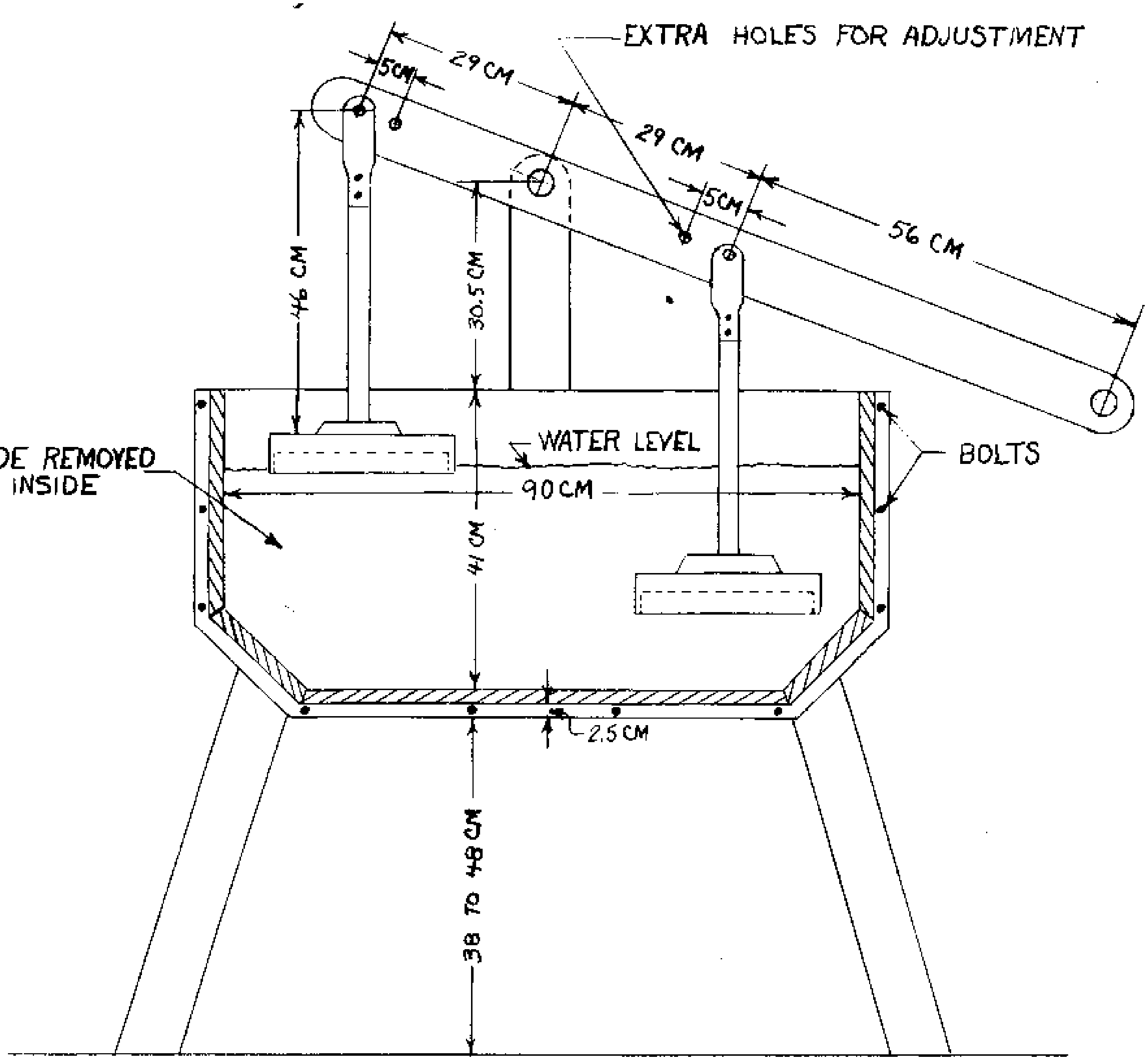

EXTRA HOLES FOR ADJUSTMENT
29 CM
5CM
29 CM
5CM
56 CM
46 CM
30.5 CM
WATER LEVEL
WASHER SIDE REMOVED TO SHOW INSIDE
90 CM
BOLTS
41 CM
2.5 CM
38 TO 48 CM

FIGURE 4

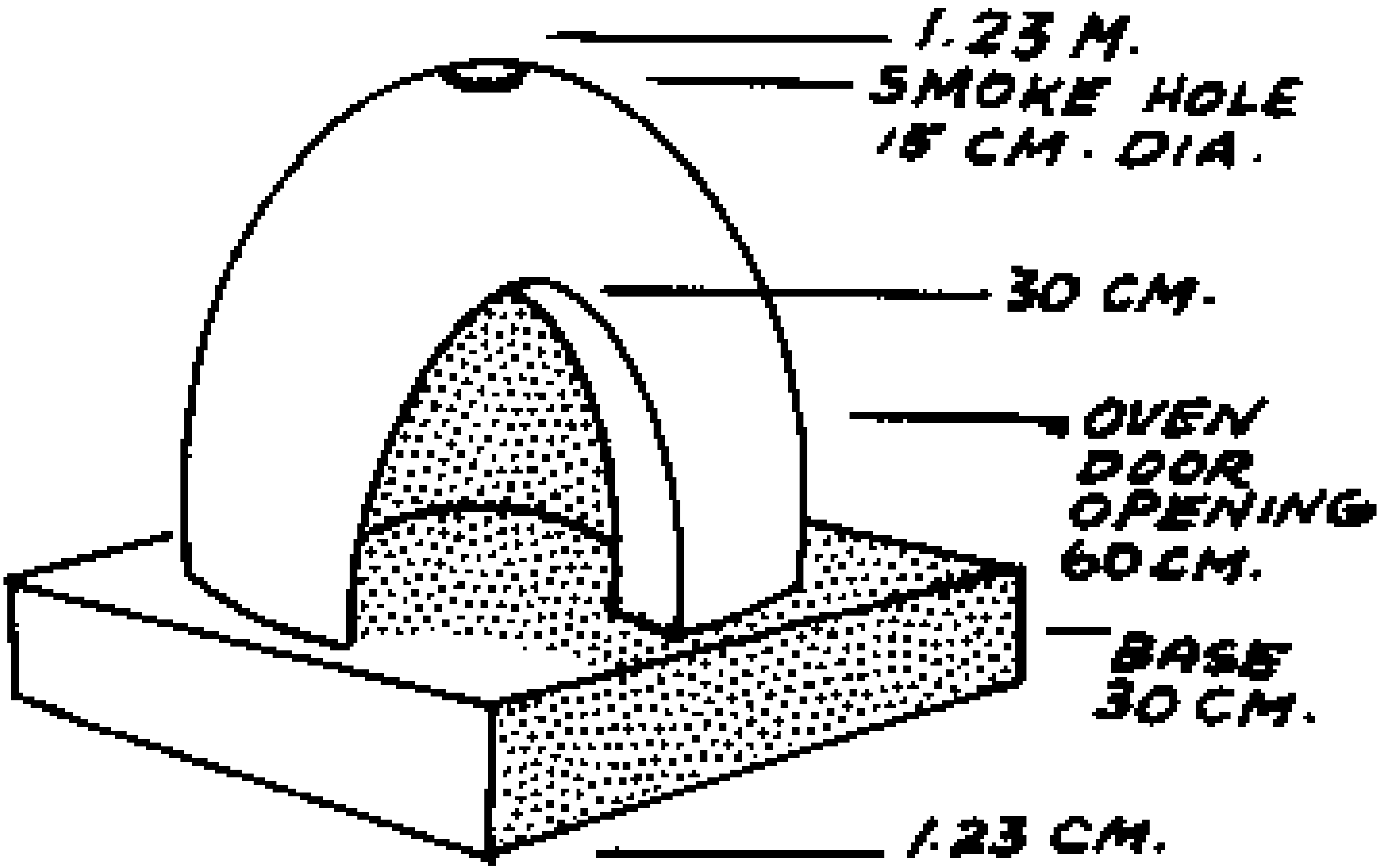


FIGURE 2. THE OUTDOOR OVEN AFTER BEING PLASTERED.

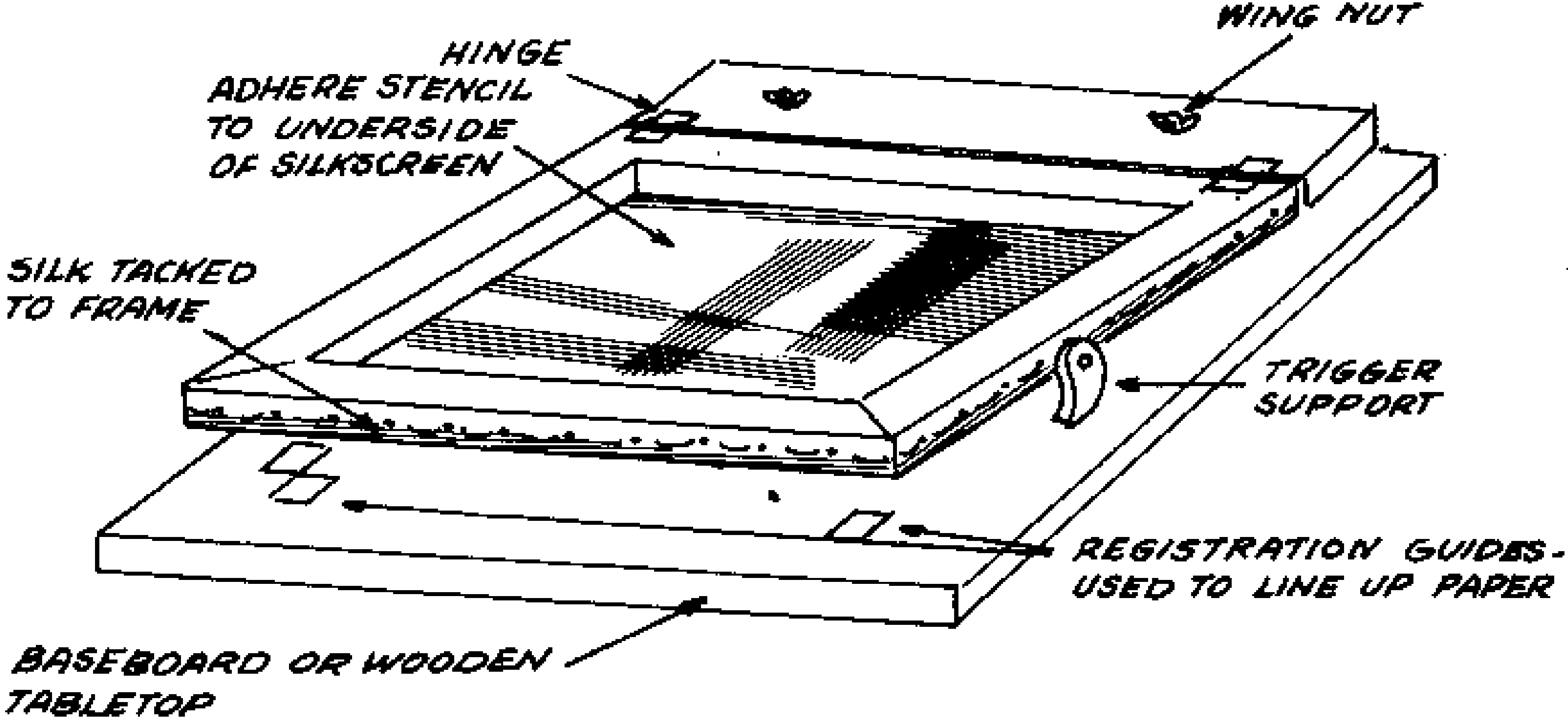
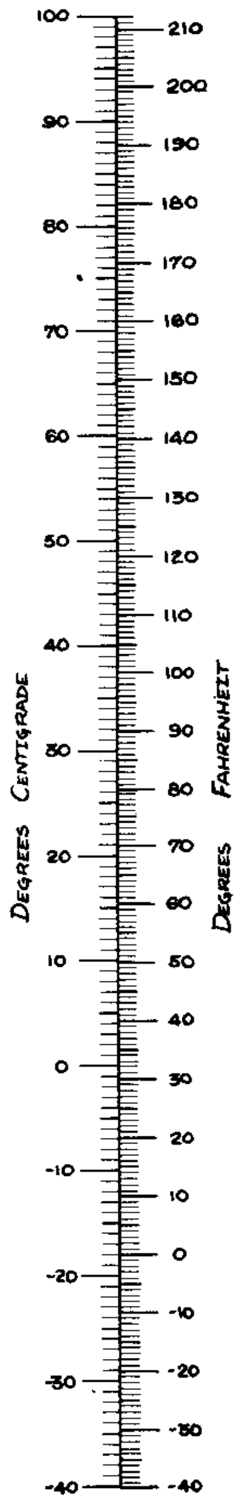


FIGURE 2. BOLT THE HINGED END OF THE FRAME TO A FLAT BASEBOARD OR WOODEN TABLE TOP.

FIGURE 1


100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
DEGREES CENTIGRADE
DEGREES FAHRENHEIT

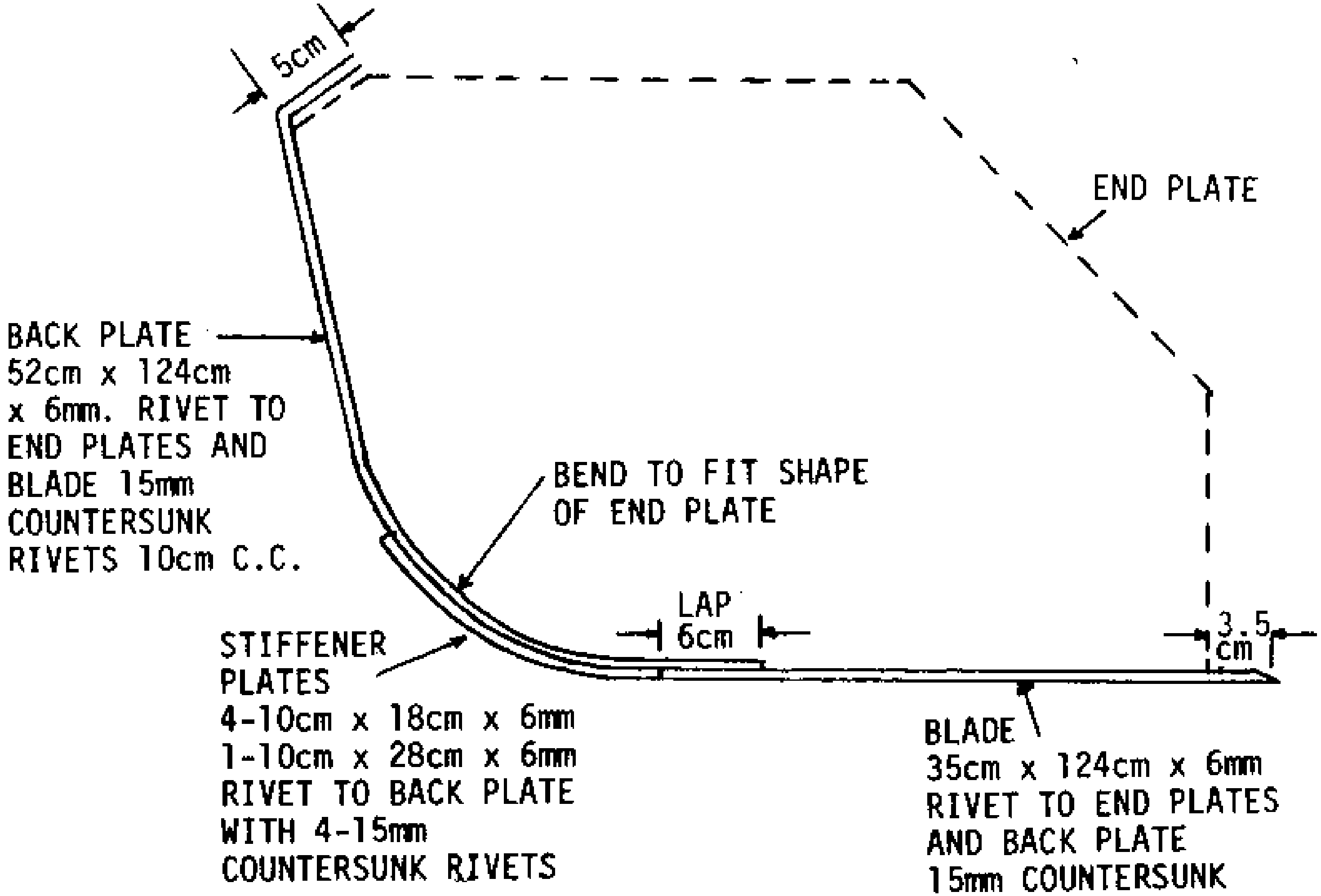
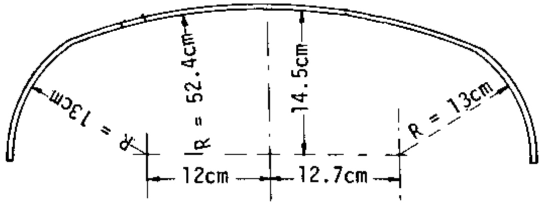


FIGURE 3 - ARRANGEMENT OF BLADE, BACK AND STIFFENER PLATES, END VIEW.

SHOES

12.5cm x 6mm x 66cm plate
Rivet to Runners, 6-20mm countersunk rivets



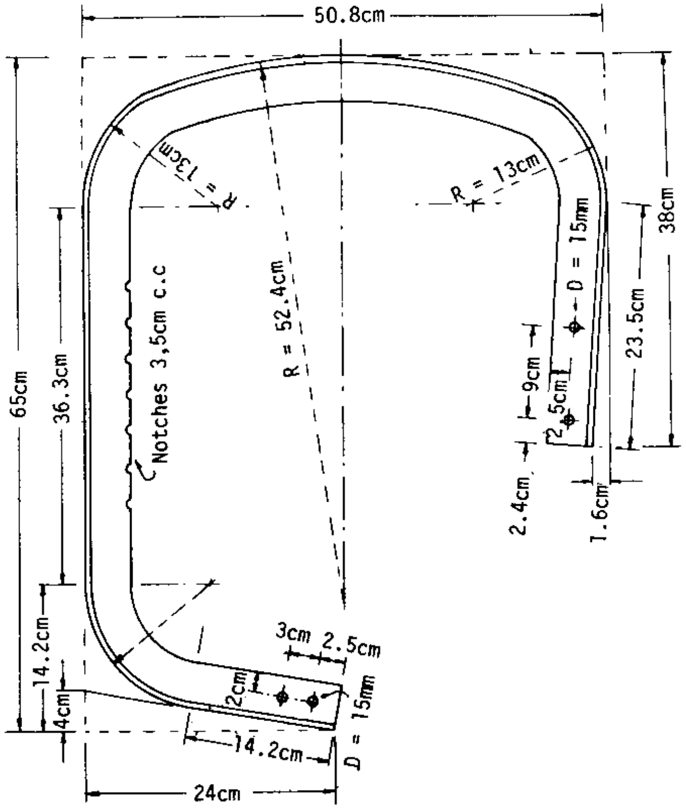


FIGURE 4 FRESNO RUNNER AND SHOES

Runner

4.5cm x 4.5cm x 6mm Angle
157cm long (overall)

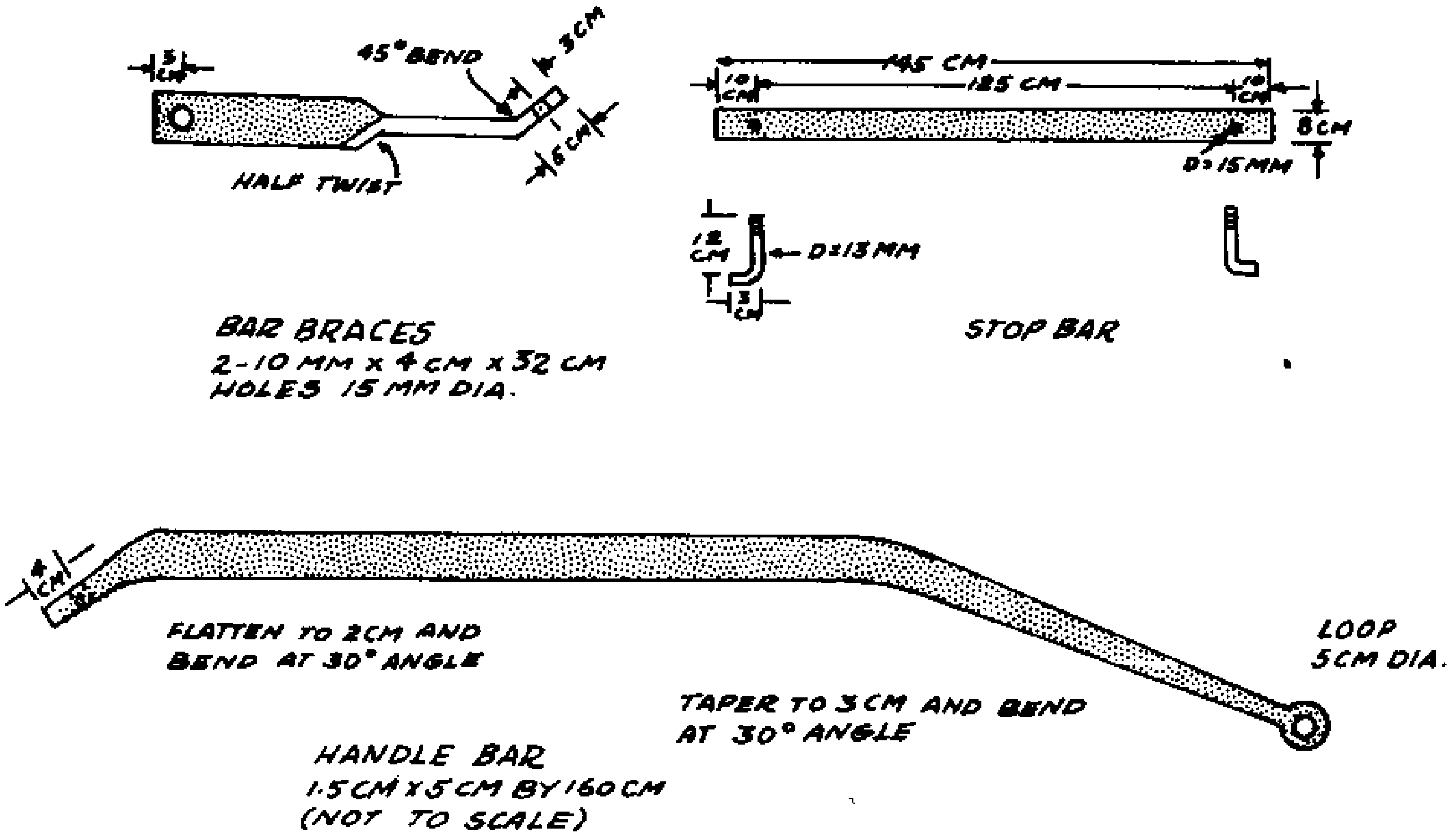
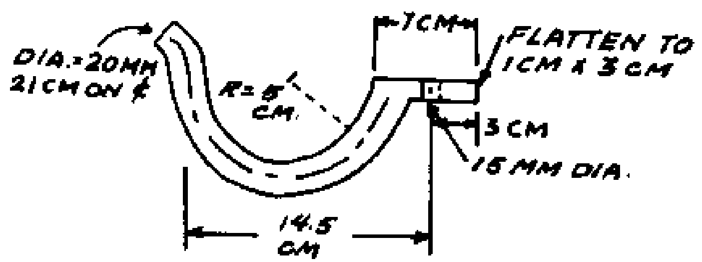
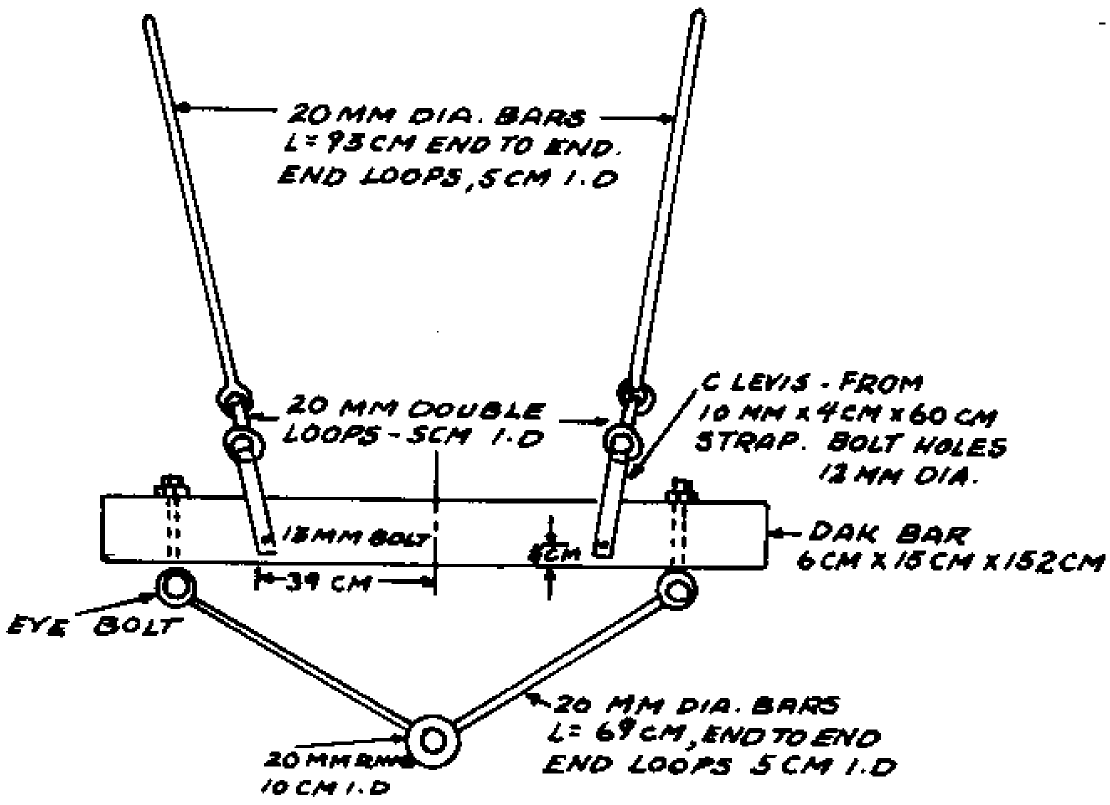


FIGURE 5 FRESNO BAR BRACES, STOP BAR AND HANDLE BAR.



SIDE PLATE DRAFT CLAMP



DRAFT BAR ASSEMBLY
FIGURE 6

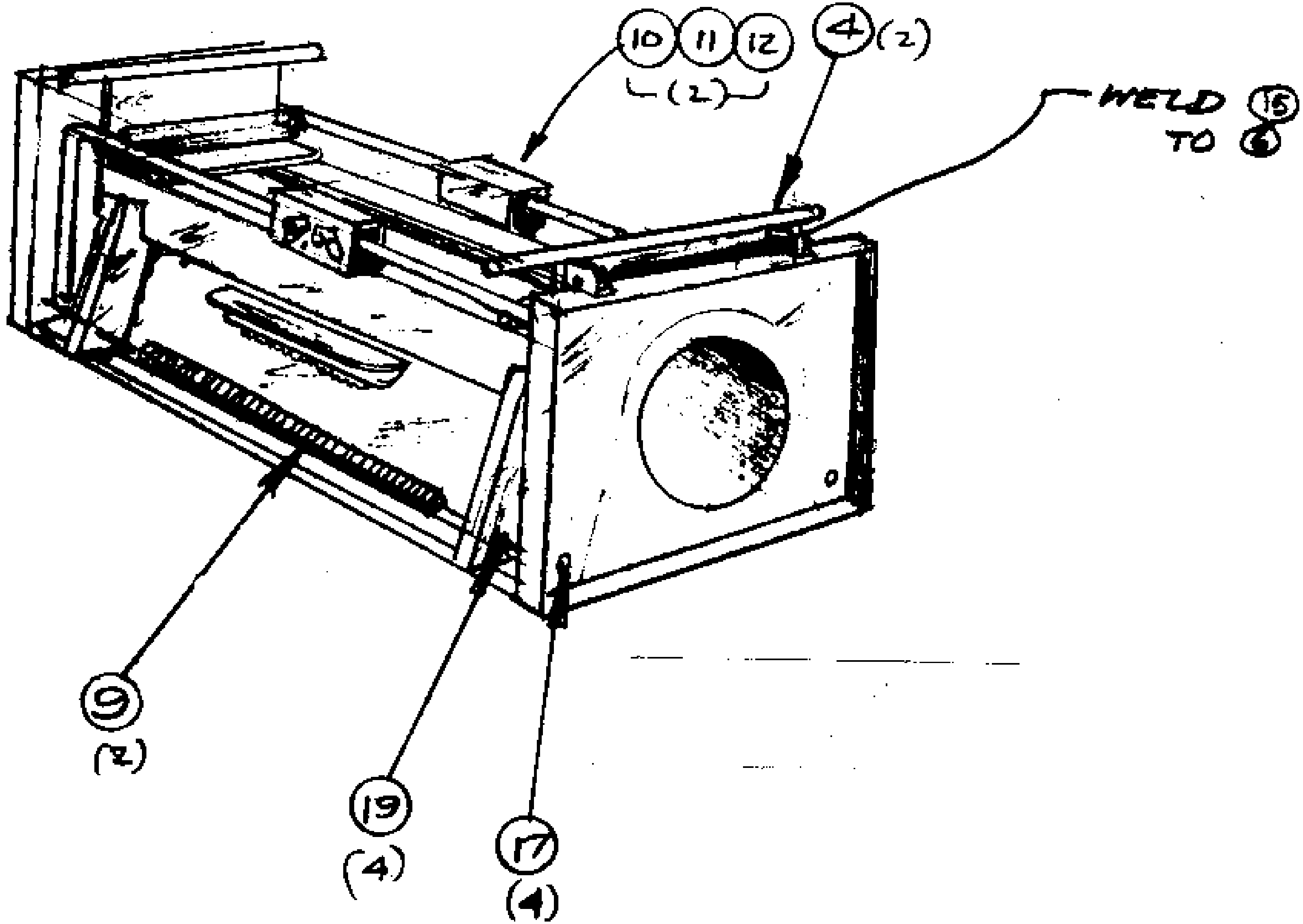


FIGURE 14. ATTACH DOORS WITH HINGEPIN (15), WELD IN PLACE, AND PUT SPRINGS (9), CONNECTORS (19), AND ATTACHMENTS (17) IN PLACE. UNIT IS NOW COMPLETE EXCEPT FOR PARTS 10, 11 AND 12, WHICH NOW CAN BE INSTALLED.

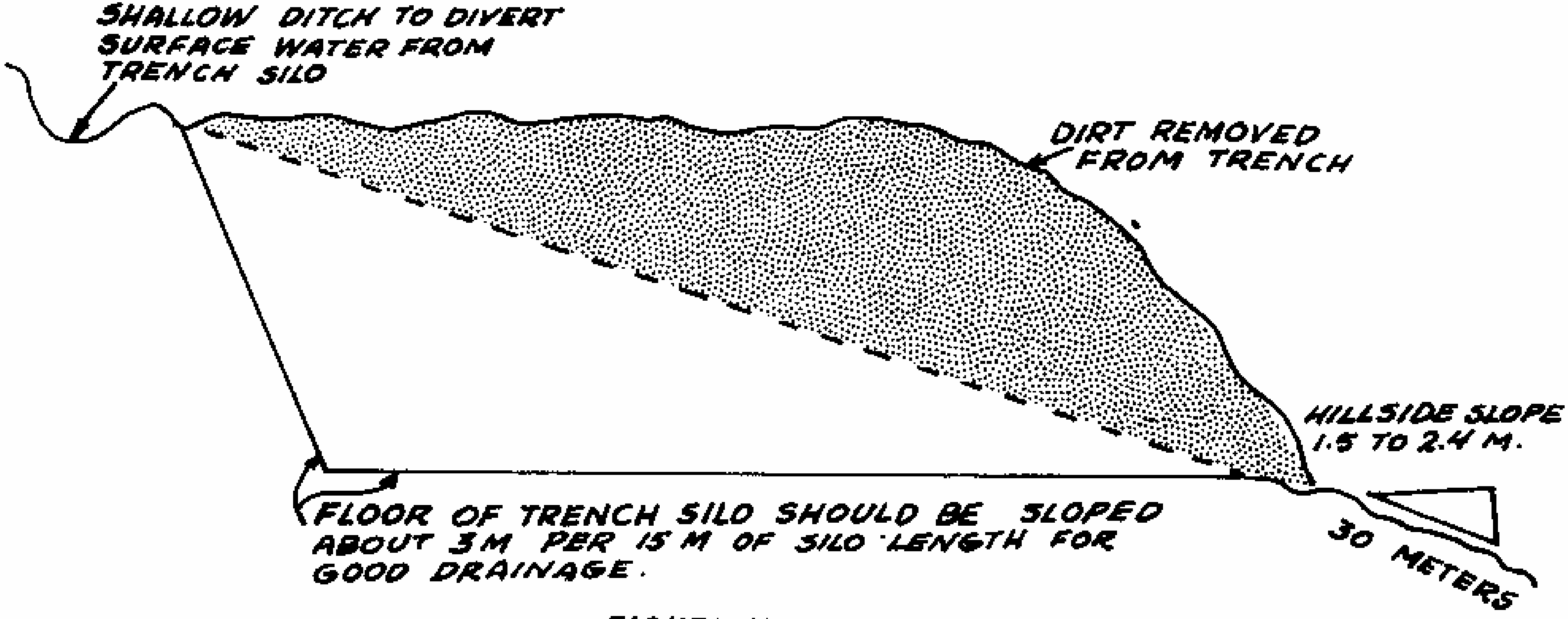

SHALLOW DITCH TO DIVERT SURFACE WATER FROM TRENCH SILO
DIRT REMOVED FROM TRENCH
HILLSIDE SLOPE 1.5 TO 2.4 M.
FLOOR OF TRENCH SILO SHOULD BE SLOPED ABOUT 3M PER 15 M OF SILO LENGTH FOR GOOD DRAINAGE.
30 METERS

FIGURE 3

FIGURE 4

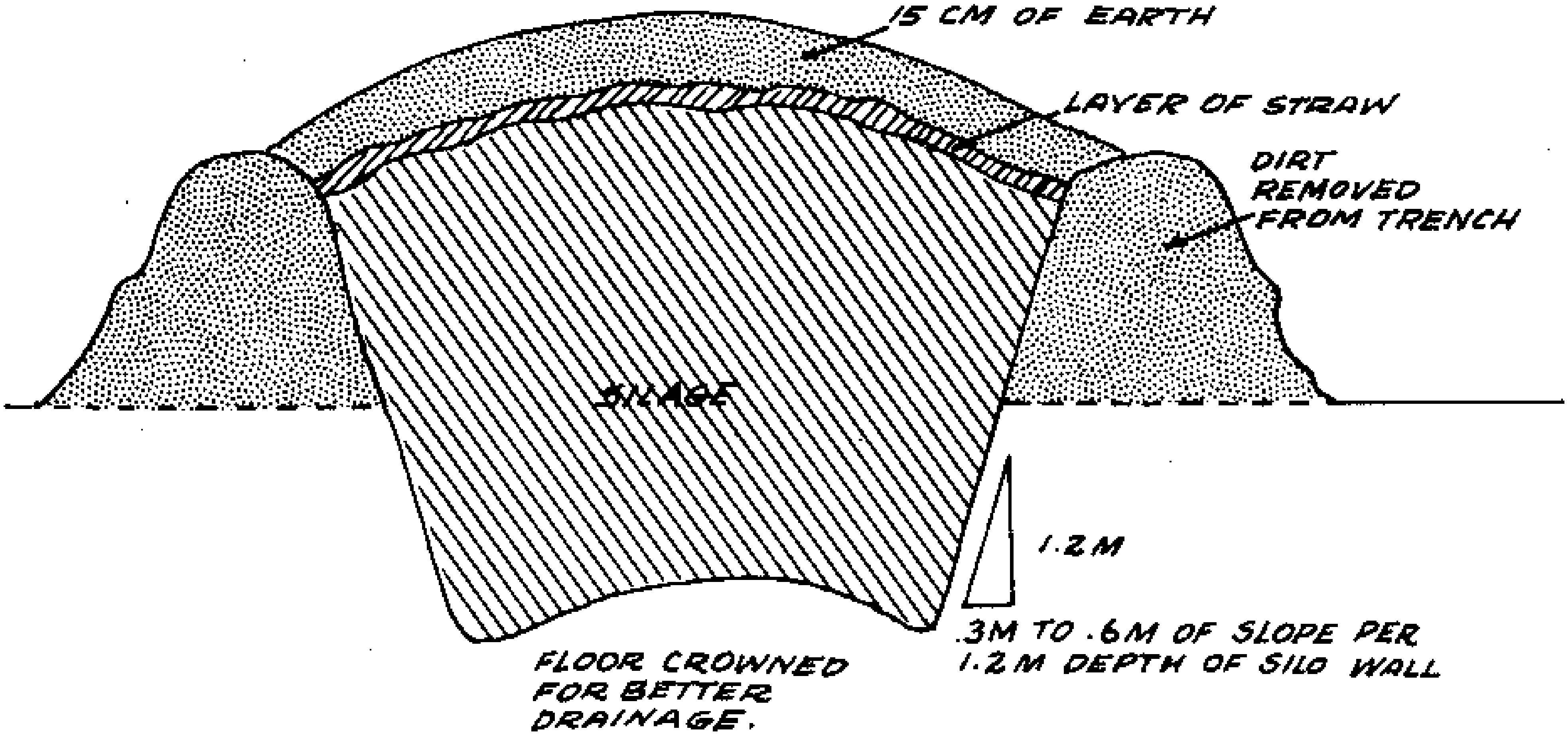
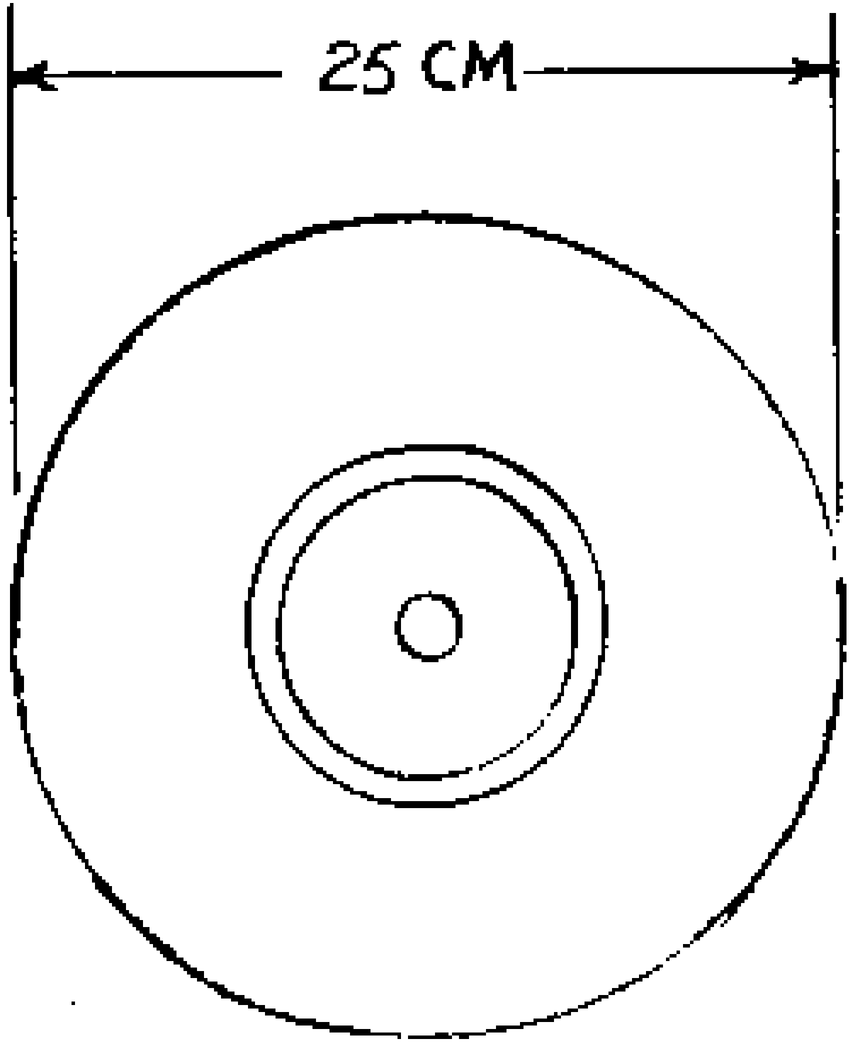
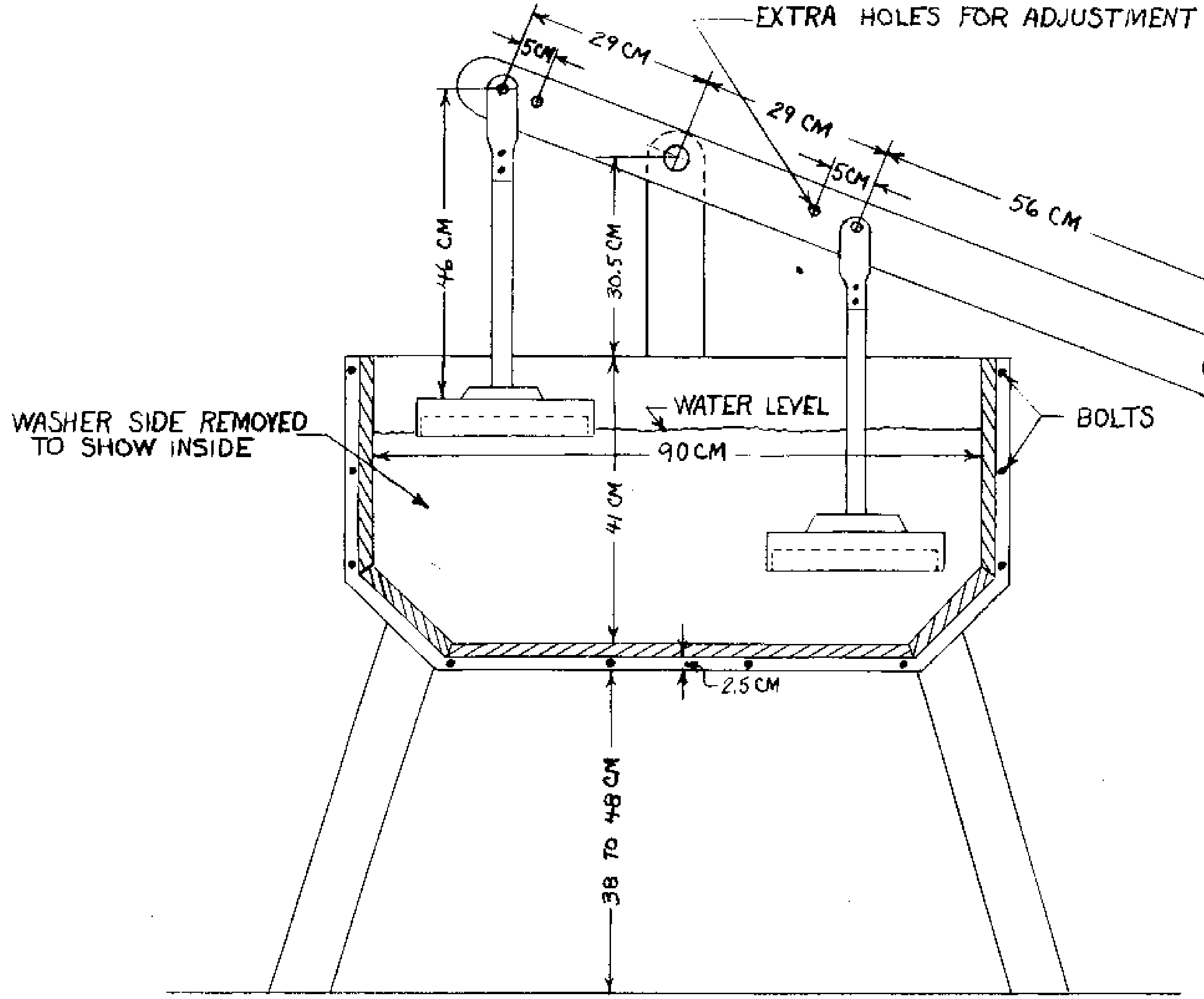

15 CM OF EARTH
LAYER OF STRAW
DIRT REMOVED FROM TRENCH
SILAGE
1.2M
.3M TO .6M OF SLOPE PER 1.2M DEPTH OF SILO WALL
FLOOR CROWNED FOR BETTER DRAINAGE.

FIGURE 3



TOP VIEW OF
PLUNGER



EXTRA HOLES FOR ADJUSTMENT
29 CM
5CM
29 CM
5CM
56 CM
46 CM
30.5 CM
WATER LEVEL
BOLTS
WASHER SIDE REMOVED TO SHOW INSIDE
90 CM
41 CM
2.5 CM
38 TO 48 CM

FIGURE 4

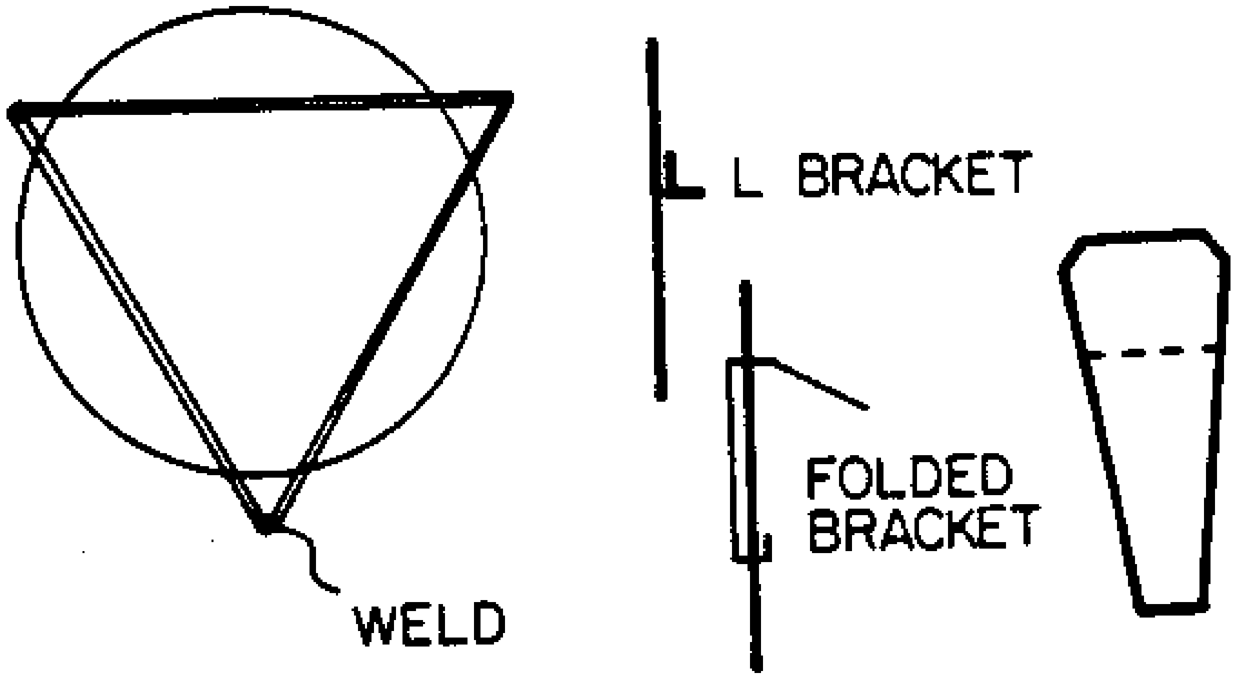


Figure 3. Templates for a folded pot support, a welded L-bracket, and a complete triangular support of re-rod. Supports should be kept small so they don't keep heat away from the pot.

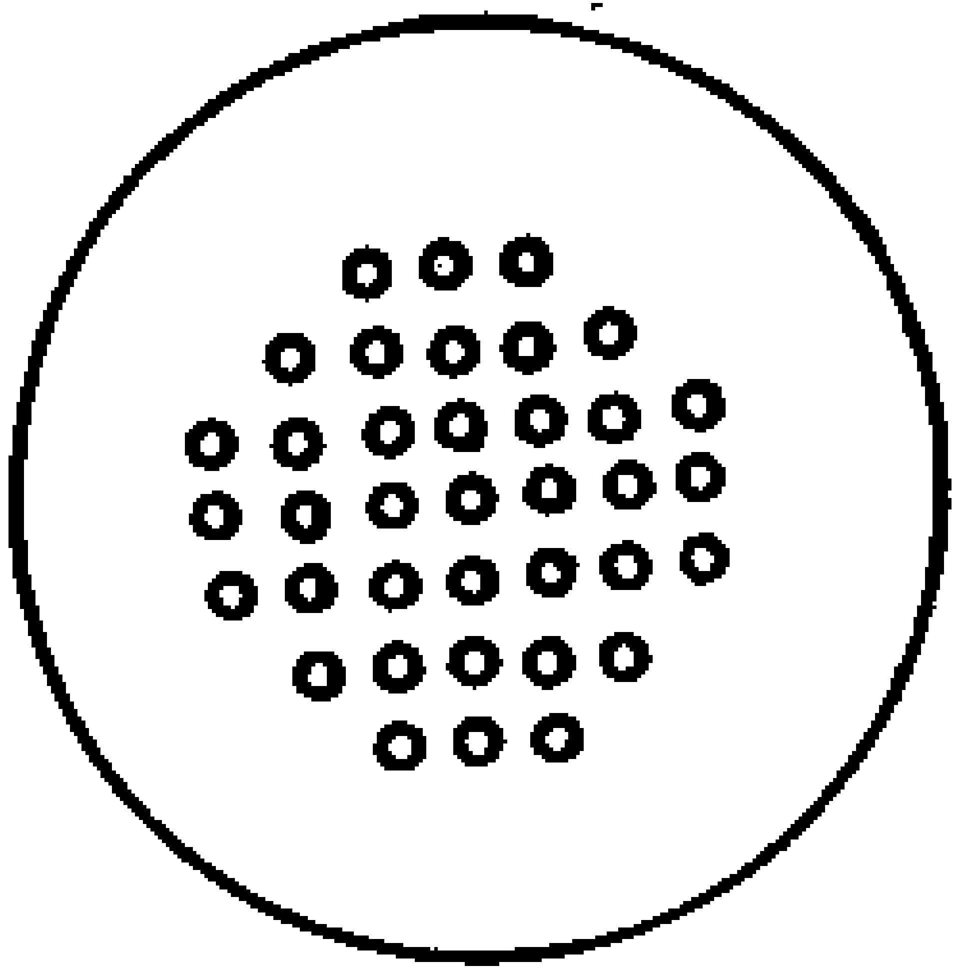


Figure 4. Template for a grate. Grate holes are not to scale.

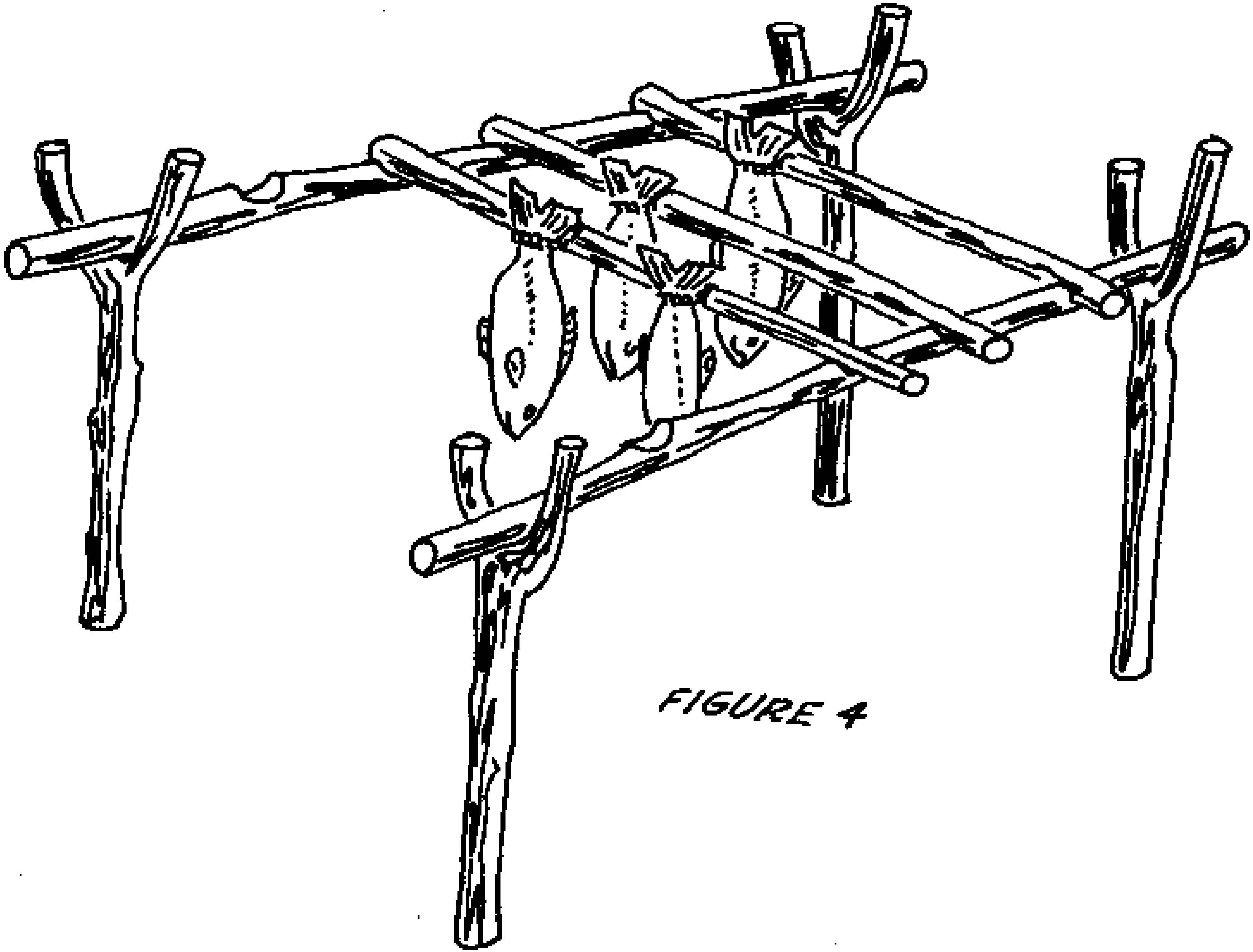


FIGURE 4

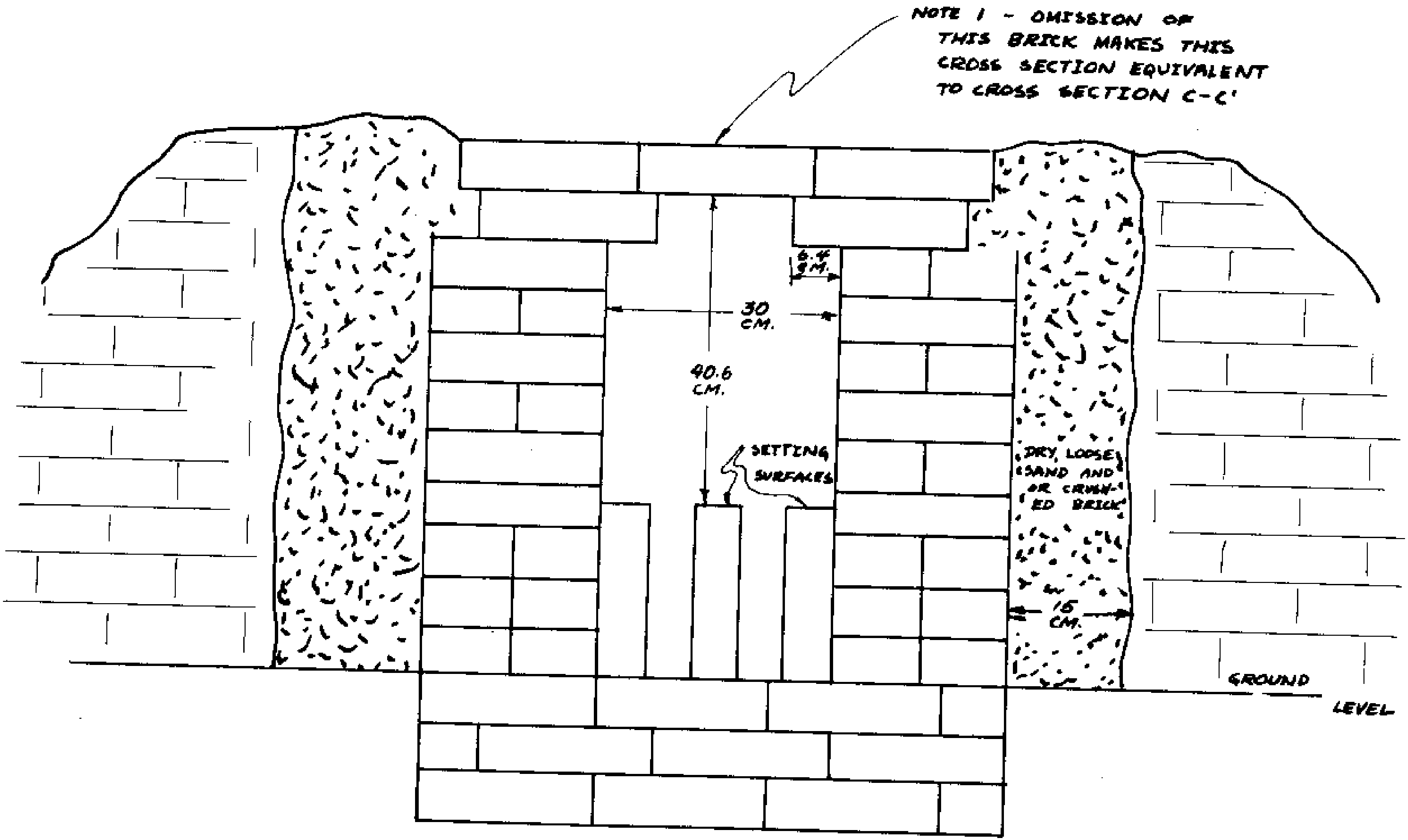
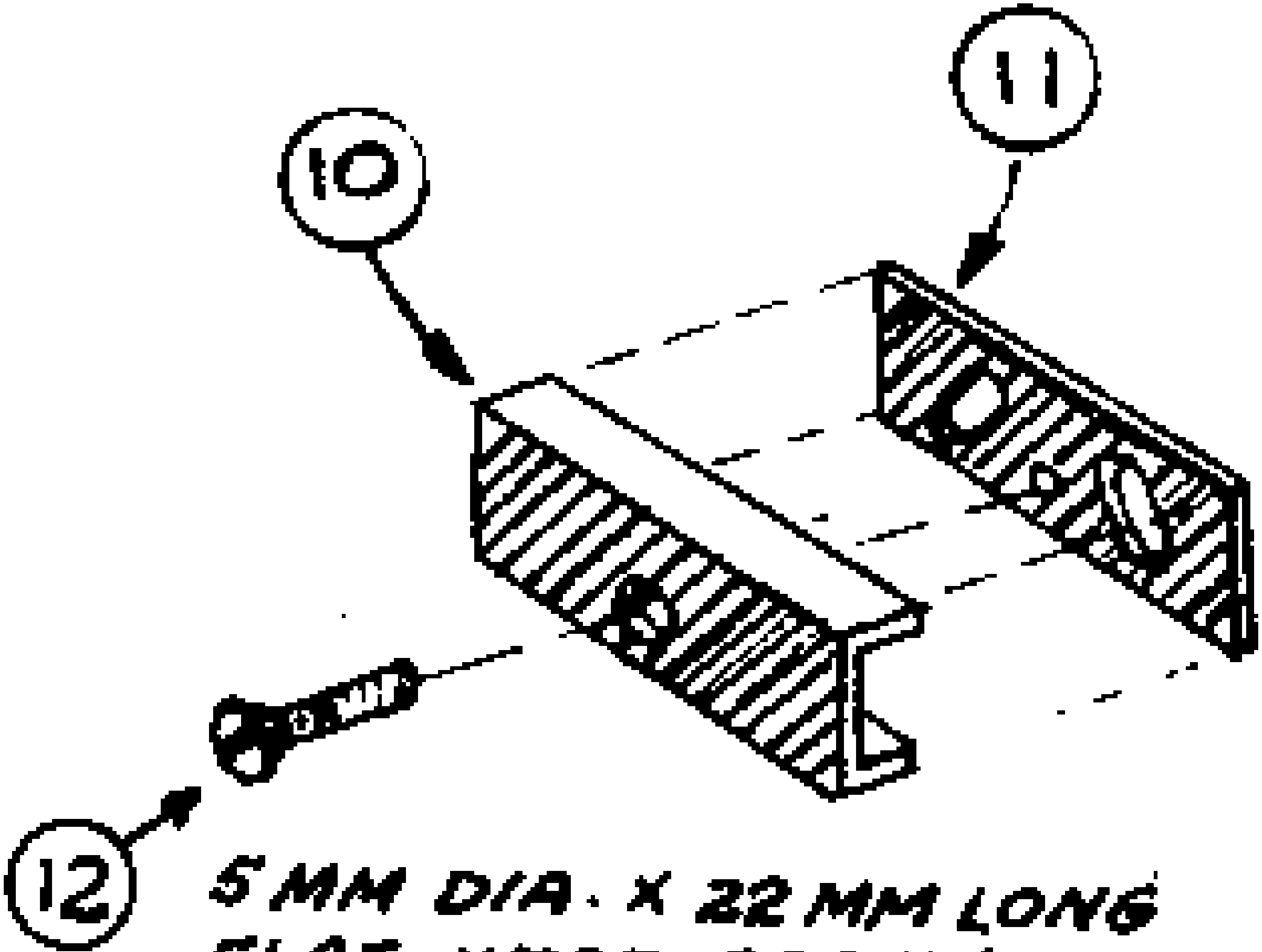


FIGURE 4. RECTANGULAR KILN: CROSS-SECTION BB' (SEE FIGURE 5) REMOVAL OF THE BRICK AT THE CENTER OF THE TOP LAYER MAKES THIS DRAWING EQUIVALENT TO CROSS-SECTION CC' OF FIGURE 5.



5 MM DIA. X 22 MM LONG
FLAT HEAD SCREW
(2 REQUIRED)

FIGURE 8

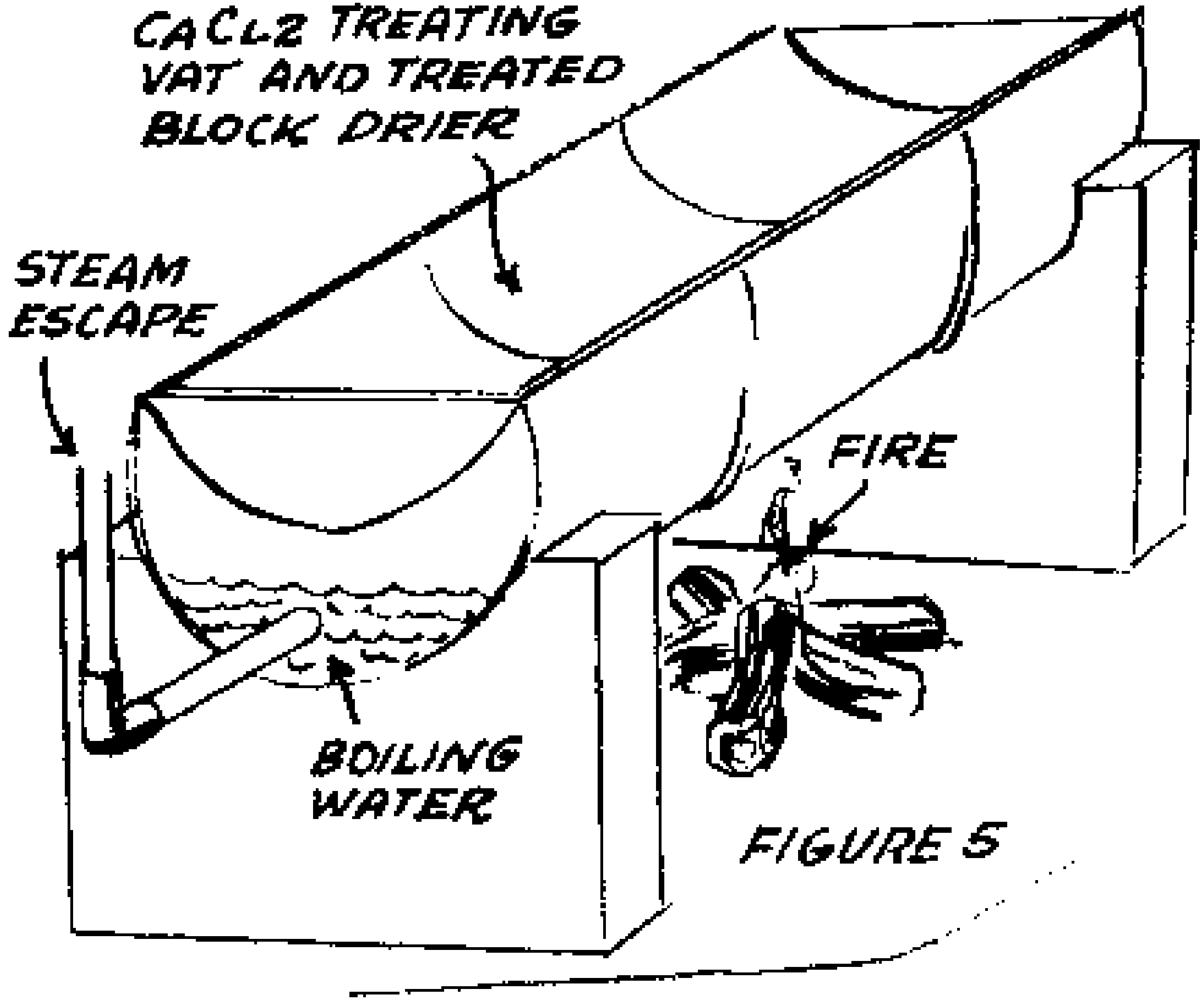

CaCl2 TREATING
VAT AND TREATED
BLOCK DRIER
STEAM
ESCAPE
FIRE
BOILING
WATER

FIGURE 5

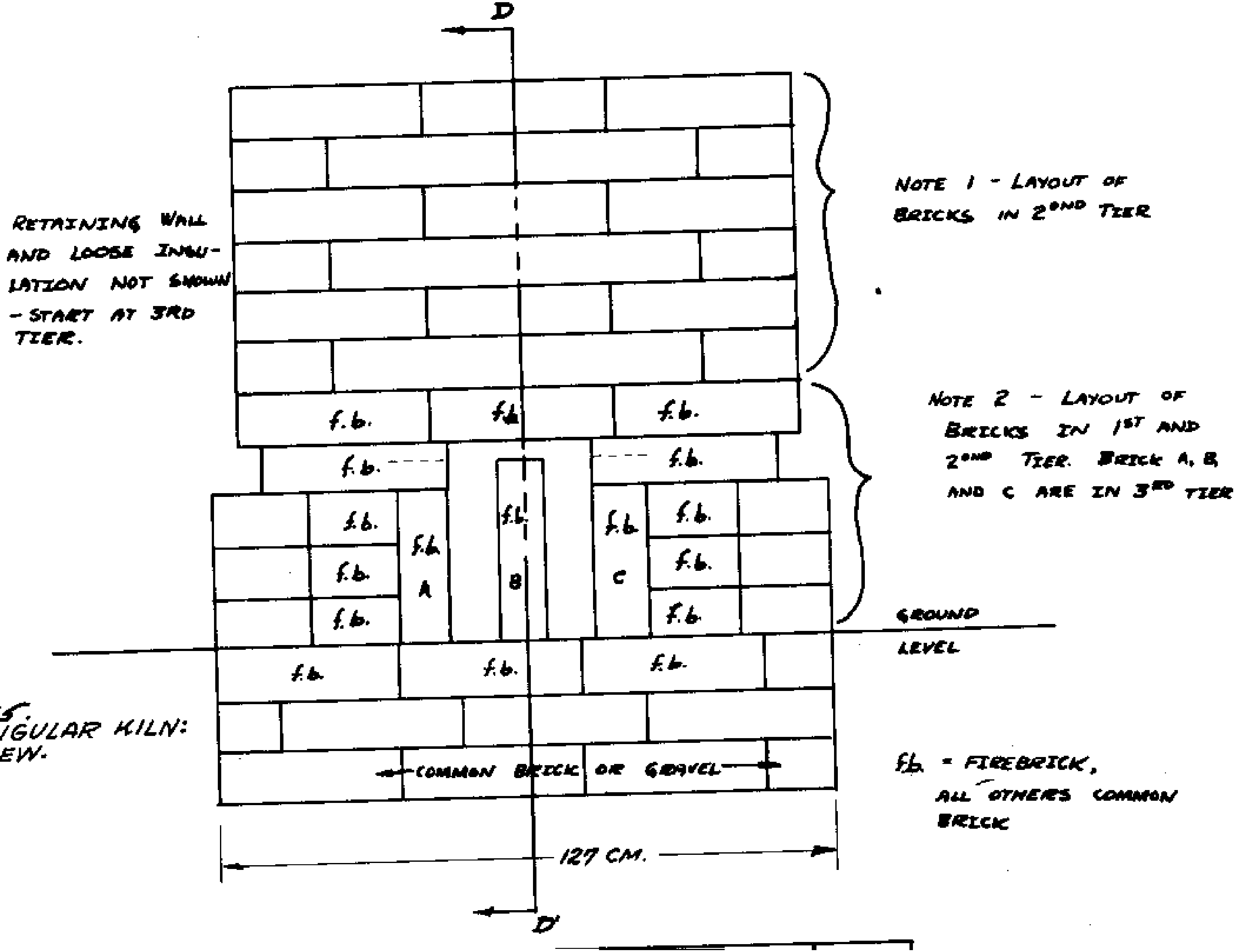


FIGURE 5.
RECTANGULAR KILN:
END VIEW.

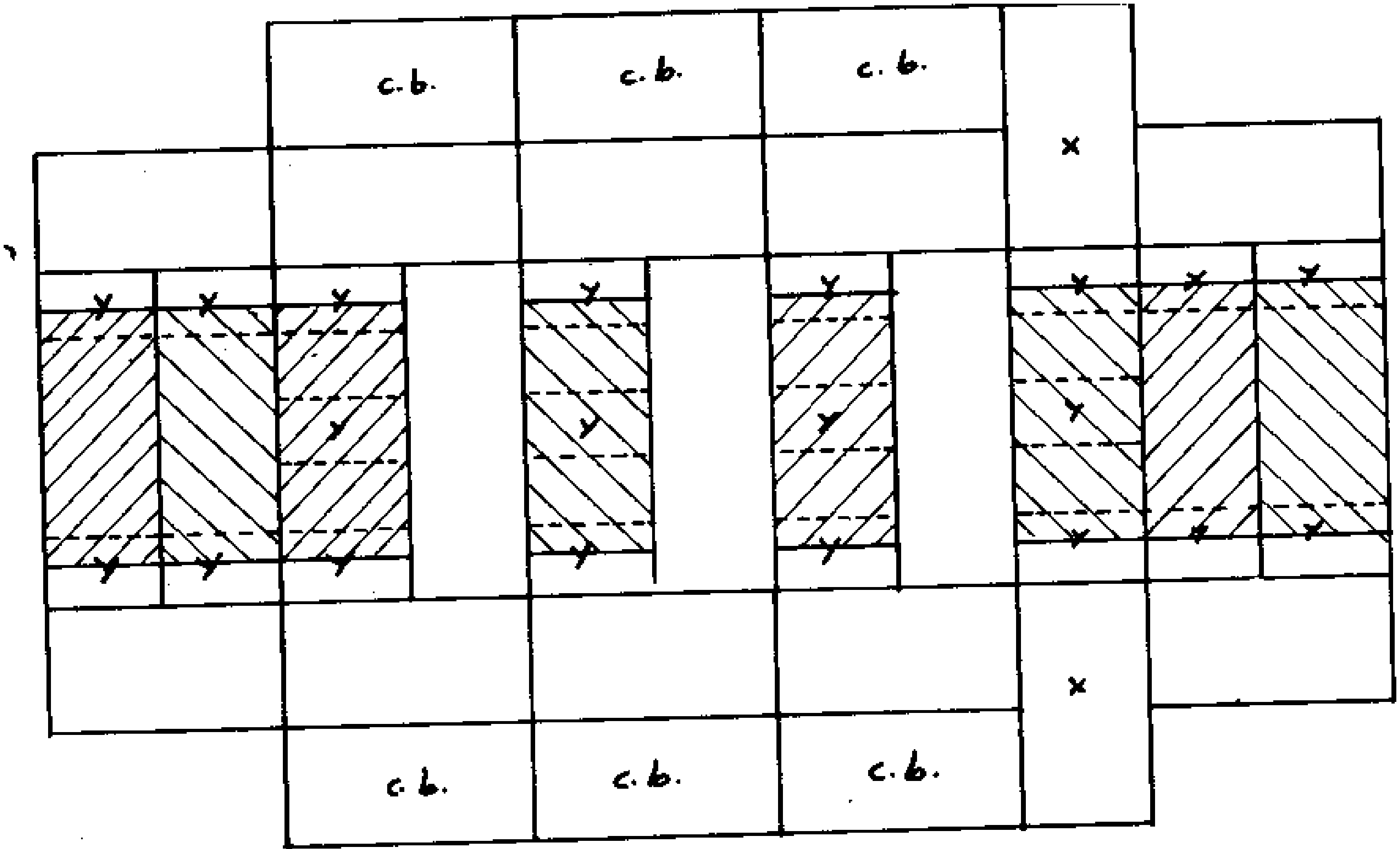


FIGURE 6. RECTANGULAR KILN: CROSS-SECTION EE' TOP VIEW (SEE FIGURE 3)

c.b. - COMMON BRICK, ALL OTHERS ARE FIREBRICK.
SHADED BRICKS ARE PLACED ON TOP TO FORM SHELVES AND TOP OF FIREBOX.
ALTERNATE LAYERS FORM MIRROR IMAGES - i.e. BRICKS "X" ARE ON LEFT.
BRICKS "Y" ARE STOOD ON END TO SUPPORT SHELVES

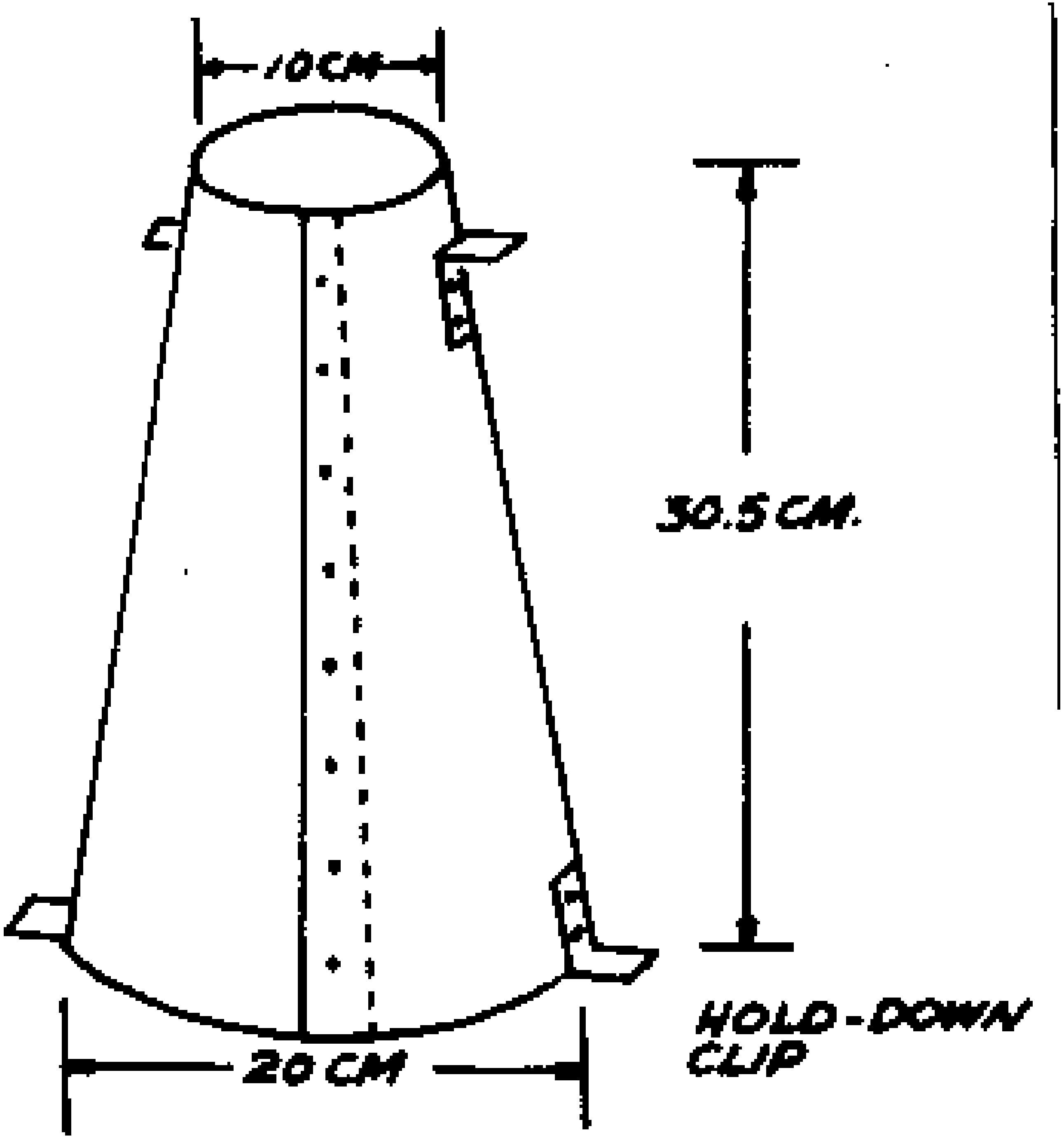


FIGURE 6

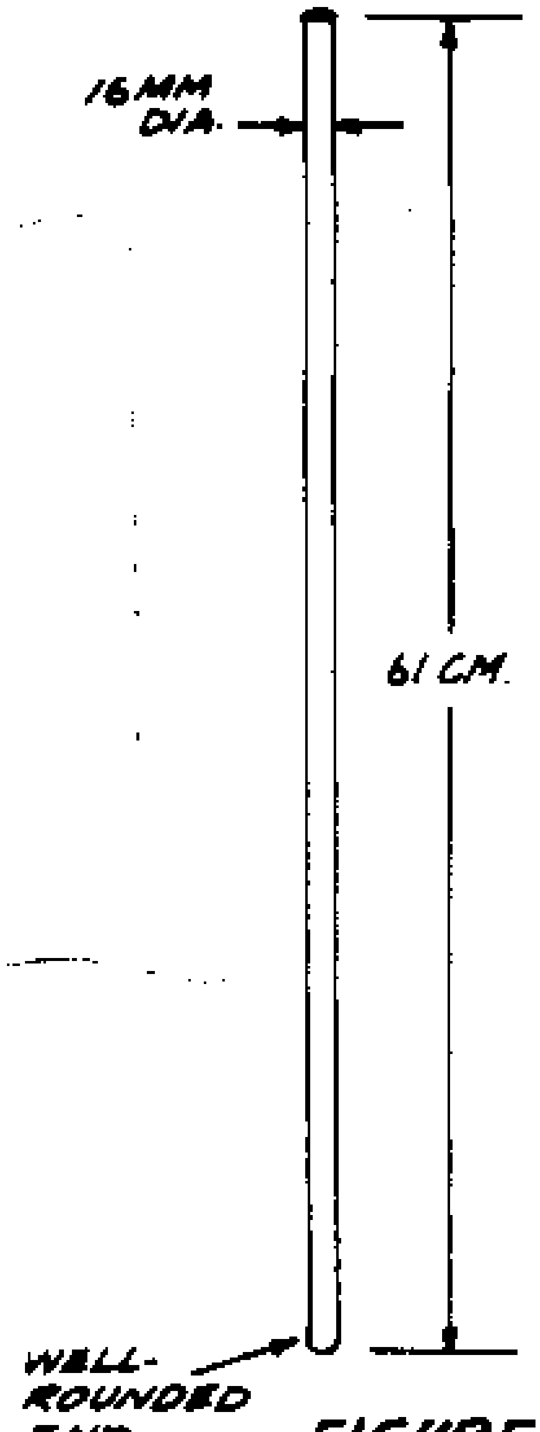


FIGURE 7

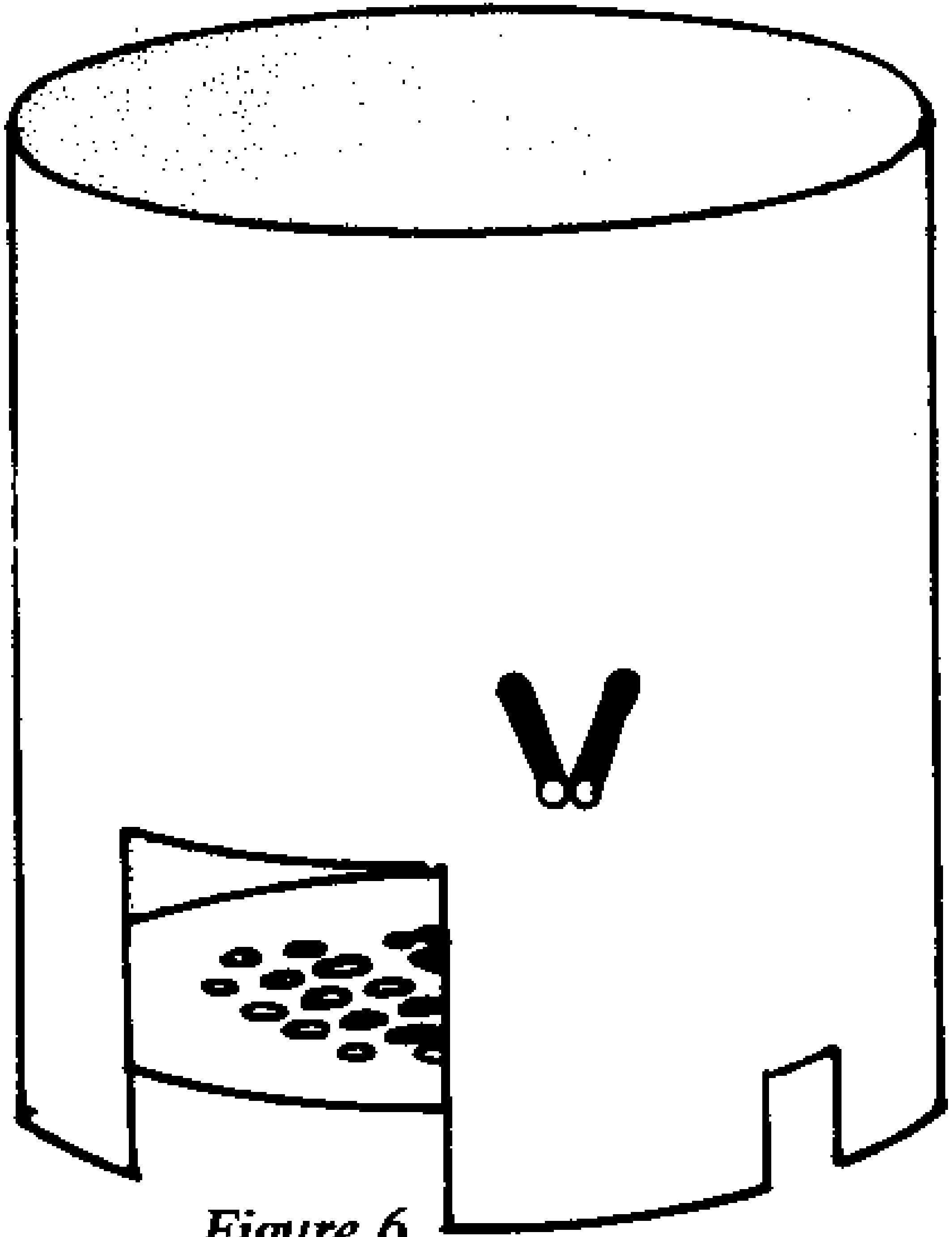


Figure 6

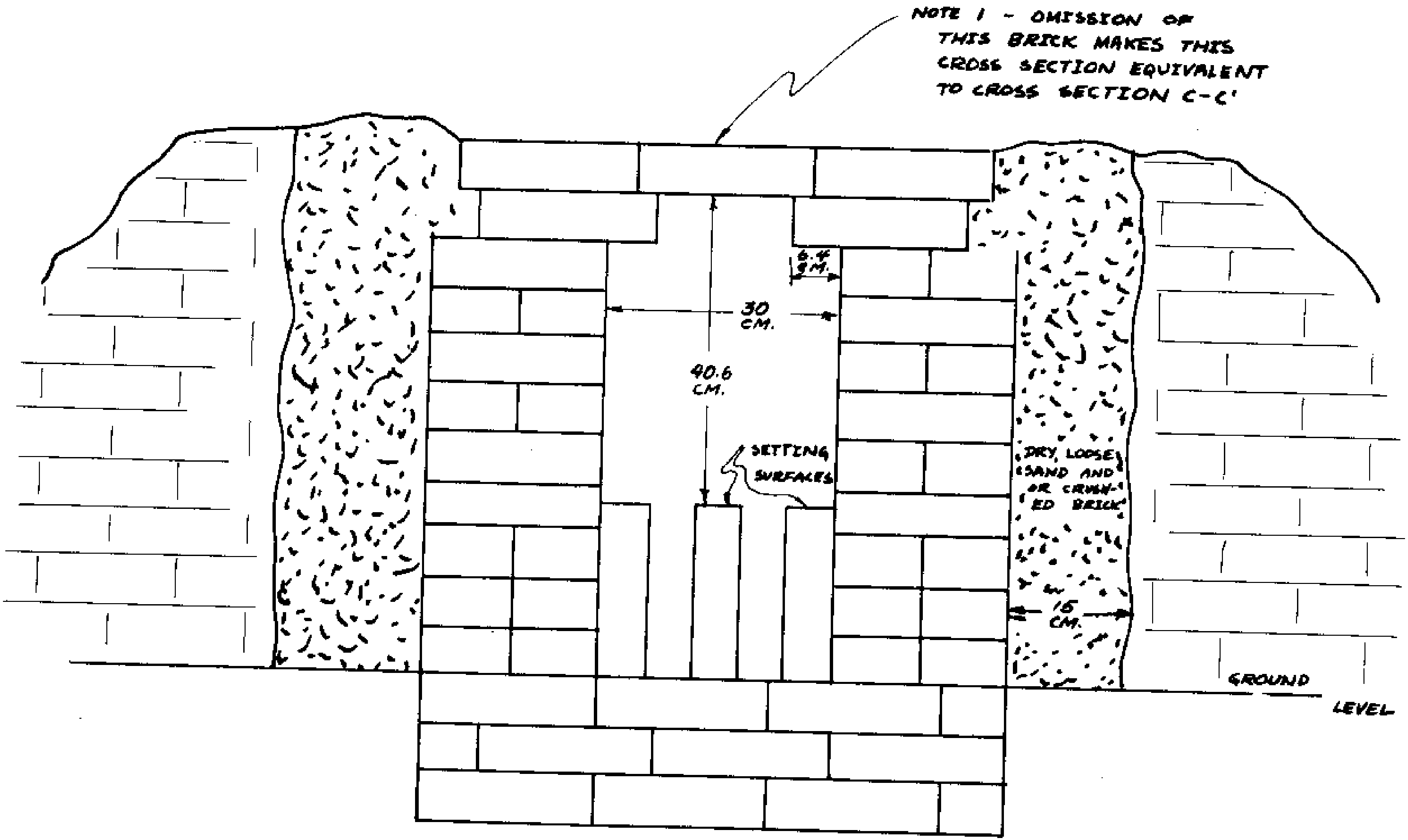


FIGURE 4. RECTANGULAR KILN: CROSS-SECTION BB' (SEE FIGURE 5) REMOVAL OF THE BRICK AT THE CENTER OF THE TOP LAYER MAKES THIS DRAWING EQUIVALENT TO CROSS-SECTION CC' OF FIGURE 5.

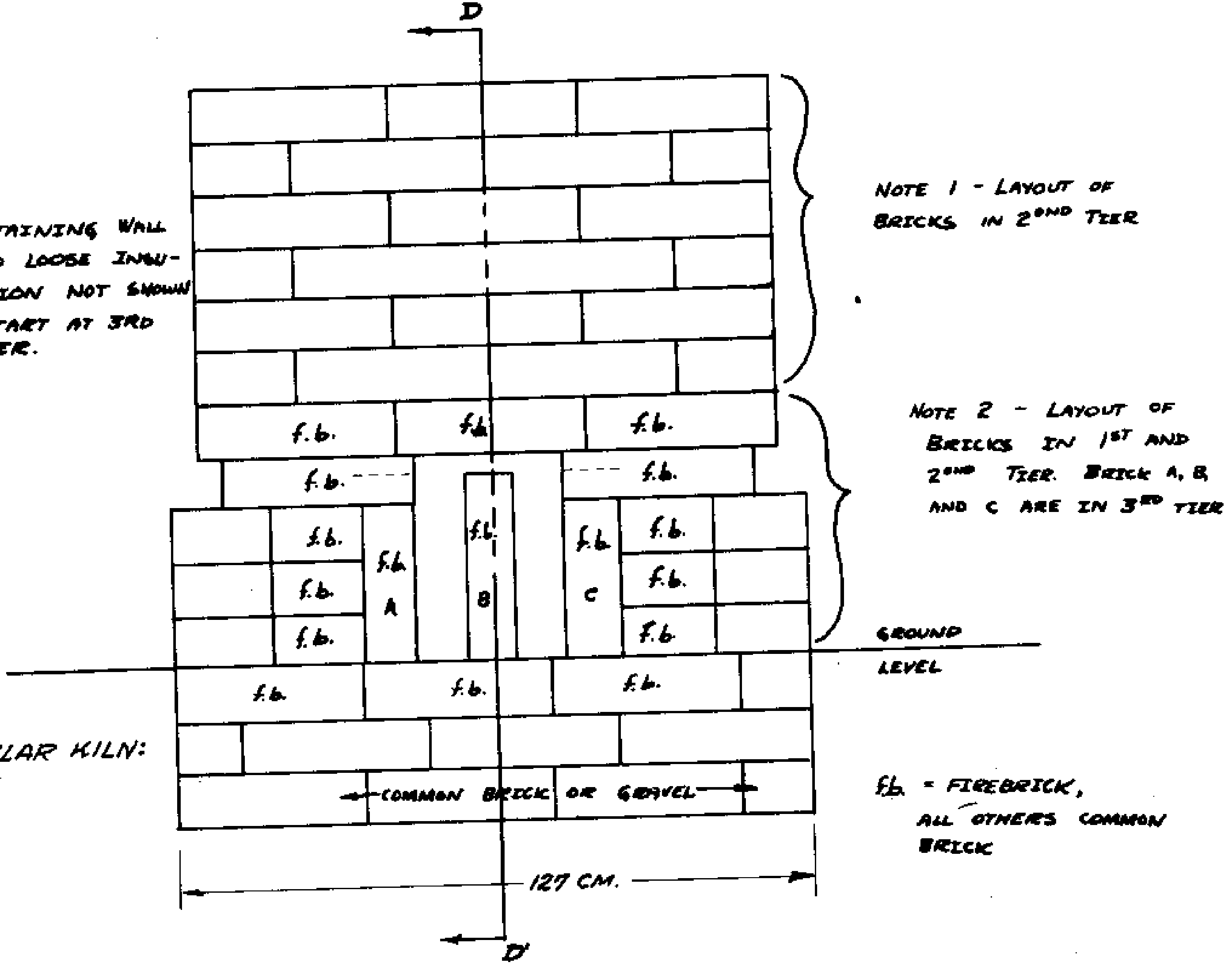


FIGURE 5. RECTANGULAR KILN: END VIEW.

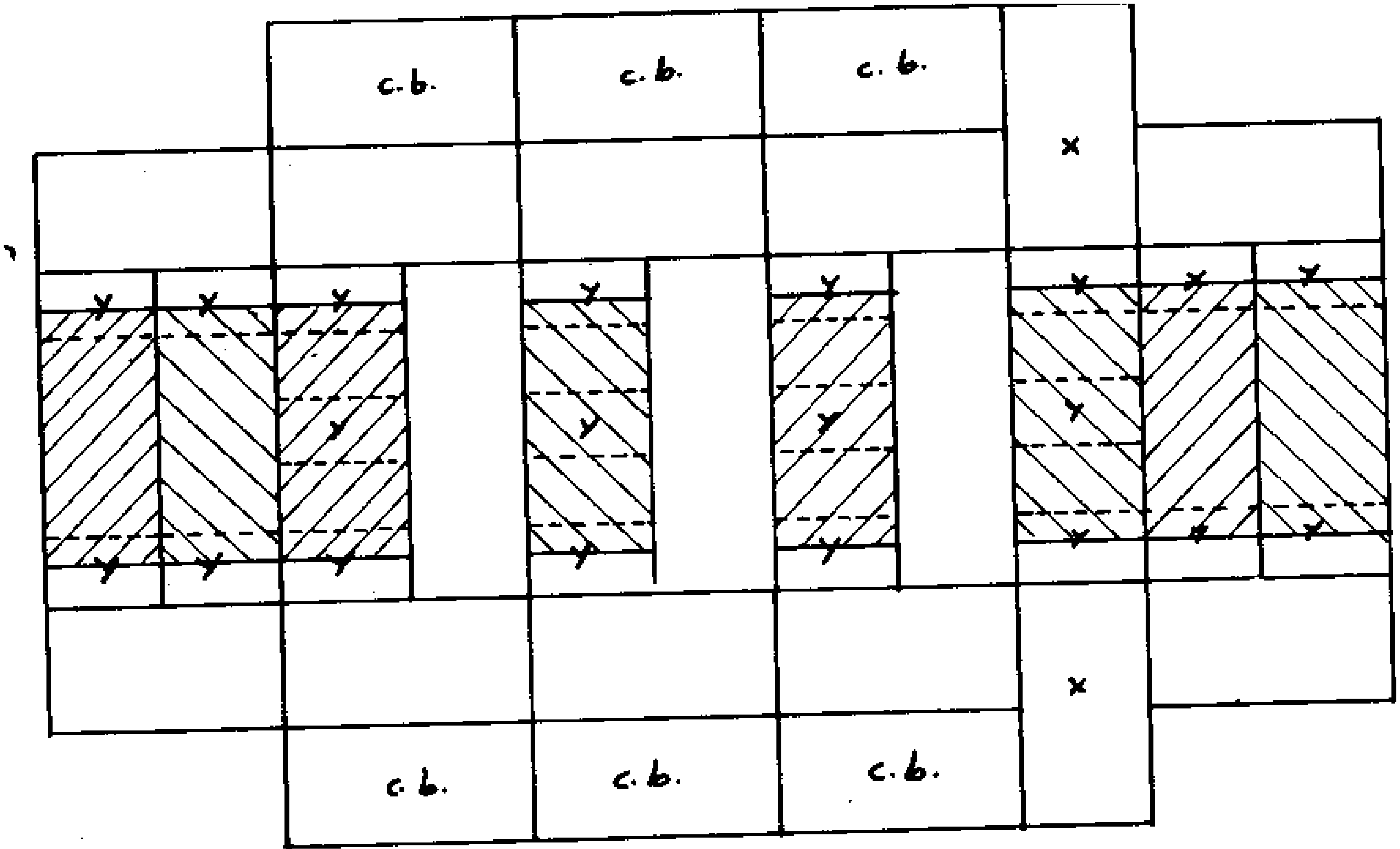


FIGURE 6. RECTANGULAR KILN: CROSS-SECTION EE' TOP VIEW (SEE FIGURE 3)

C.b. - COMMON BRICK, ALL OTHERS ARE FIREBRICK.
SHADED BRICKS ARE PLACED ON TOP TO FORM SHELVES AND TOP OF FIREBOX.
ALTERNATE LAYERS FORM MIRROR IMAGES - i.e. BRICKS "X" ARE ON LEFT.
BRICKS "Y" ARE STOOD ON END TO SUPPORT SHELVES

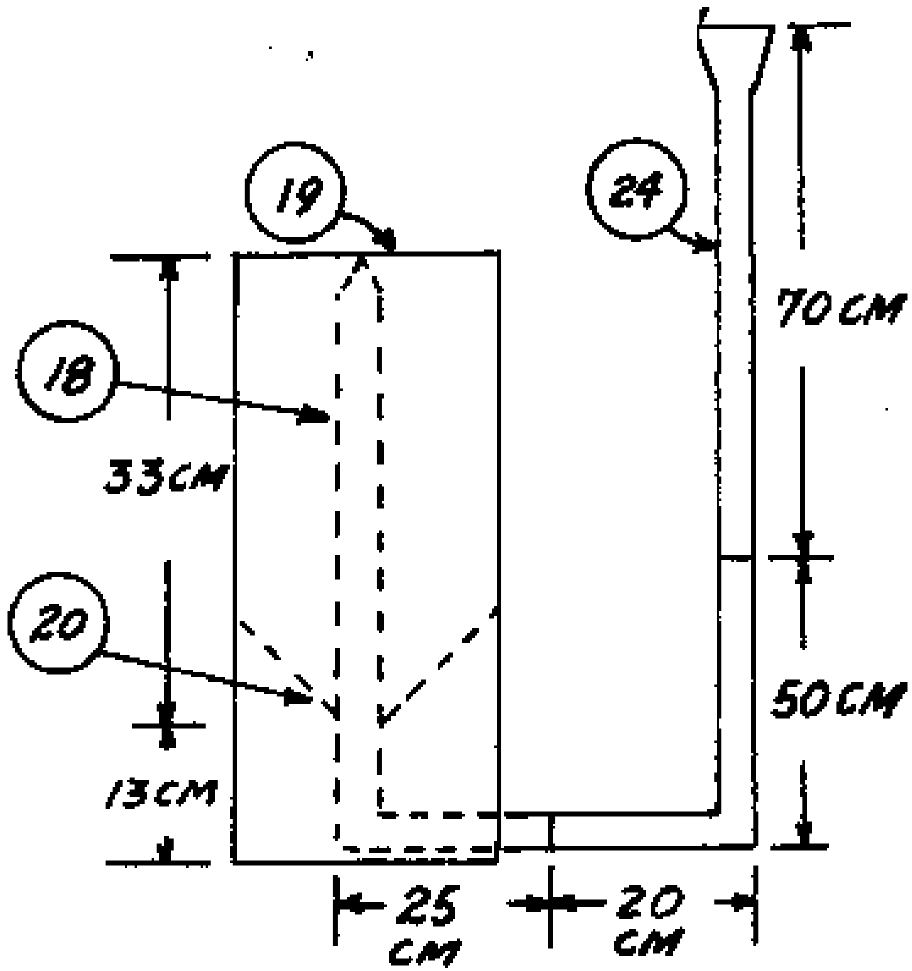


FIGURE 7, DETAIL OF PART 19
HOPPER AND PART 24, PIPE.
BROKEN LINES SHOW PART 18,
PIPE, AND PART 20, FLOOR.

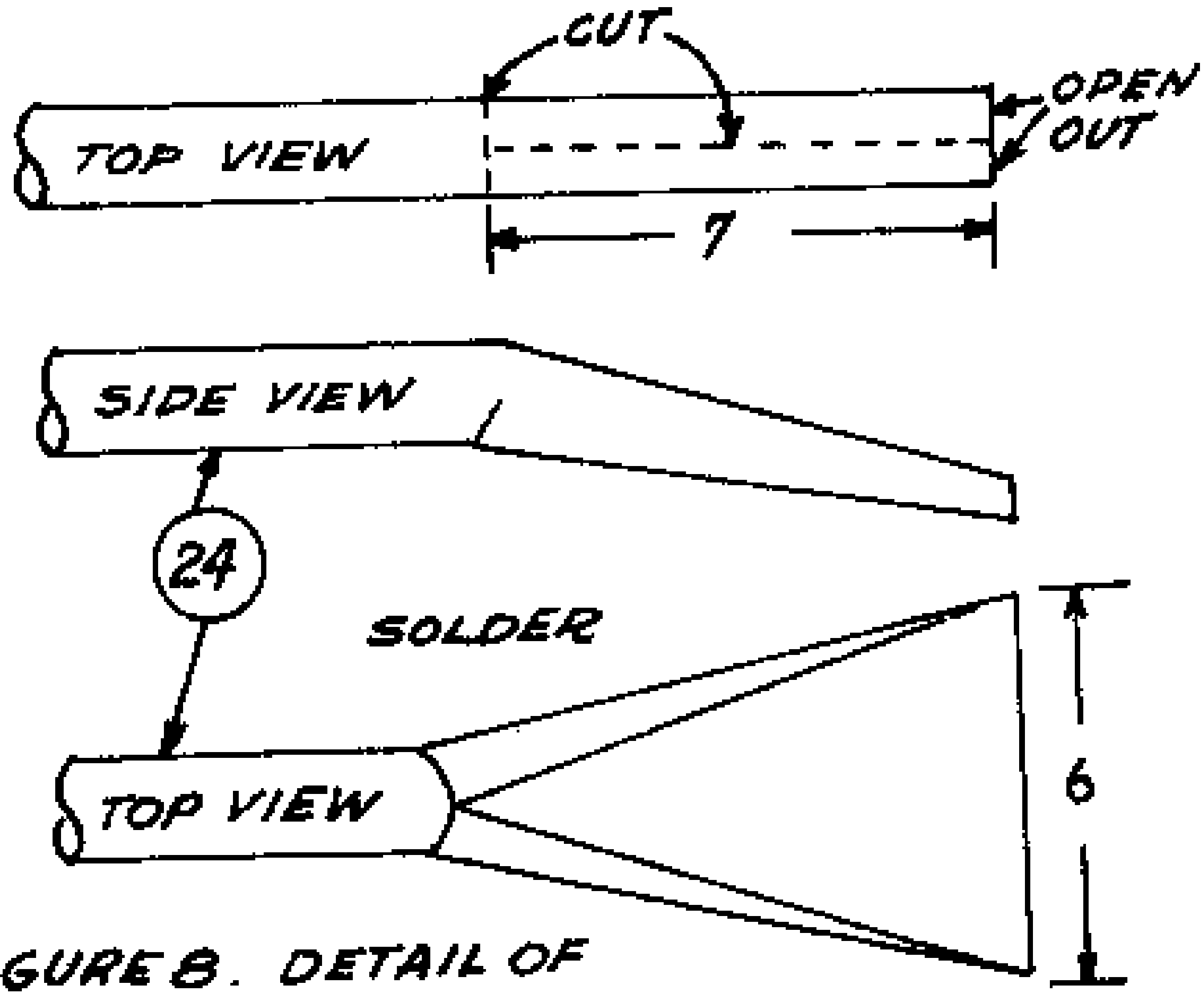


FIGURE 8. DETAIL OF PART 24, PIPE.

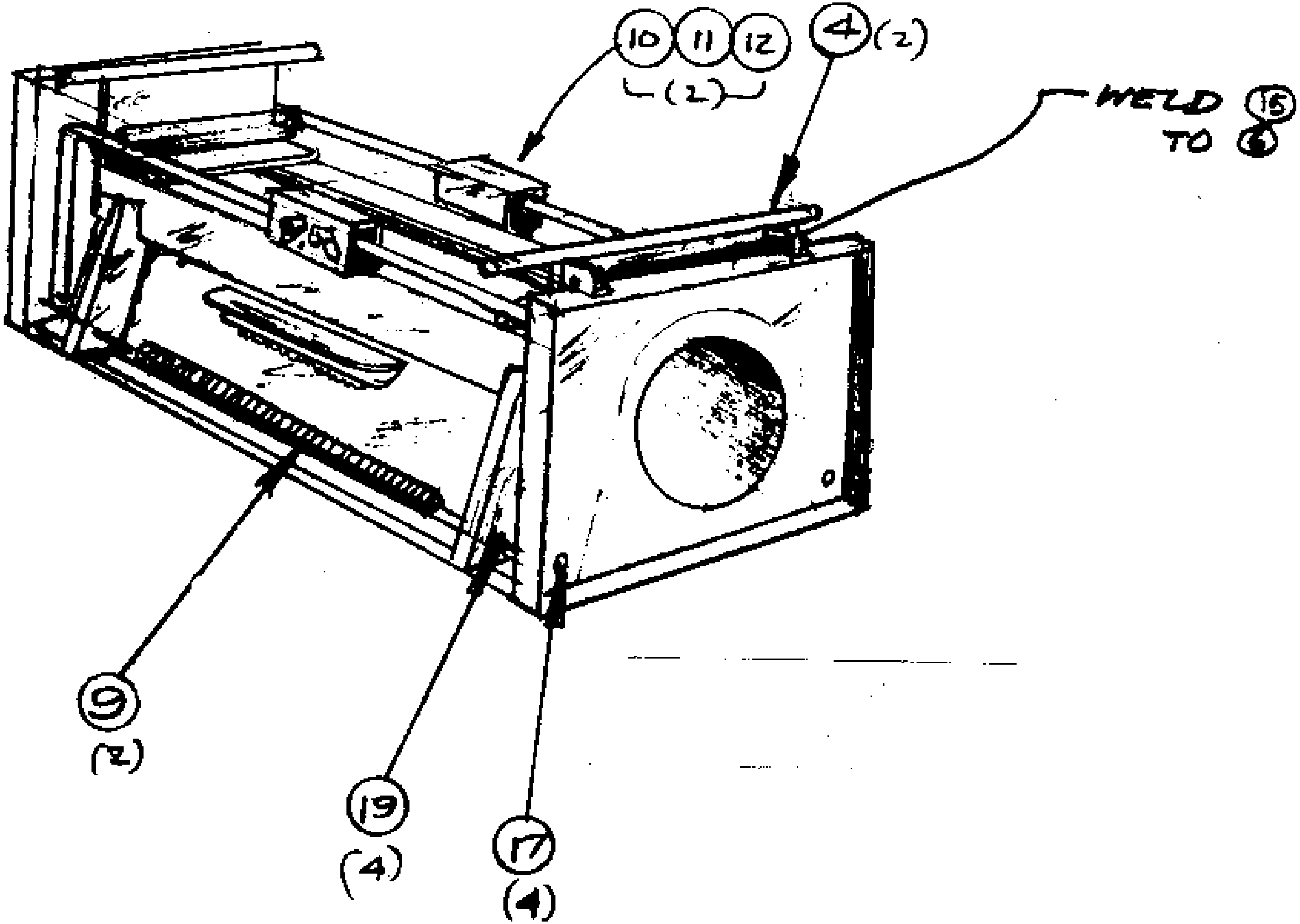


FIGURE 14. ATTACH DOORS WITH HINGEPIN (15), WELD IN PLACE, AND PUT SPRINGS (9), CONNECTORS (19), AND ATTACHMENTS (17) IN PLACE. UNIT IS NOW COMPLETE EXCEPT FOR PARTS 10, 11 AND 12, WHICH NOW CAN BE INSTALLED.

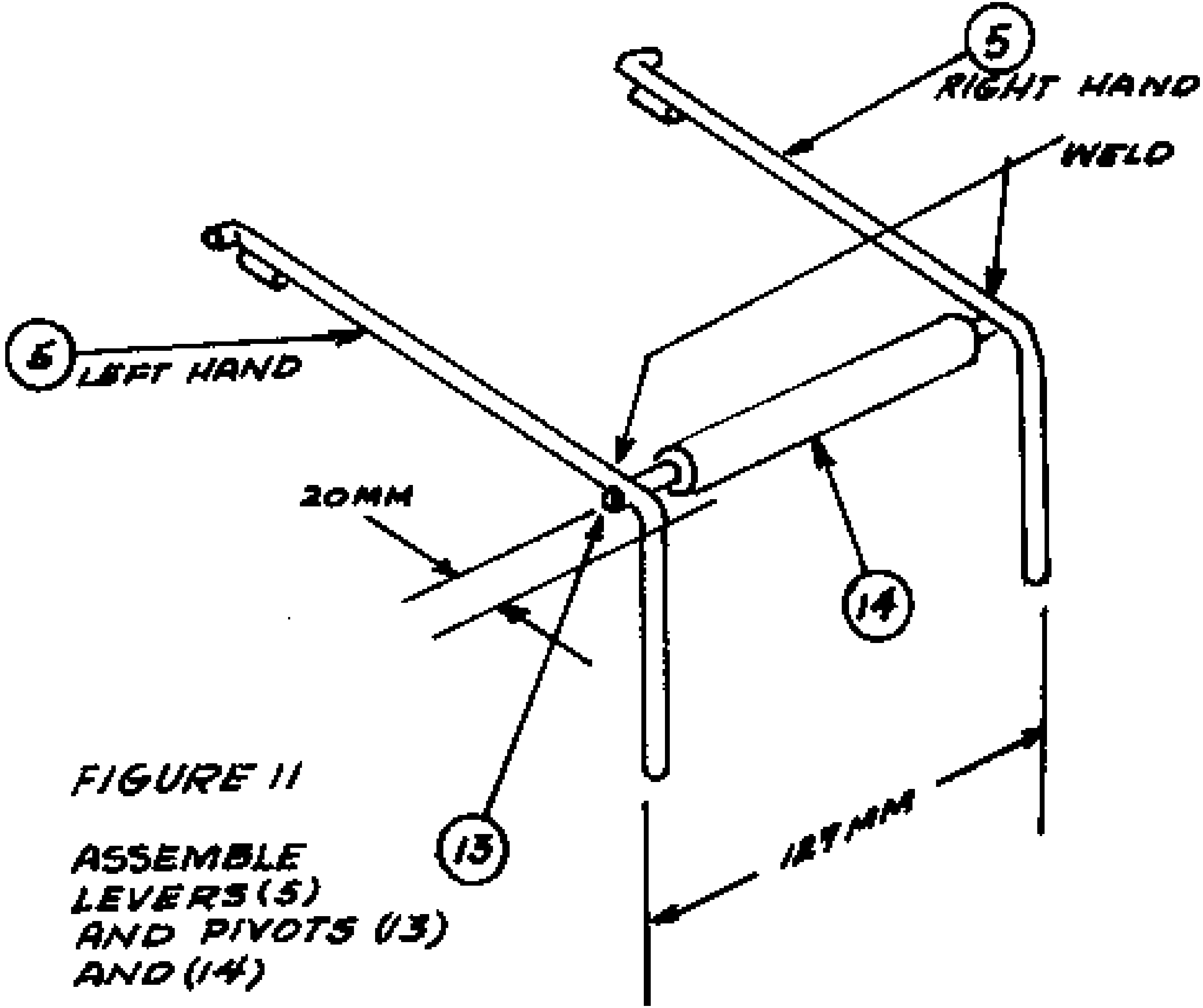


FIGURE 11

ASSEMBLE
LEVERS (5)
AND PIVOTS (13)
AND (14)

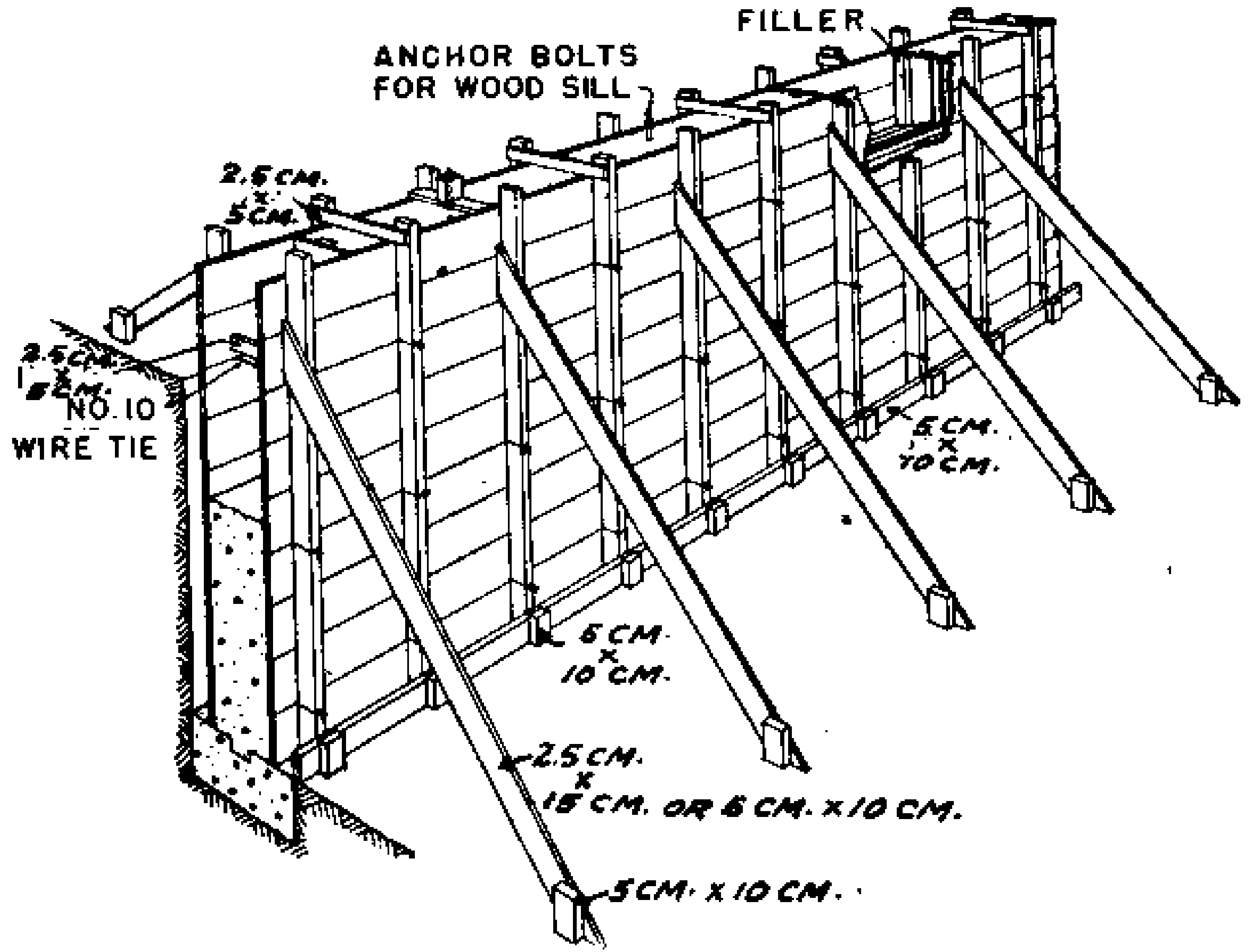


FIGURE 10--Forms for a basement or cellar wall. The earth can be used as the outside form if sufficiently firm.

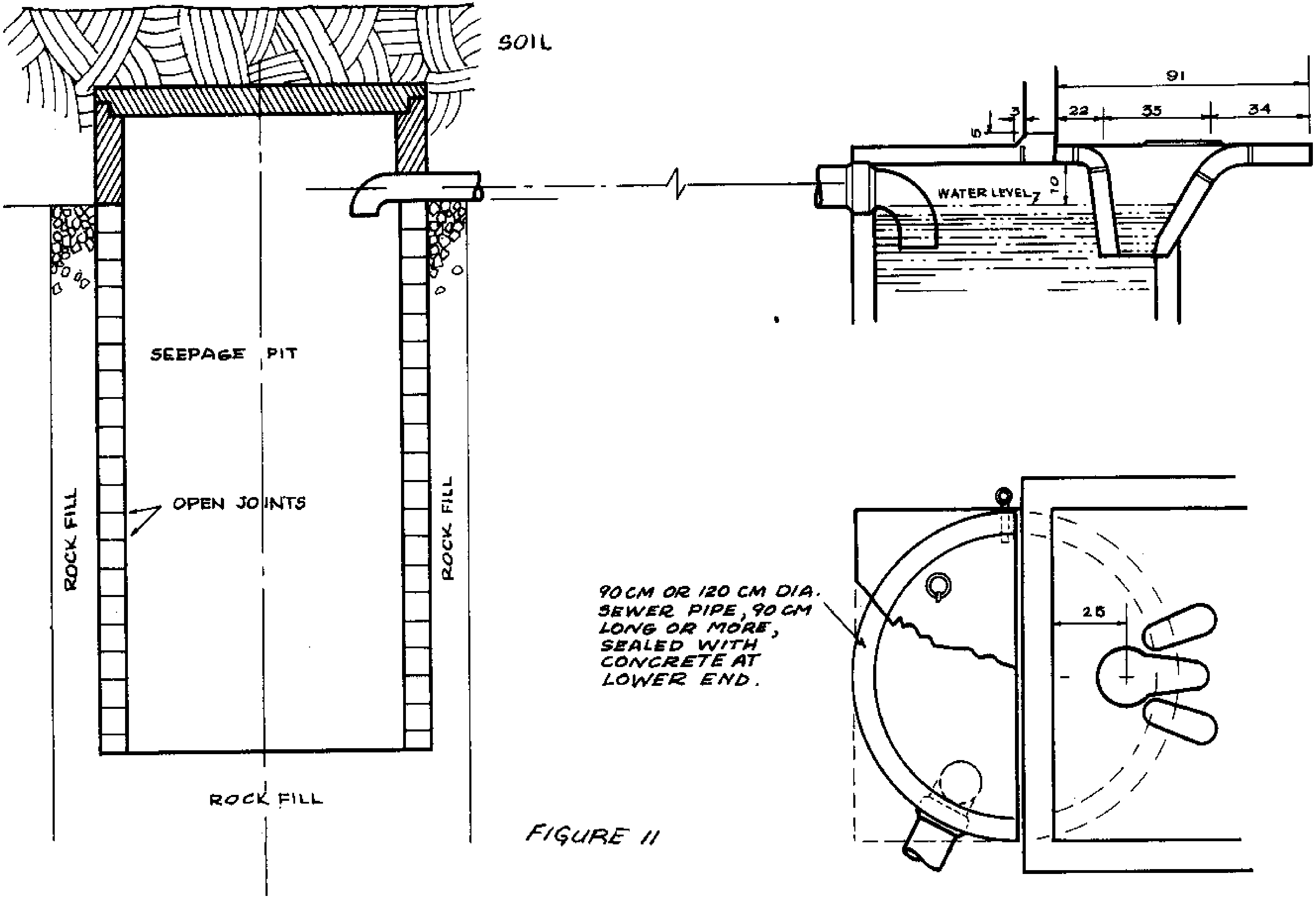


FIGURE 11

Not in Scale
Dimensions in cm.

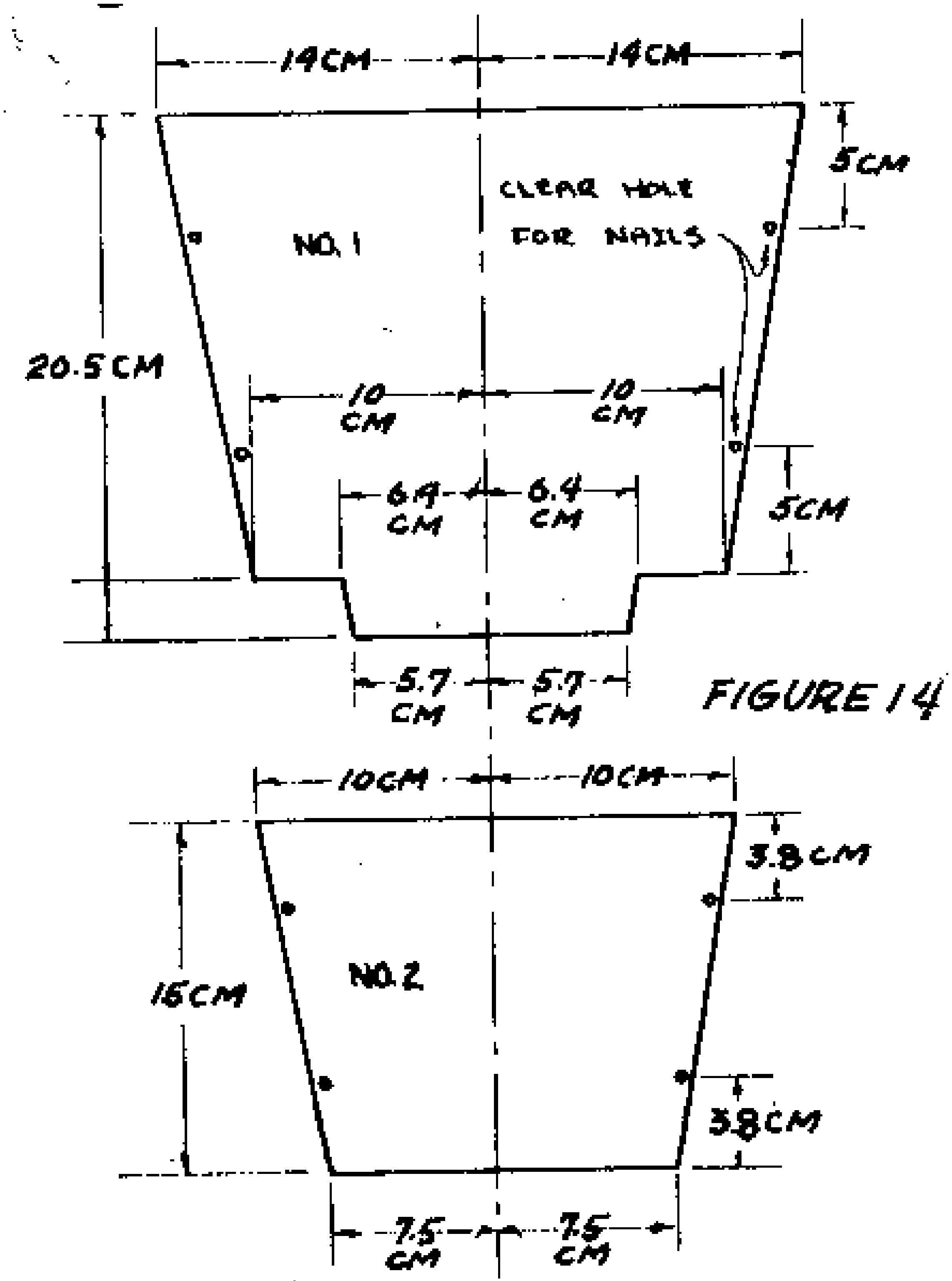

14CM
14CM
5CM
CLEAR HOLE
FOR NAILS
NO. 1
20.5CM
10 CM
10 CM
6.4 CM
6.4 CM
5CM
5.7 CM
5.7 CM
10CM
10CM
3.8CM
NO. 2
15CM
3.8CM
7.5 CM
7.5 CM

FIGURE 14

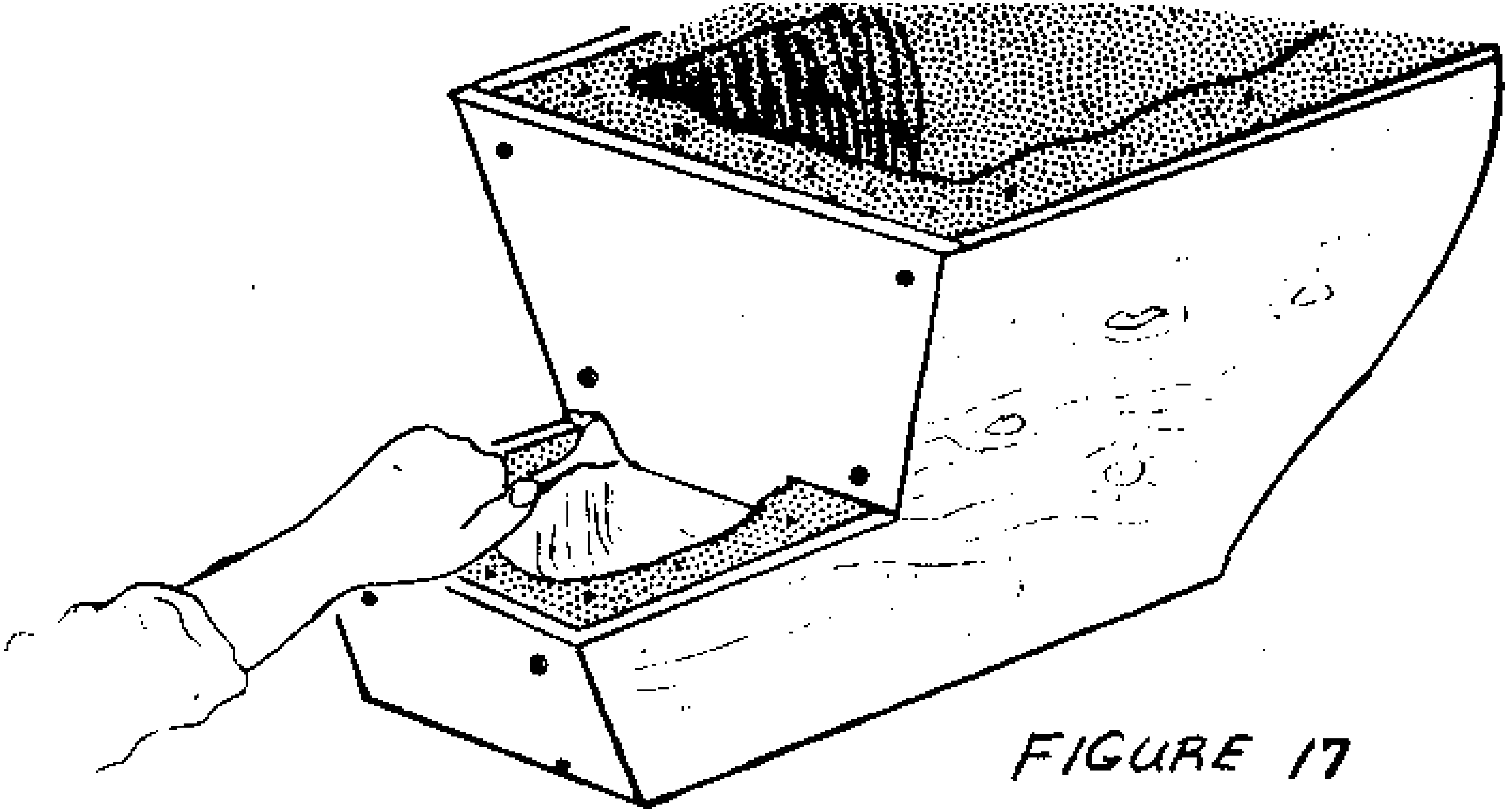
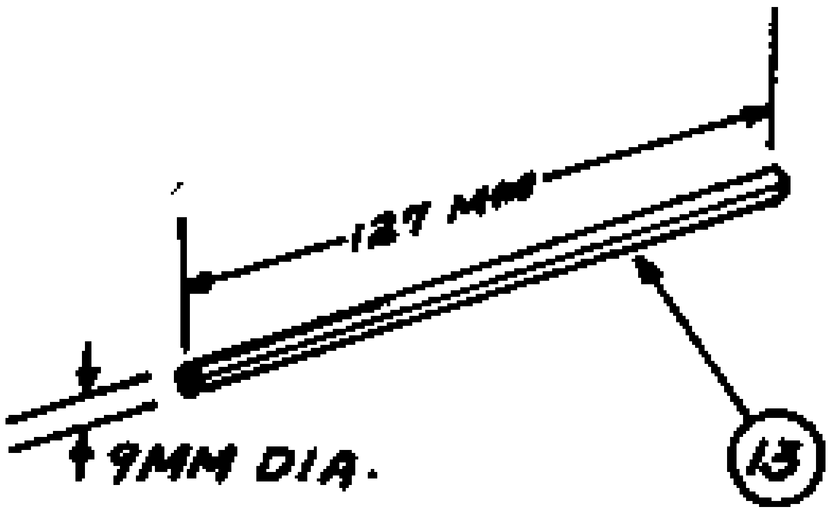


FIGURE 17



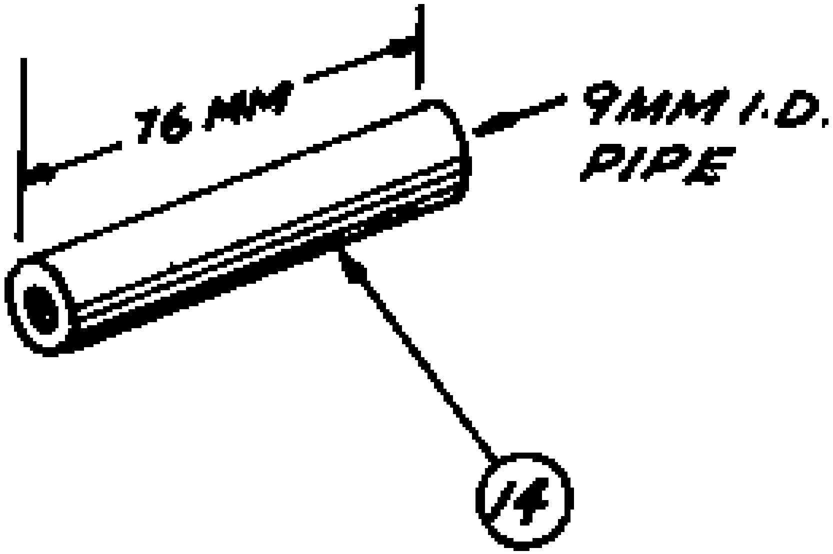


FIGURE 9 MAKE 4
LOWER HINGES

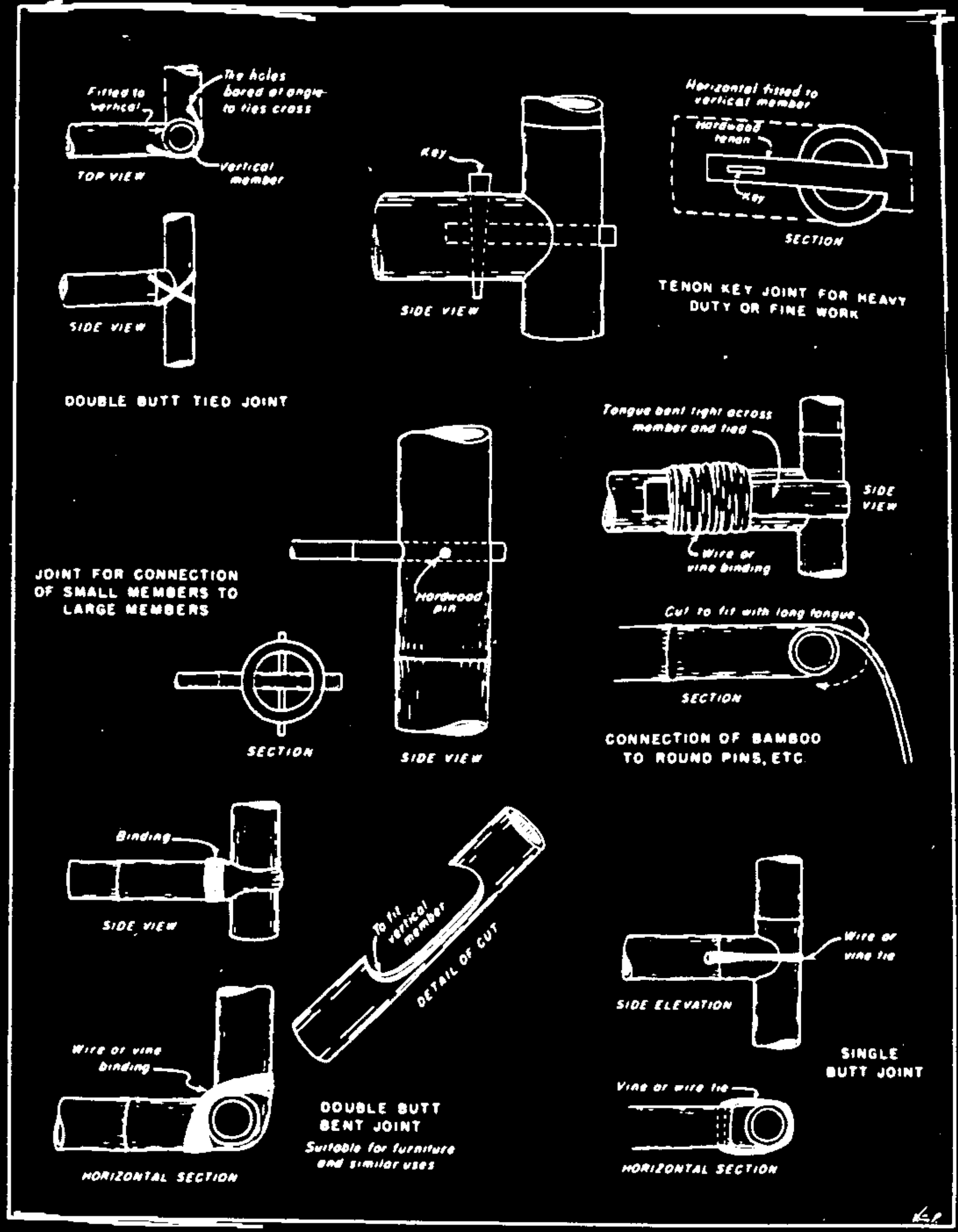


FIGURE 11--Joints used in building with bamboo.

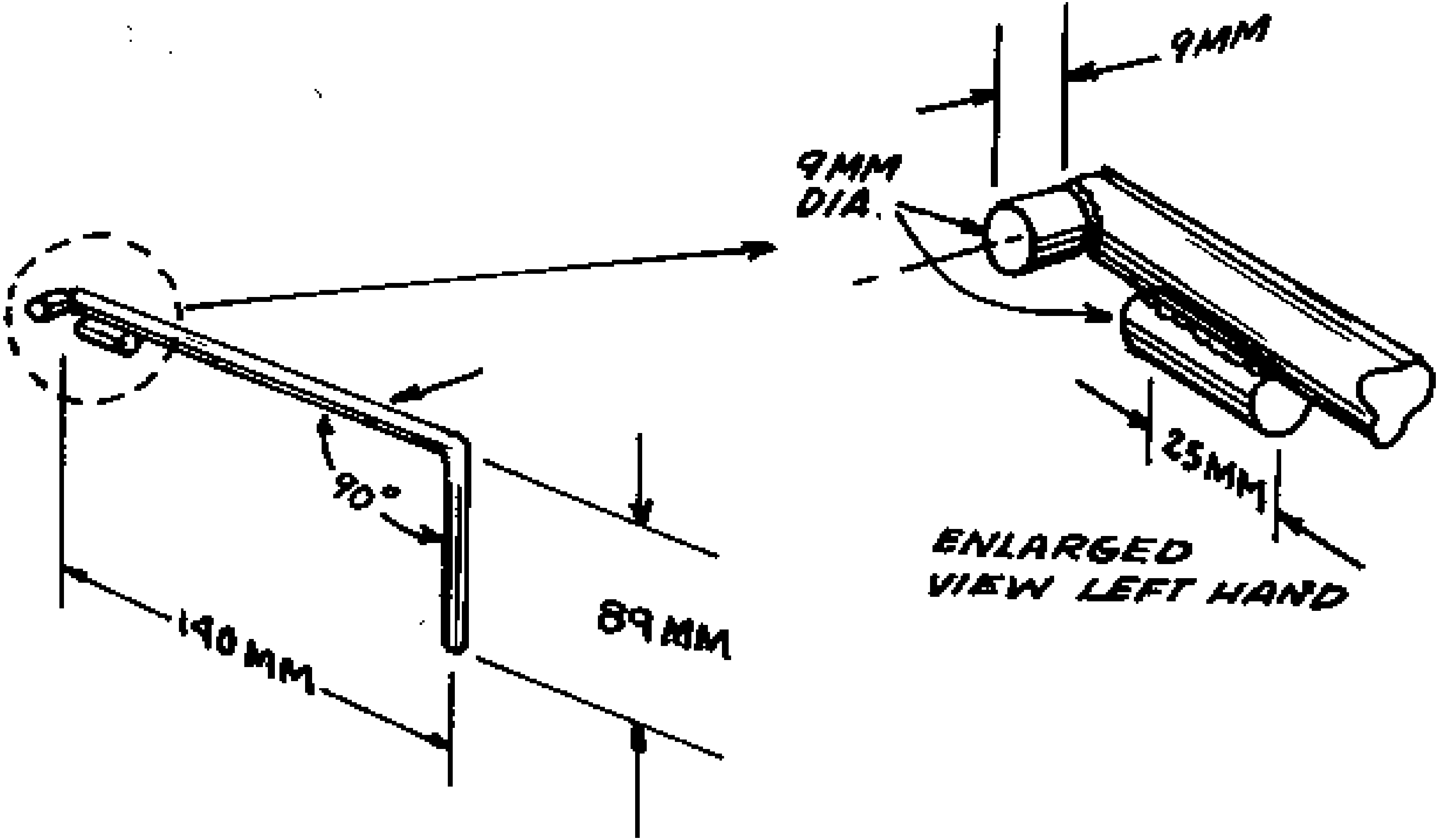


FIGURE 10 MAKE 4 LEVERS, 2 RIGHT HAND AND 2 LEFT HAND

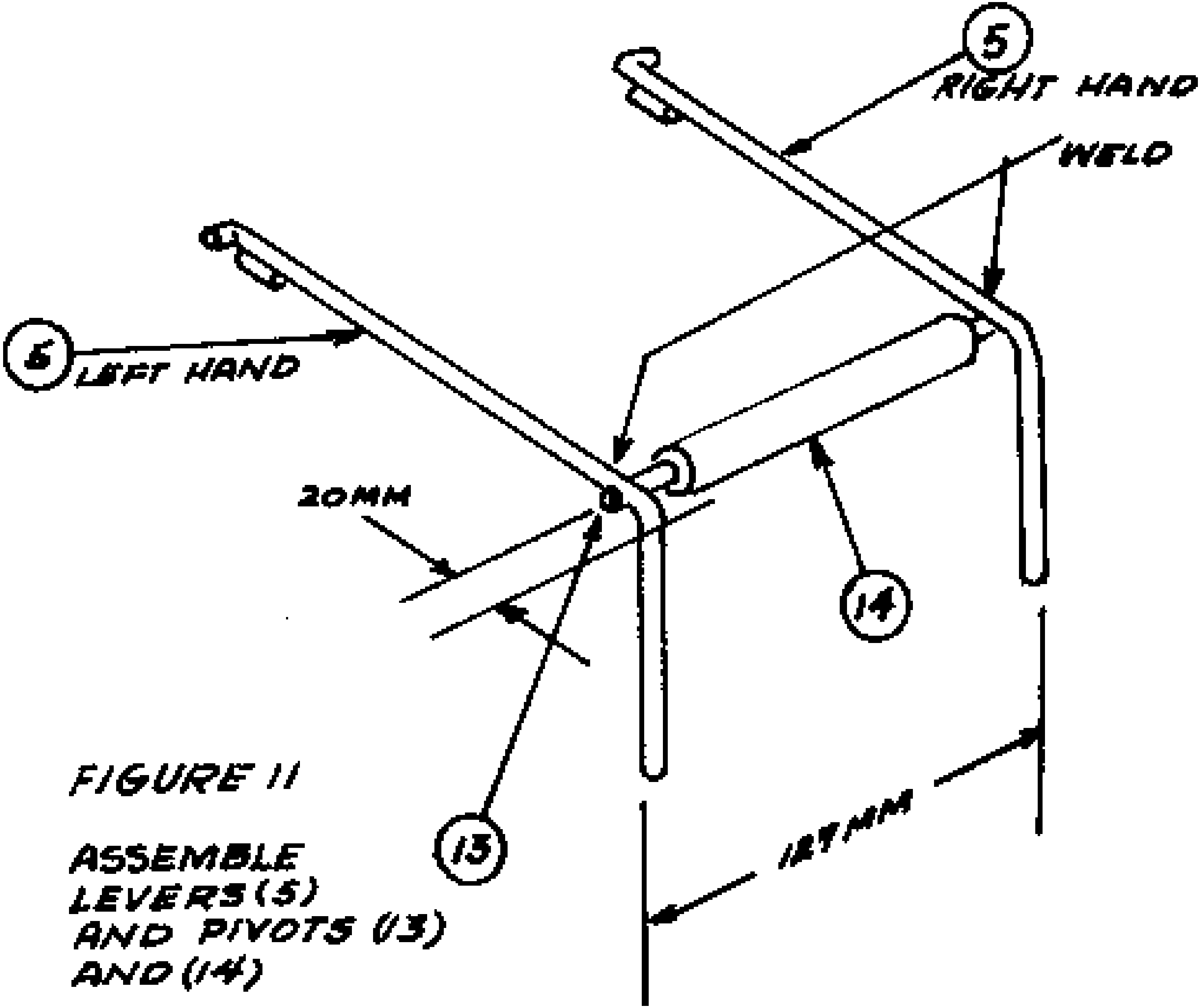


FIGURE 11

ASSEMBLE
LEVERS (5)
AND PIVOTS (13)
AND (14)

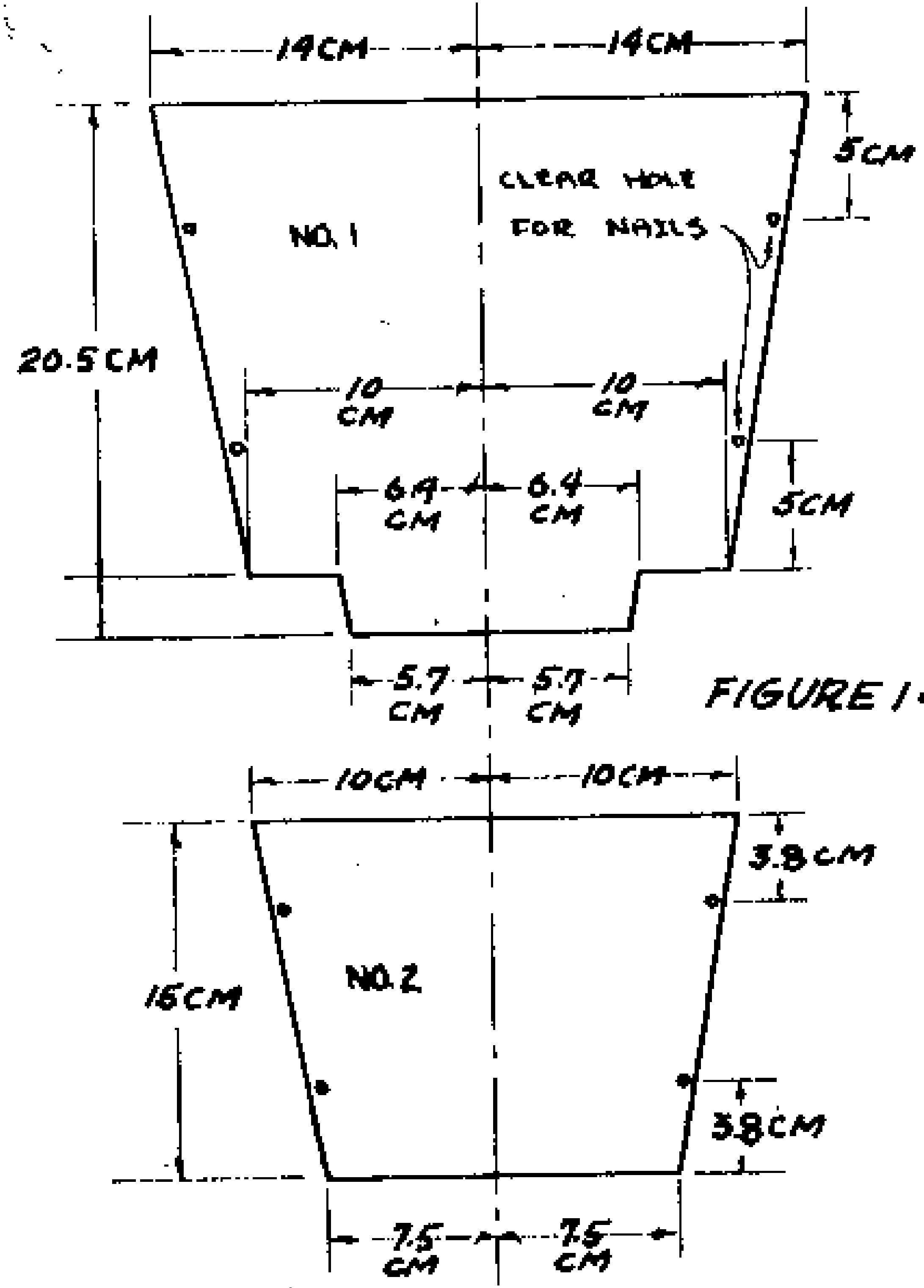

14CM
14CM
5CM
CLEAR HOLE
FOR NAILS
NO.1
20.5CM
10 CM
10 CM
6.4 CM
6.4 CM
5CM
5.7 CM
5.7 CM
10CM
10CM
3.8CM
NO.2
15CM
3.8CM
7.5 CM
7.5 CM

FIGURE 14

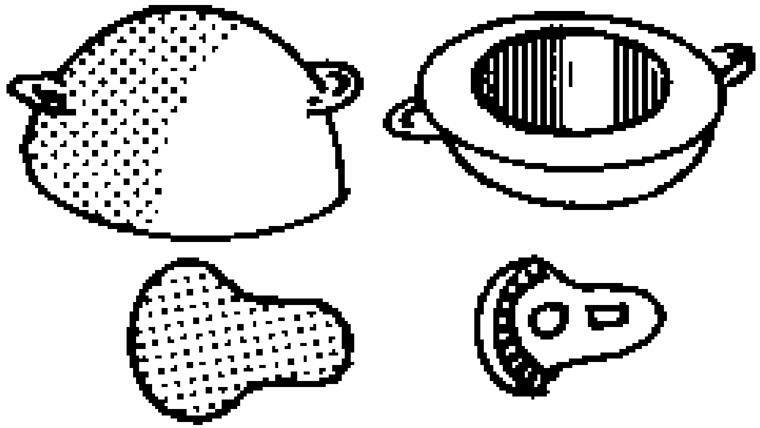


FIGURE 18. TRAP MOLD AND INSERT

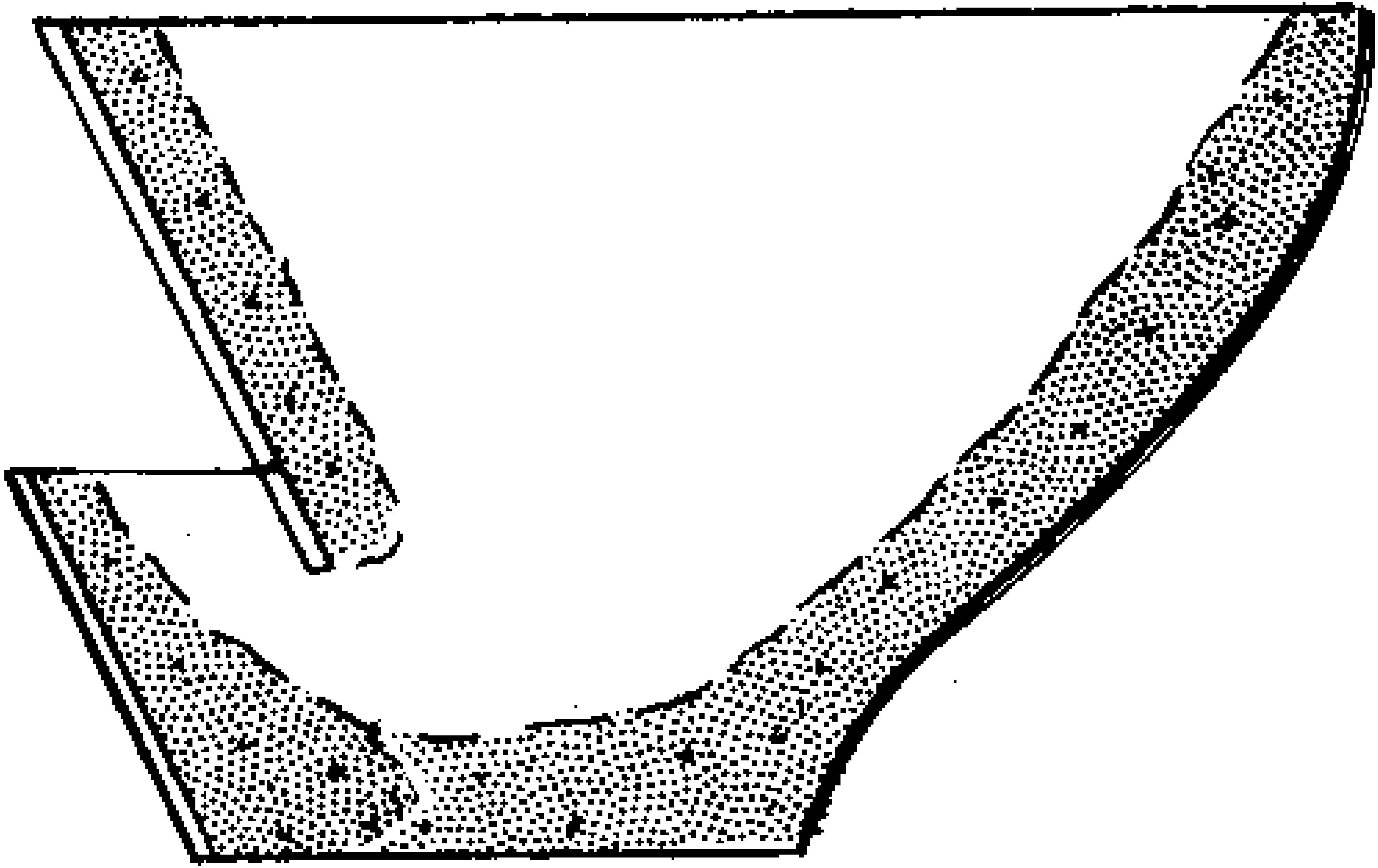


FIGURE 16

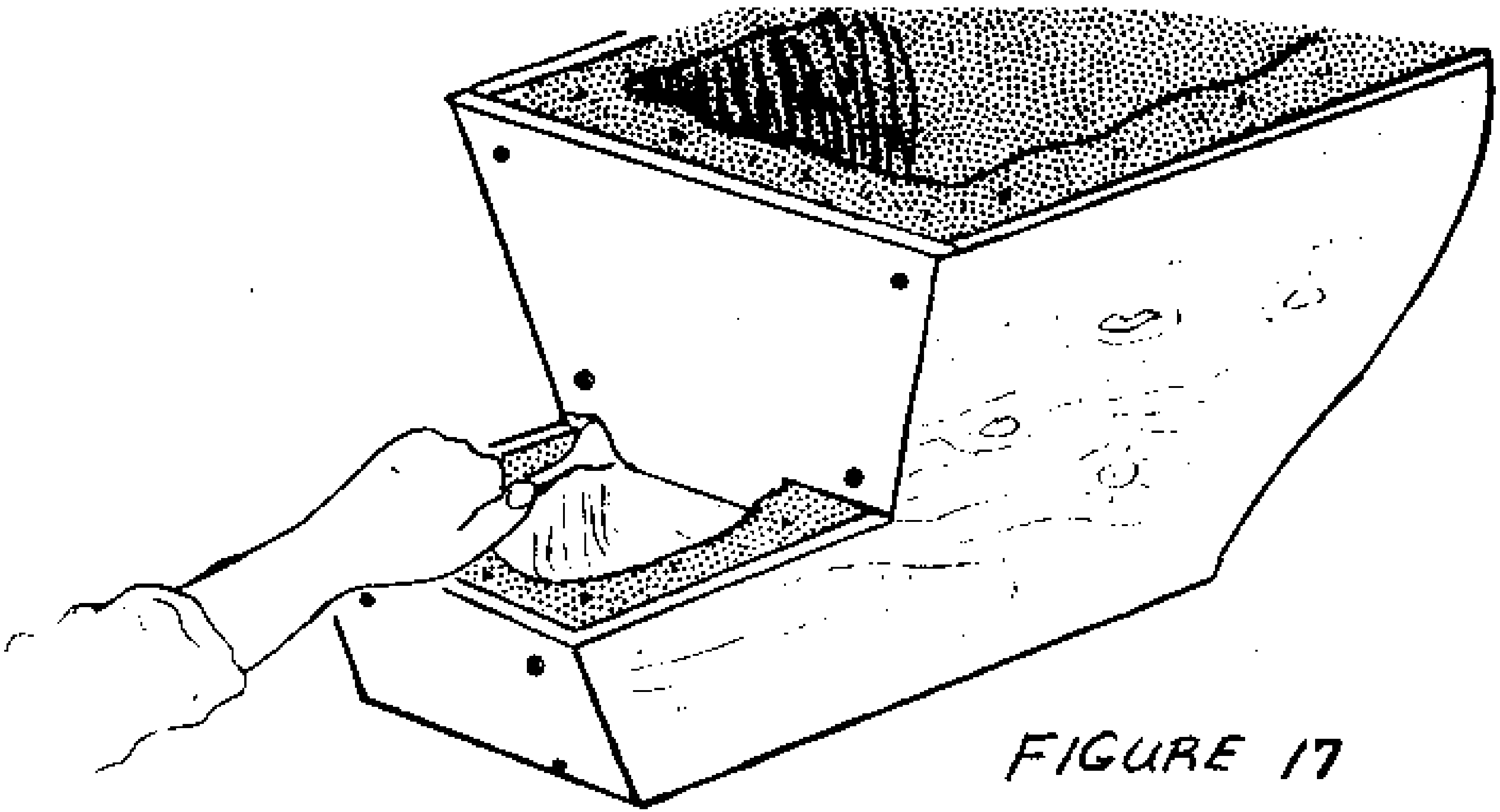


FIGURE 17

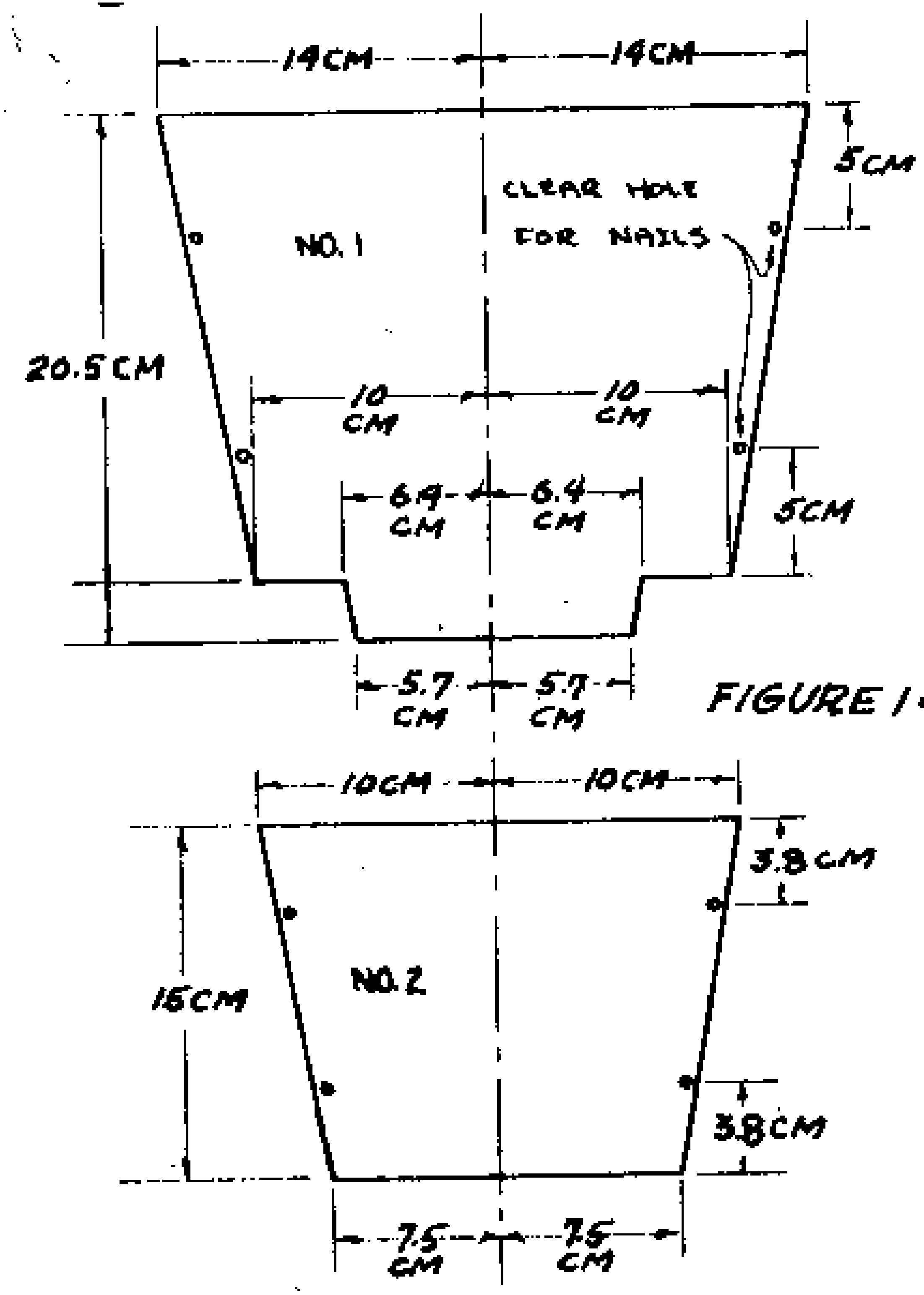

14CM
14CM
5CM
CLEAR HOLE
FOR NAILS
NO. 1
20.5CM
10
CM
10
CM
6.4
CM
6.4
CM
5CM
5.7
CM
5.7
CM
10CM
10CM
3.8CM
NO. 2
15CM
3.8CM
7.5
CM
7.5
CM

FIGURE 14

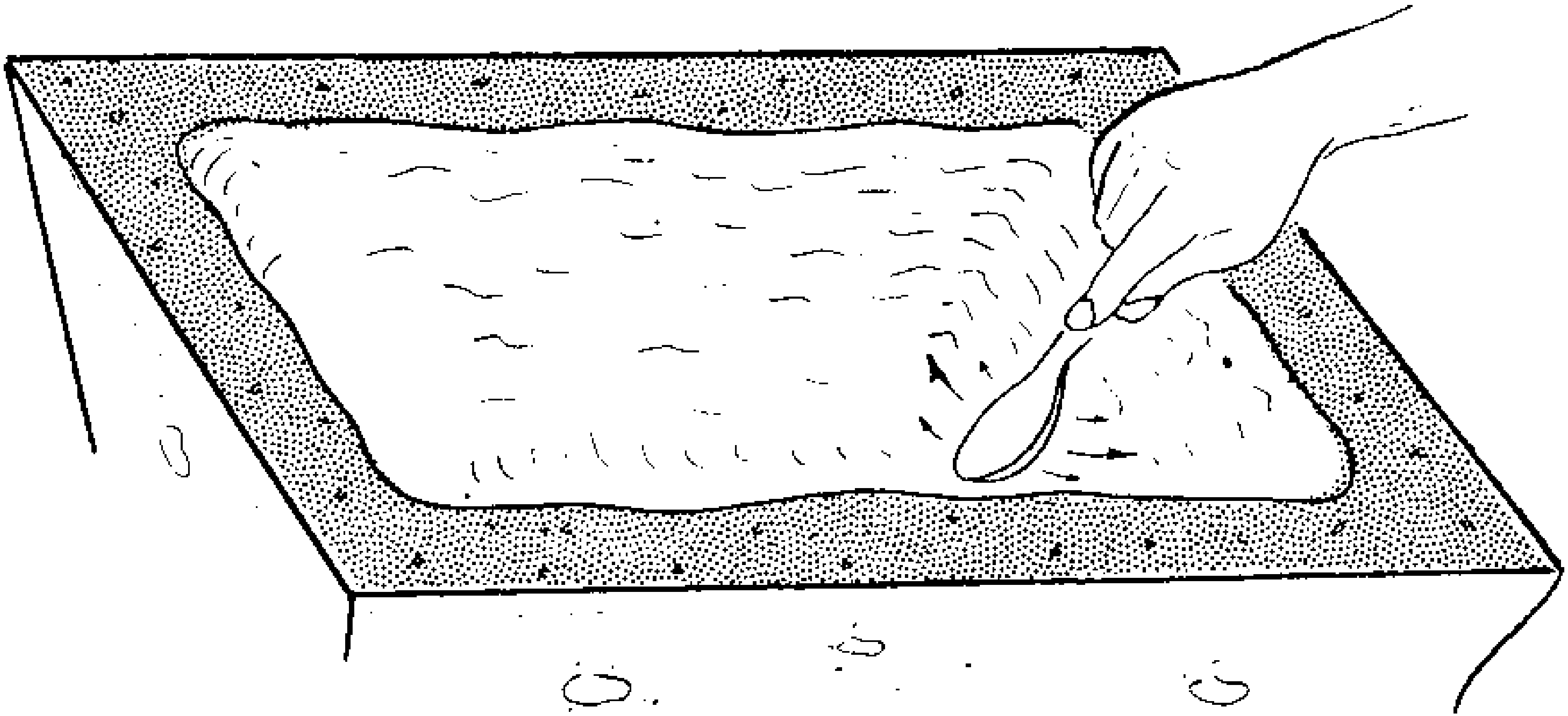
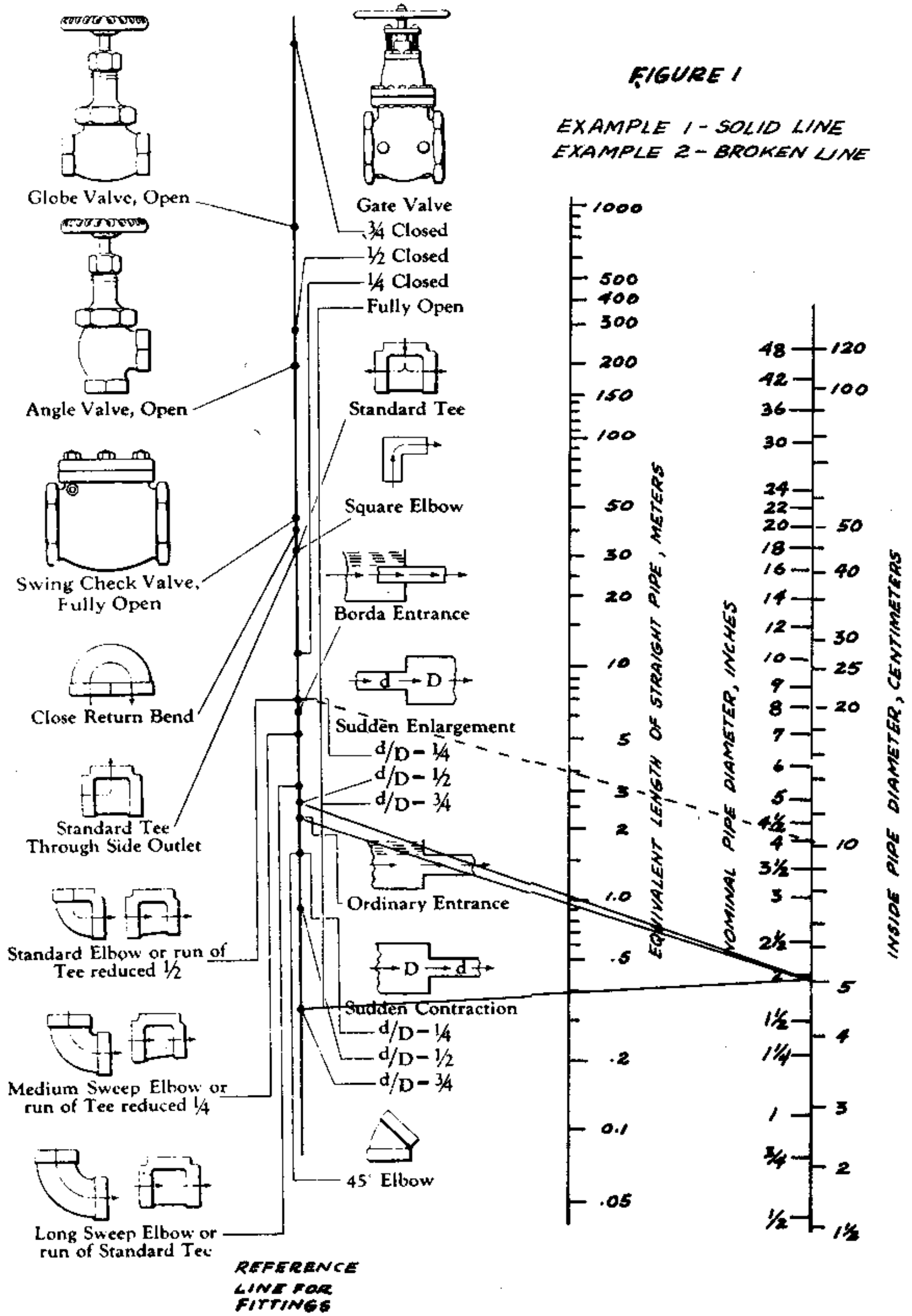


FIGURE 18

Resistance of Valves and Fittings to Flow of Fluids



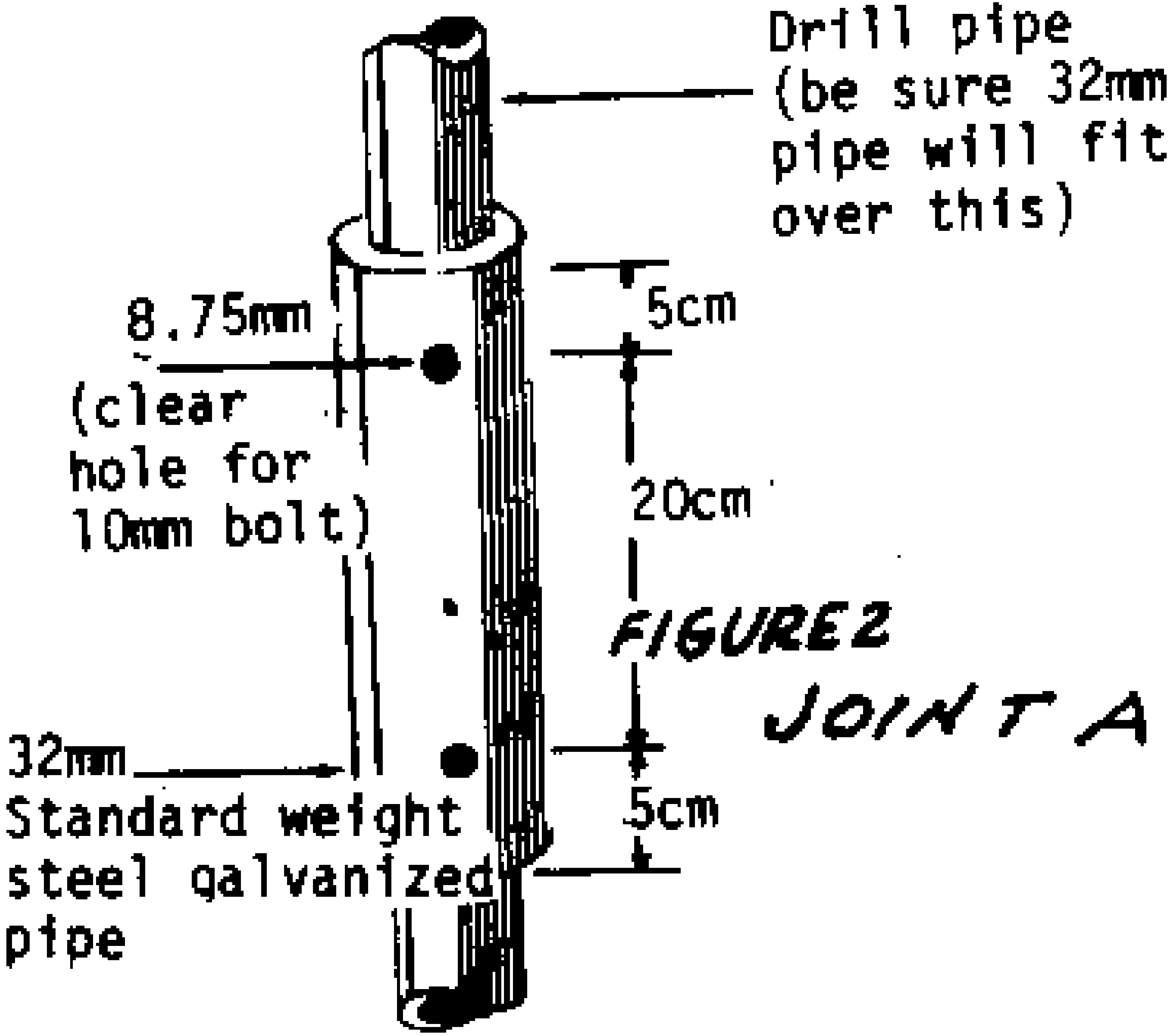


FIGURE2
JOINT A

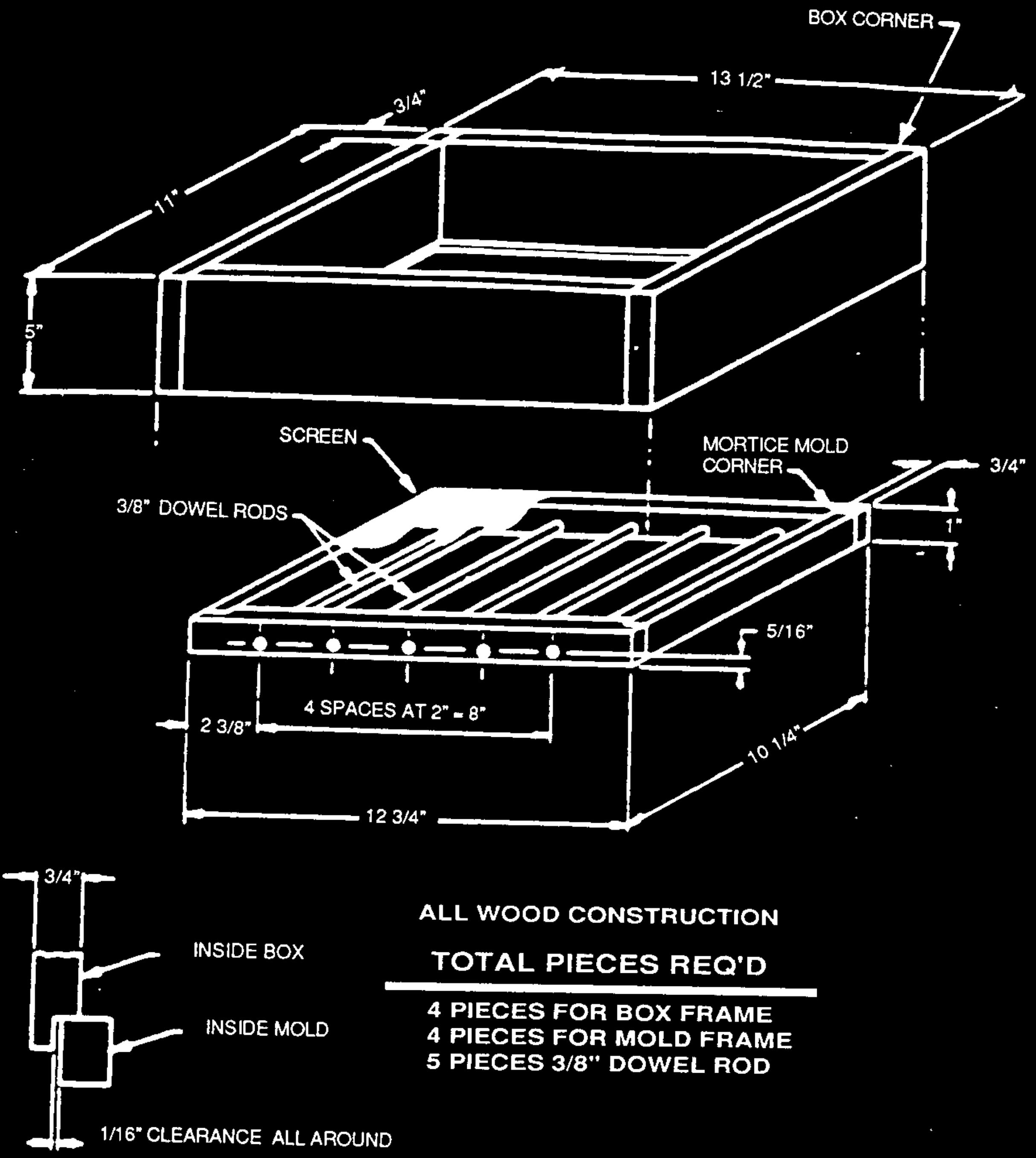
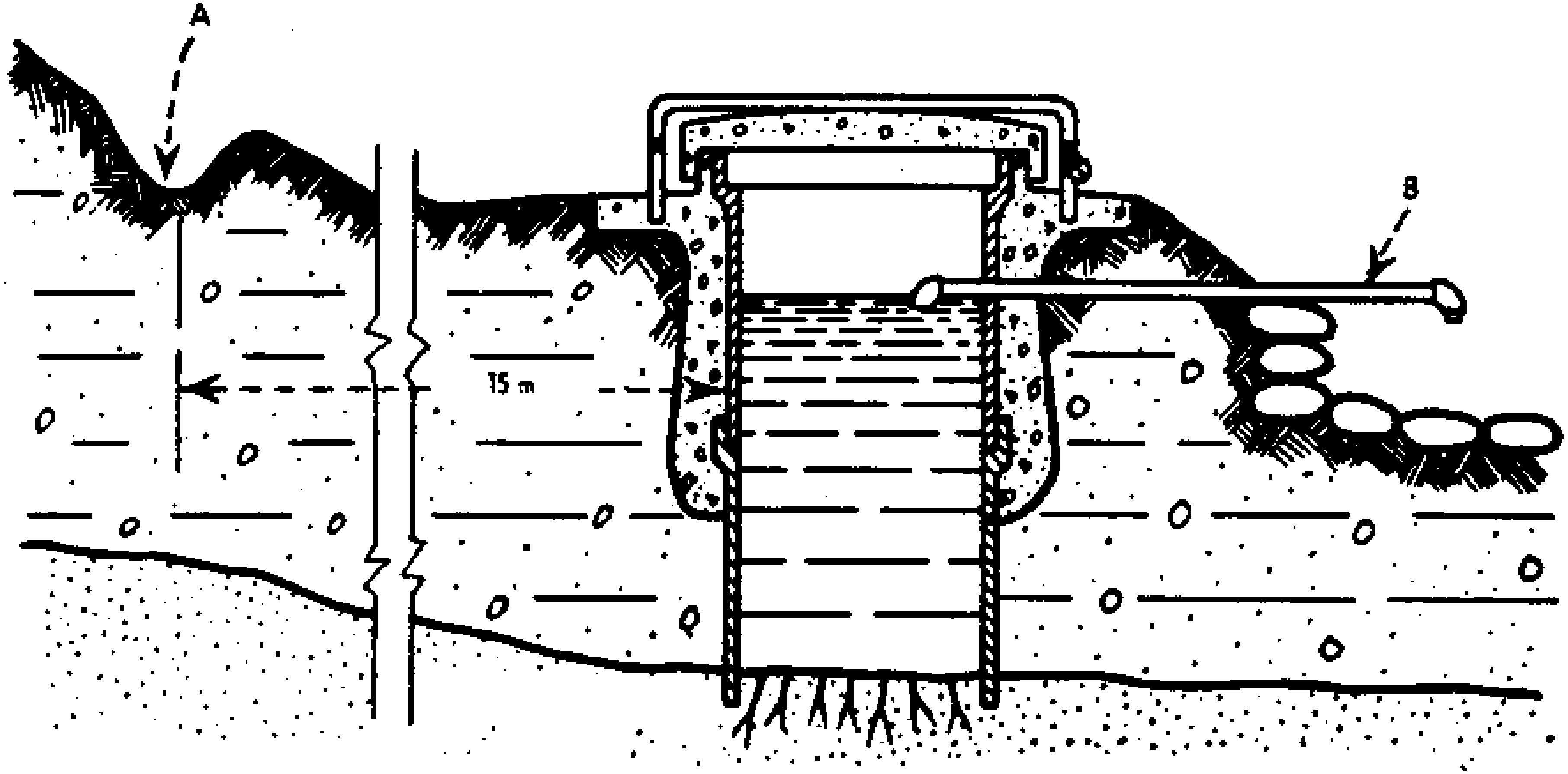

BOX CORNER
13 1/2"
3/4"
11"
5"
SCREEN
MORTICE MOLD
CORNER
3/4"
3/8" DOWEL RODS
1"
5/16"
4 SPACES AT 2" = 8"
2 3/8"
10 1/4"
12 3/4"
3/4"
INSIDE BOX
INSIDE MOLD
1/16" CLEARANCE ALL AROUND
ALL WOOD CONSTRUCTION
TOTAL PIECES REQ'D
4 PIECES FOR BOX FRAME
4 PIECES FOR MOLD FRAME
5 PIECES 3/8" DOWEL ROD

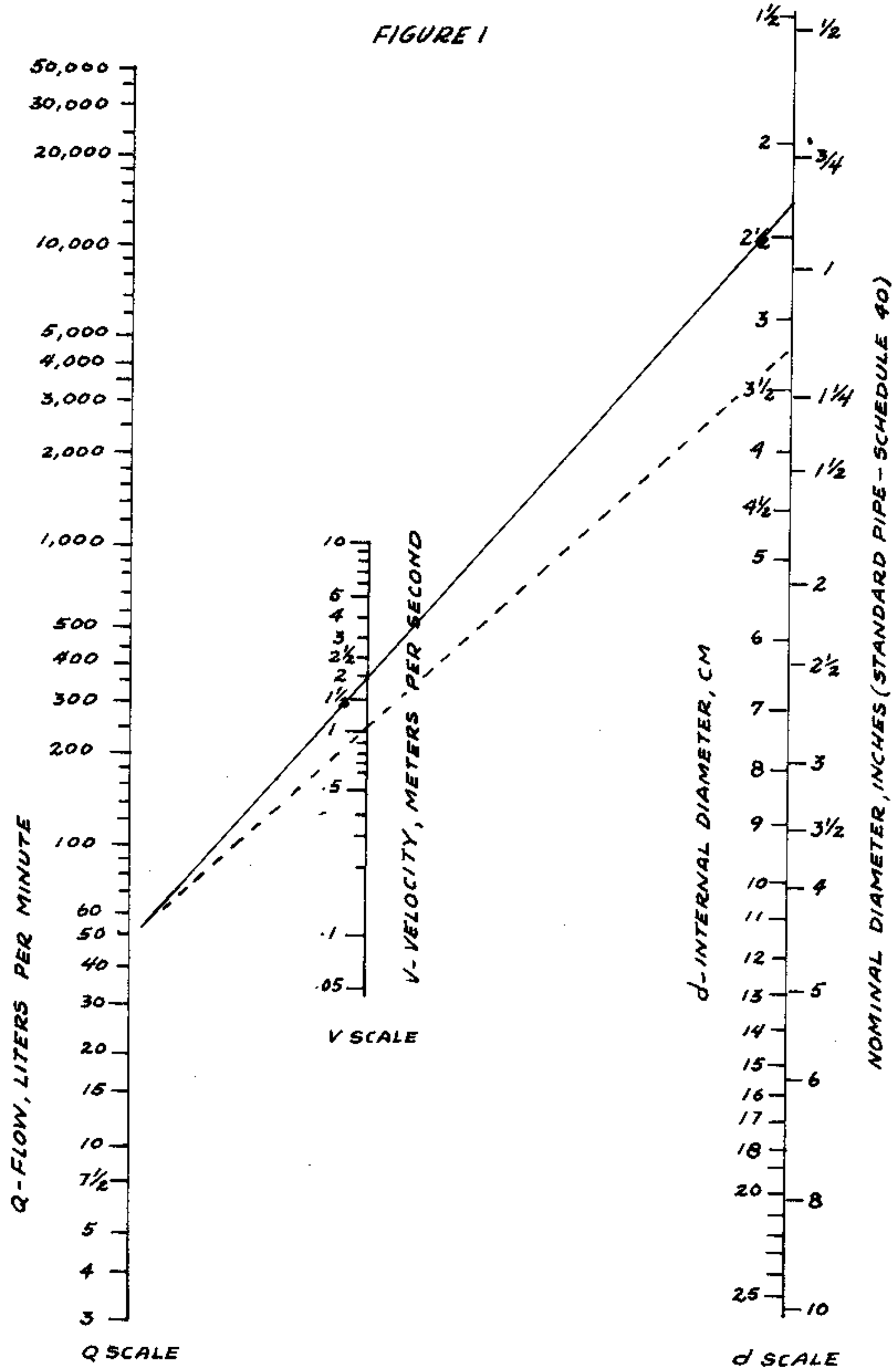
FIGURE 1

Fig. 2. PROPERLY PROTECTED SPRING (II)



A = Protective drainage ditch to keep drainage water a safe distance from spring
B = Screened outlet pipe : to discharge freely or be piped to village or residence

FIGURE 1


Q-FLOW, LITERS PER MINUTE
Q SCALE
V-VELOCITY, METERS PER SECOND
V SCALE
d-INTERNAL DIAMETER, CM
NOMINAL DIAMETER, INCHES (STANDARD PIPE-SCHEDULE 40)
d SCALE
50,000
30,000
20,000
10,000
5,000
4,000
3,000
2,000
1,000
500
400
300
200
100
60
50
40
30
20
15
10
7½
5
4
3
10
6
4
3
2½
2
1½
1
.5
.1
.05
1½
2
2½
3
3½
4
4½
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20
25
½
¾
1
1¼
1½
2
2½
3
3½
4
5
6
8
10

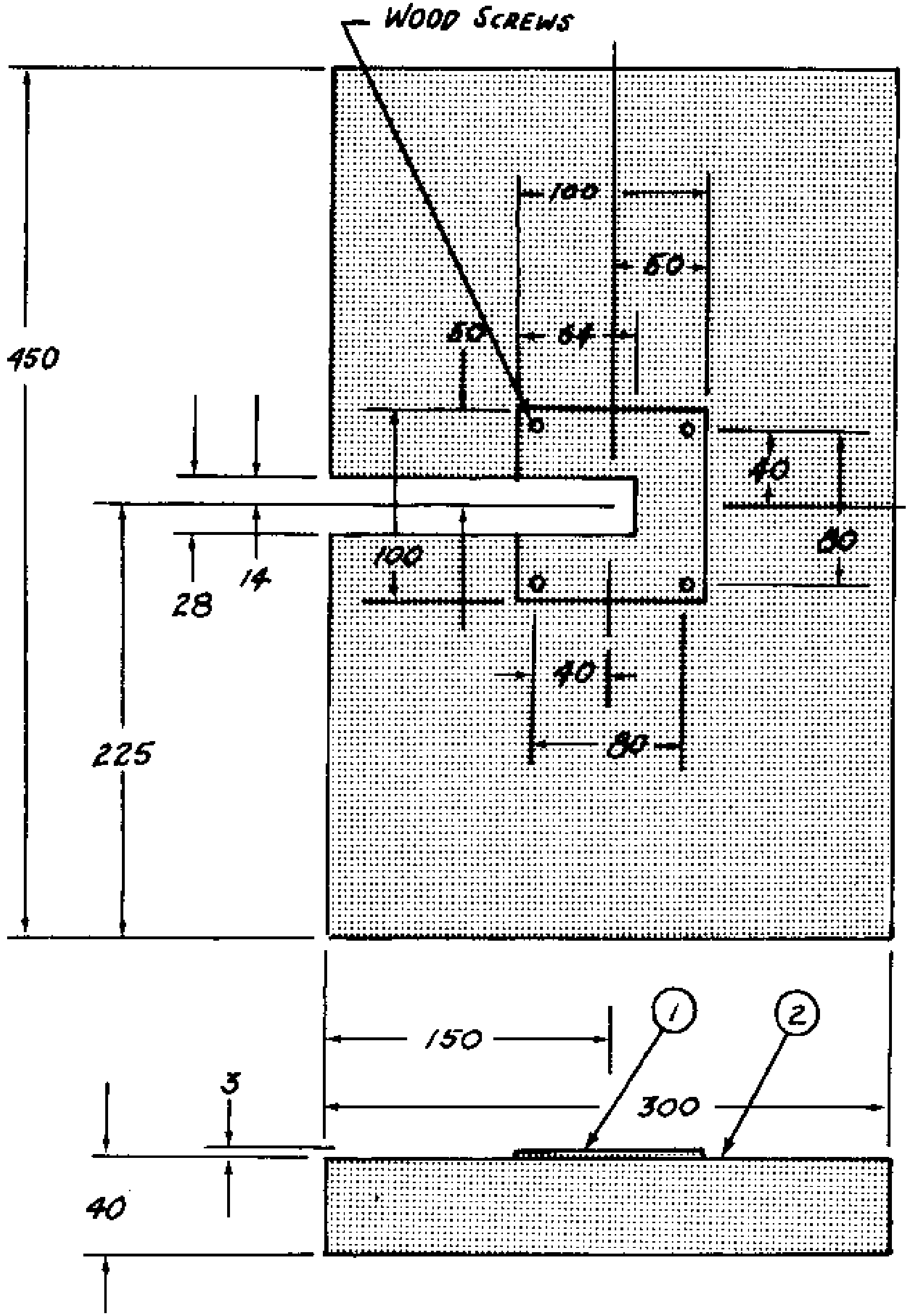


FIGURE 3 - AUGER SUPPORT

MAT'L: 1 MILD STEEL
2 HARDWOOD

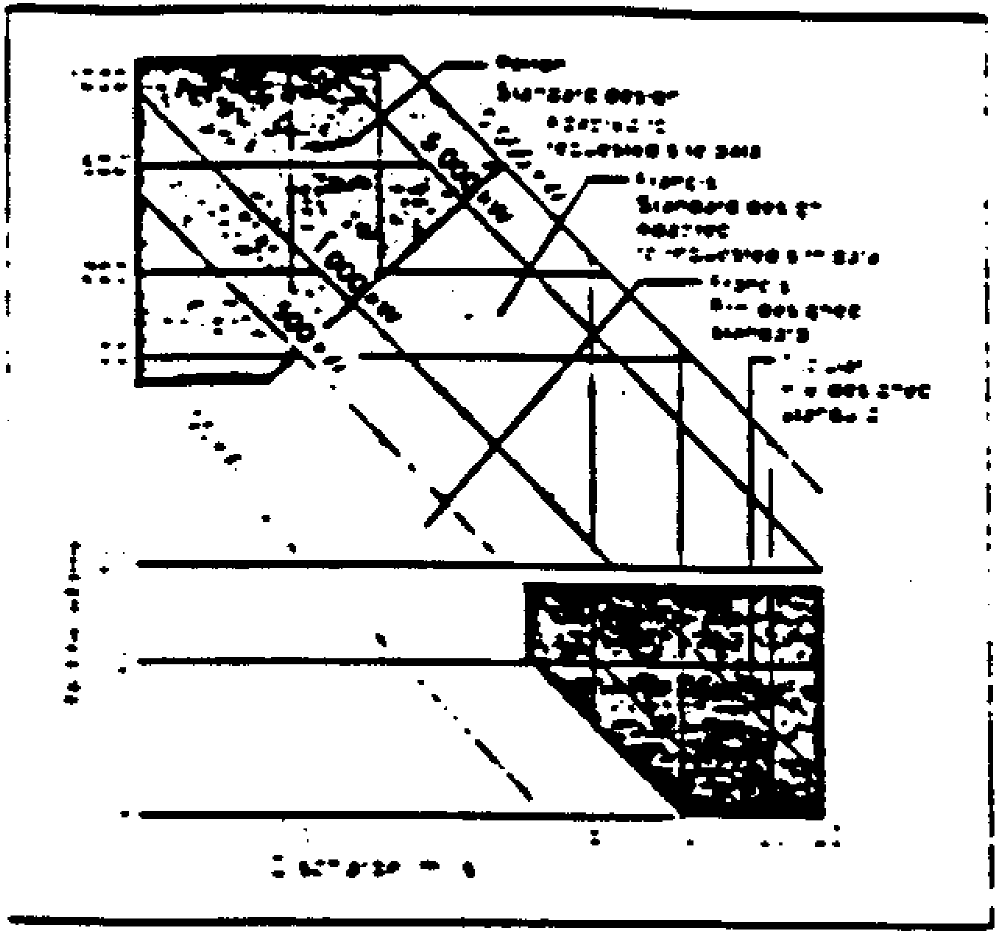


Figure 4. Discharge to Head Relation

Source: Sorumsand Verksted A/S Company, Mini Hydro Turbines (Sorumsand, Norway: Sorumsand Verksted A/S Company, 1981), p. 1.

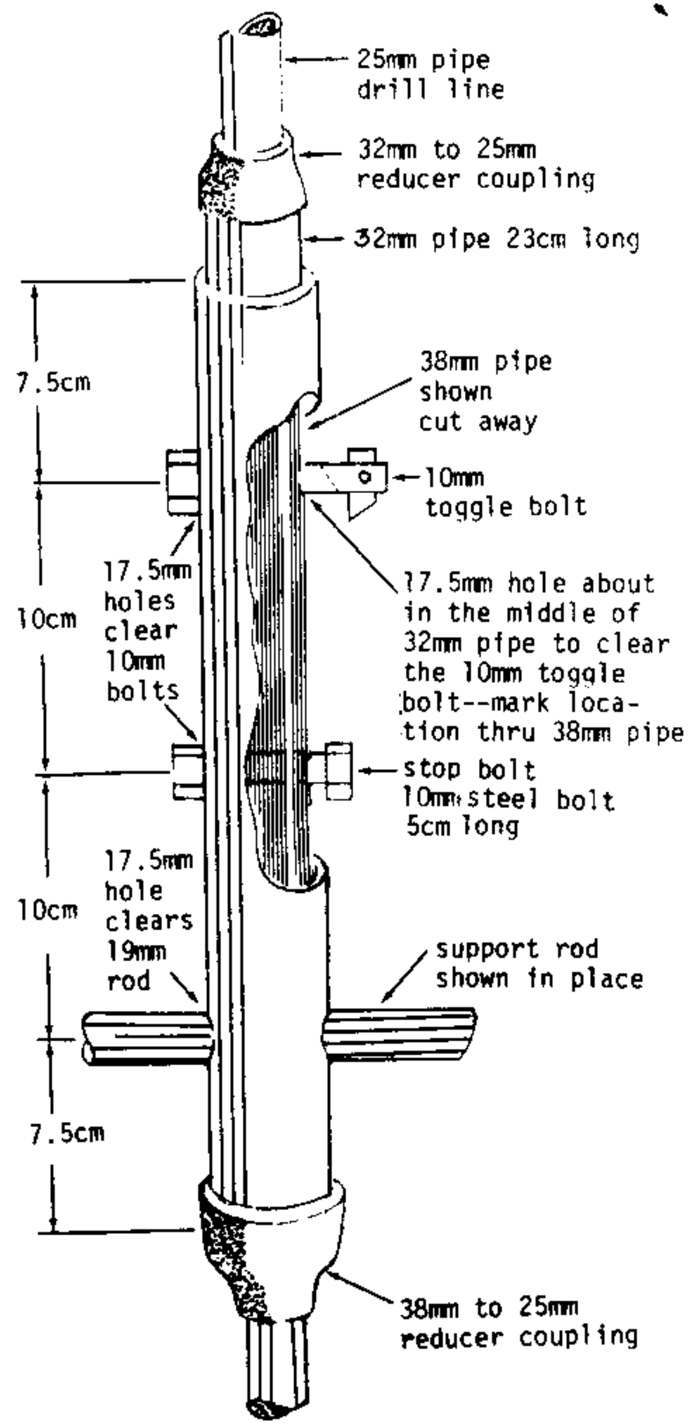

25mm pipe
drill line
32mm to 25mm
reducer coupling
32mm pipe 23cm long
7.5cm
38mm pipe
shown
cut away
10mm
toggle bolt
17.5mm
holes
clear
10mm
bolts
10cm
17.5mm hole about
in the middle of
32mm pipe to clear
the 10mm toggle
bolt--mark loca-
tion thru 38mm pipe
stop bolt
10mm steel bolt
5cm long
17.5mm
hole
clears
19mm
rod
10cm
support rod
shown in place
7.5cm
38mm to 25mm
reducer coupling

FIG.3 JOINT B

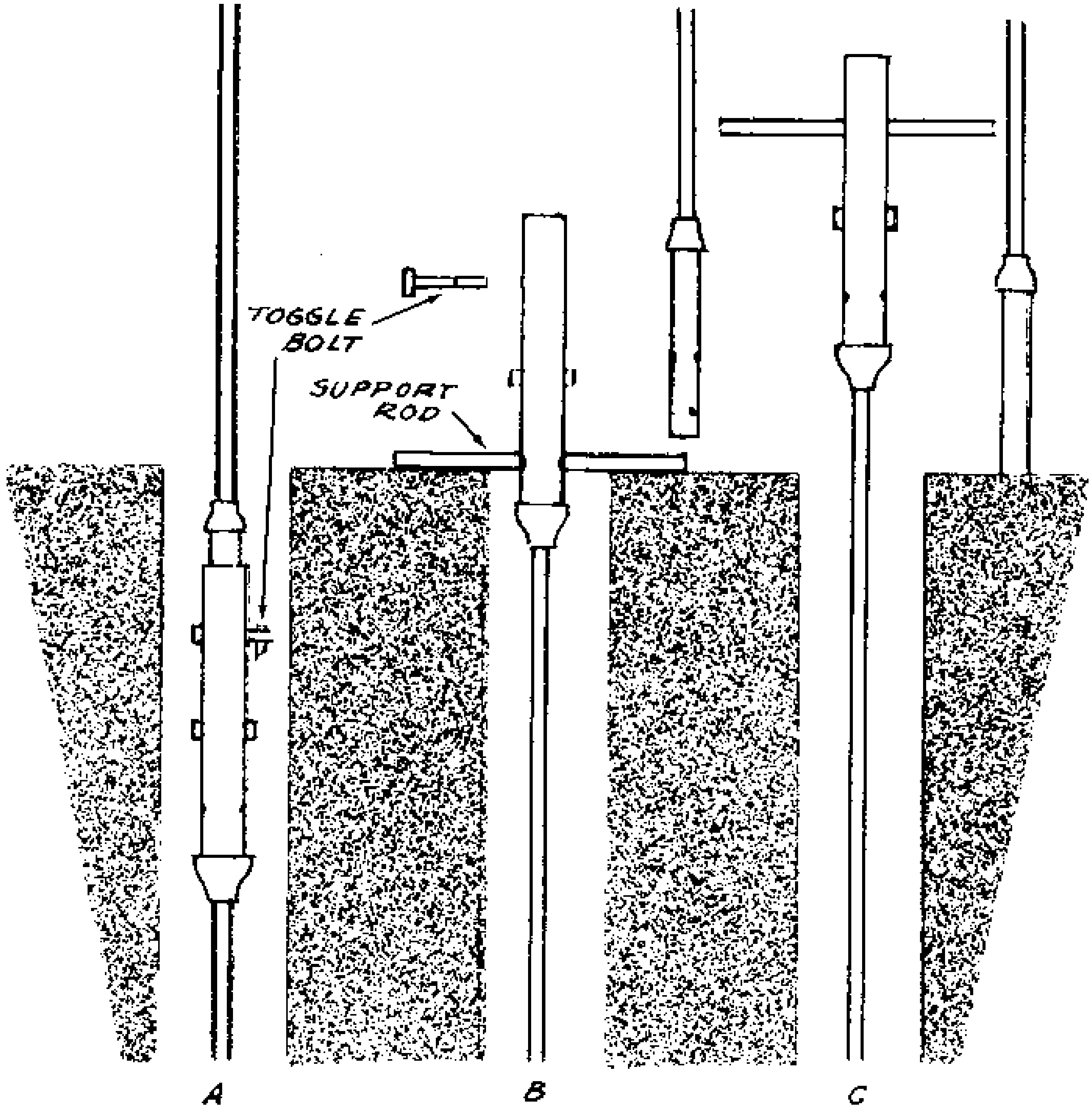


FIGURE 4 JOINT B IN OPERATION

FIGURE 5

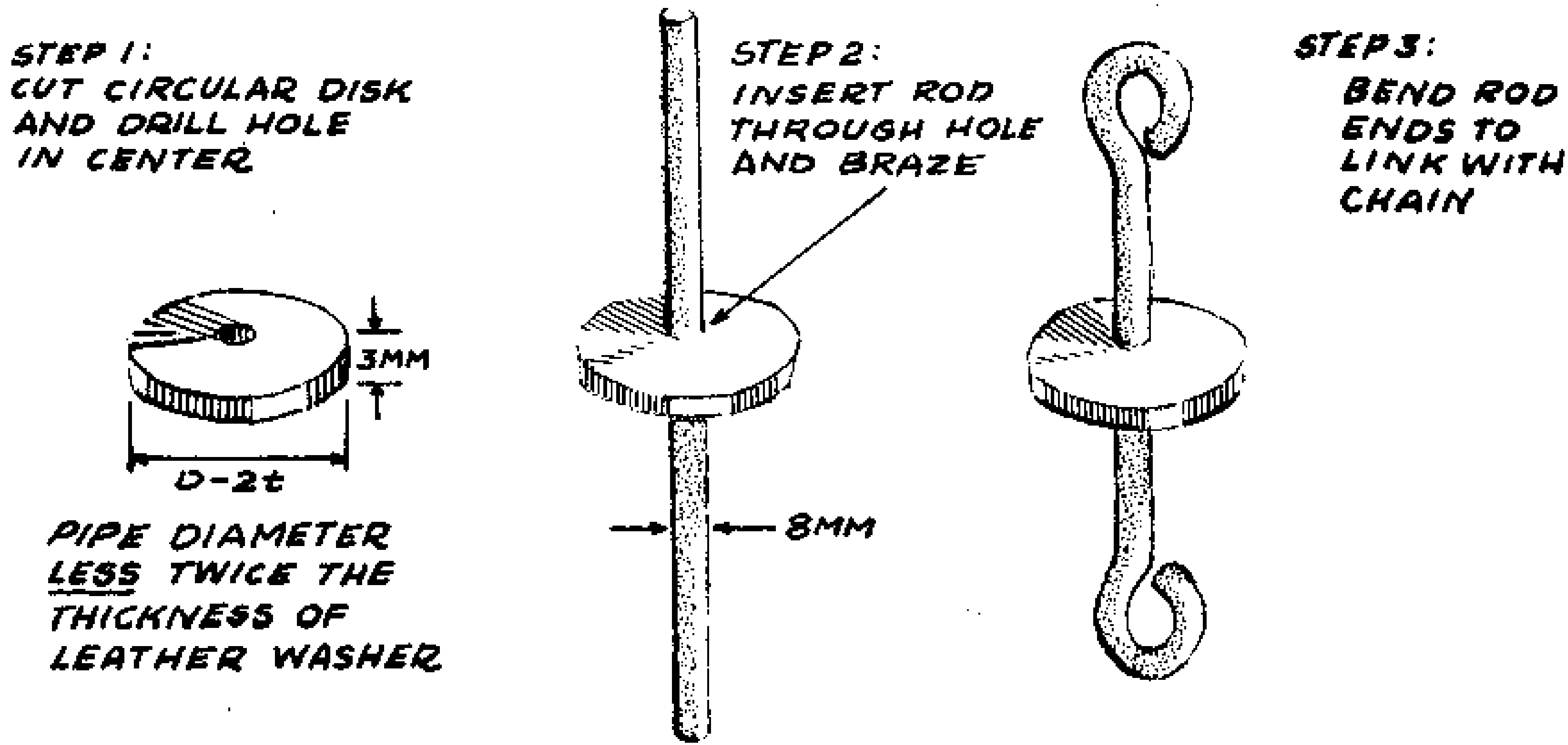

STEP 1:
CUT CIRCULAR DISK
AND DRILL HOLE
IN CENTER
3MM
D-2t
PIPE DIAMETER
LESS TWICE THE
THICKNESS OF
LEATHER WASHER
STEP 2:
INSERT ROD
THROUGH HOLE
AND BRAZE
8MM
STEP 3:
BEND ROD
ENDS TO
LINK WITH
CHAIN

FIGURE 6
RETAINING PLATE

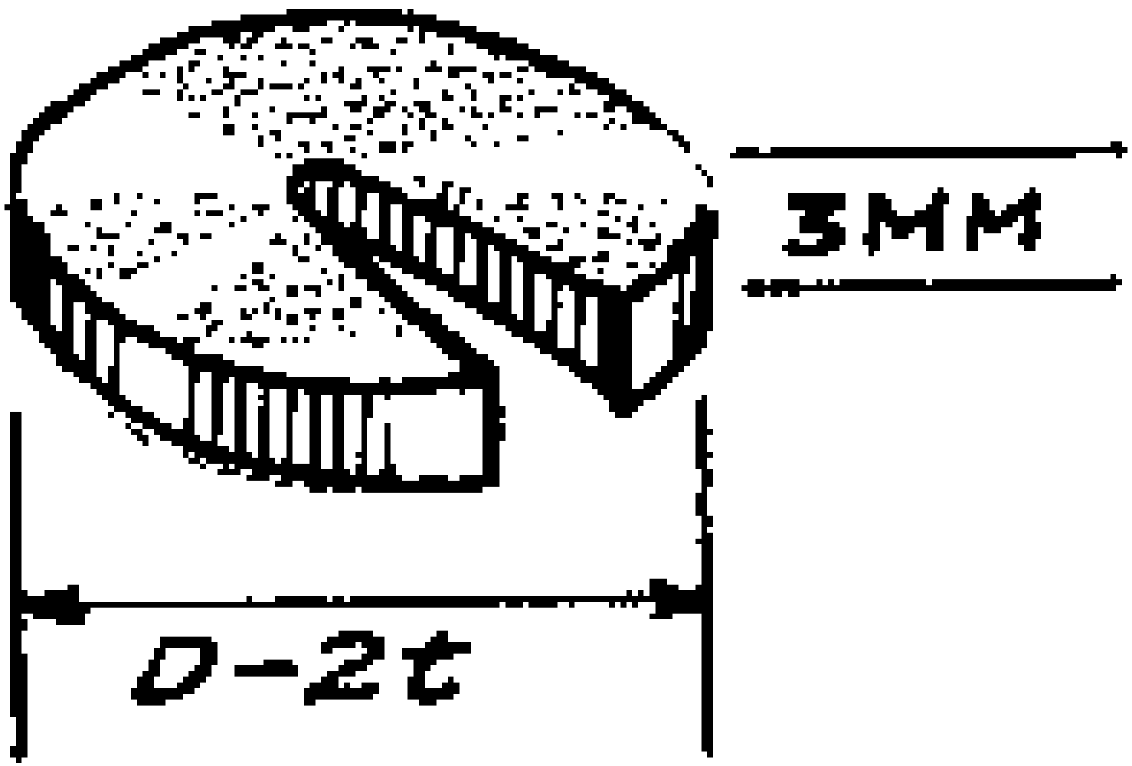
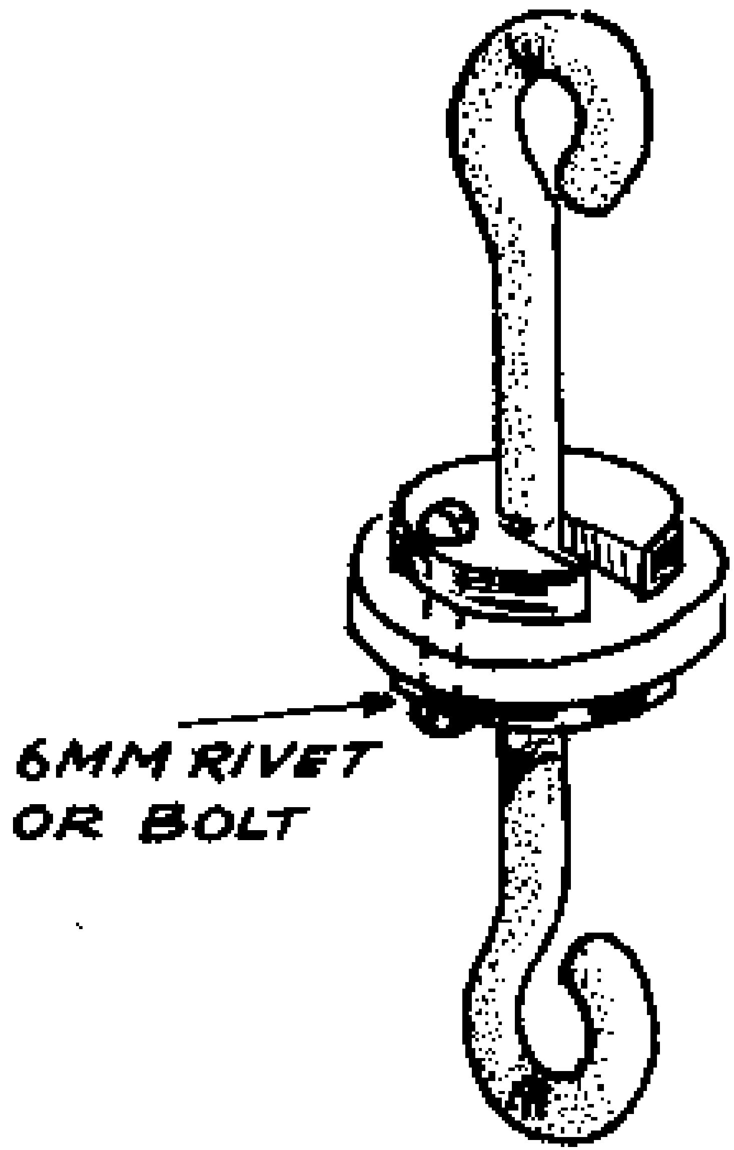


FIGURE 7
PISTON LINK
ASSEMBLED



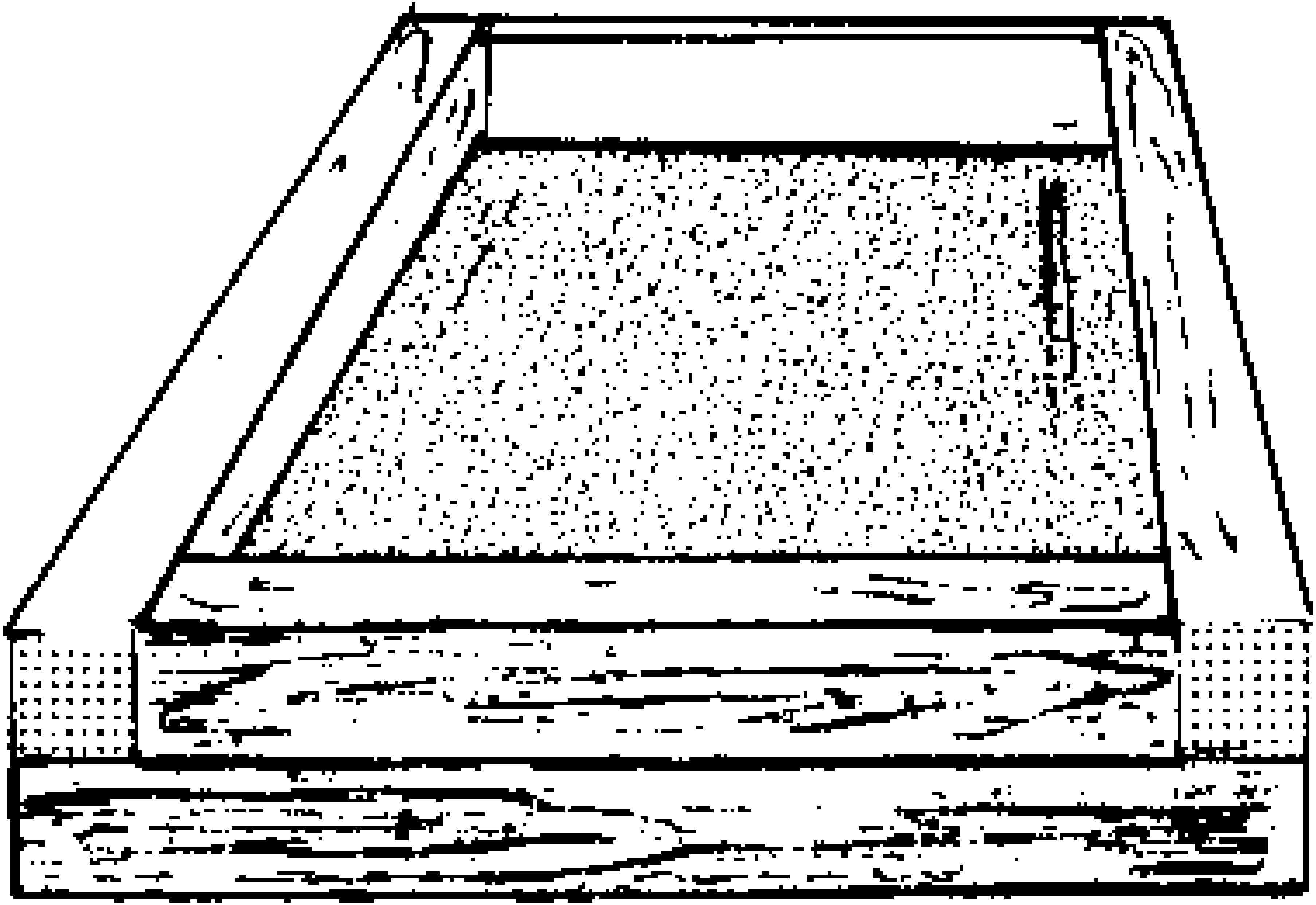
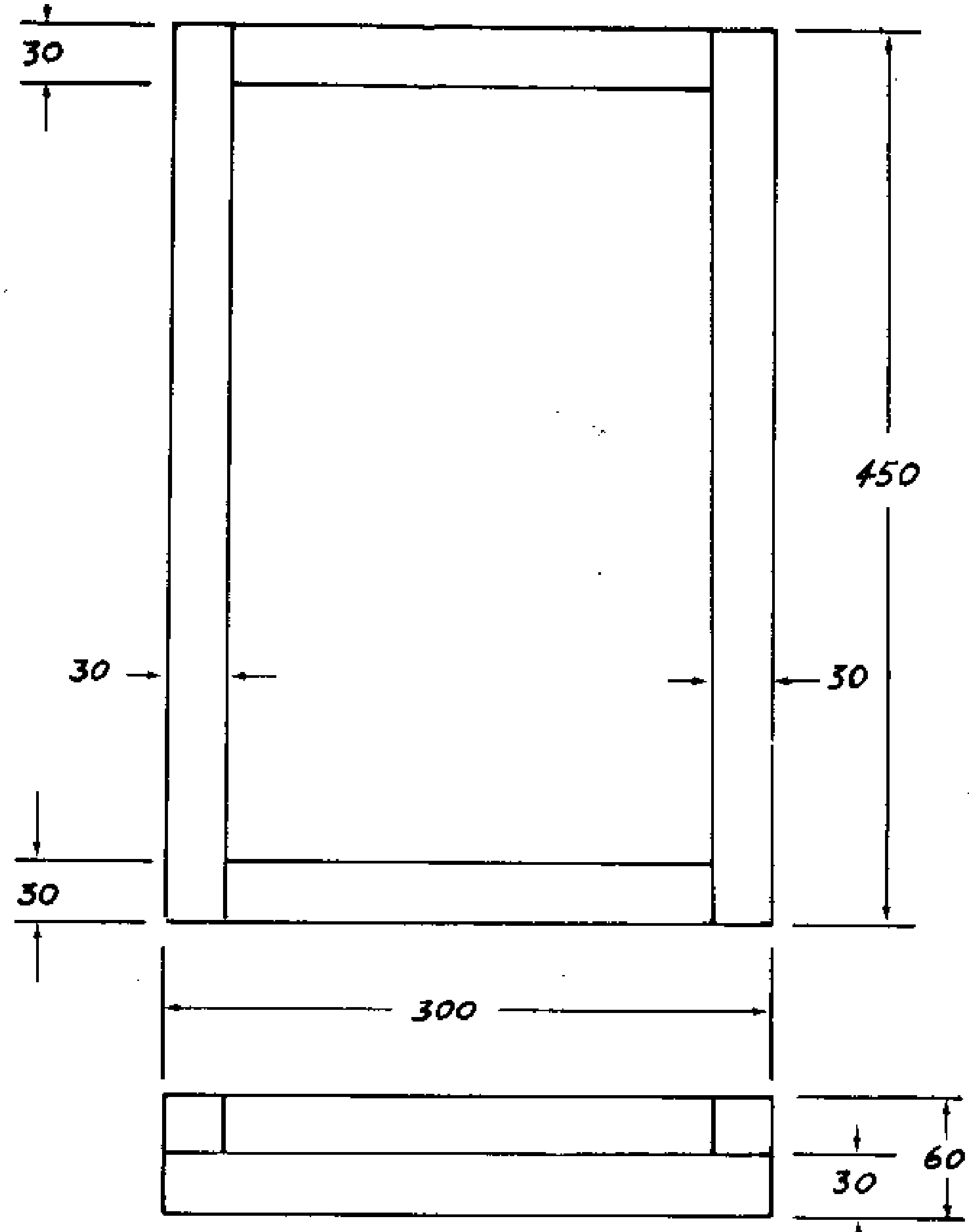
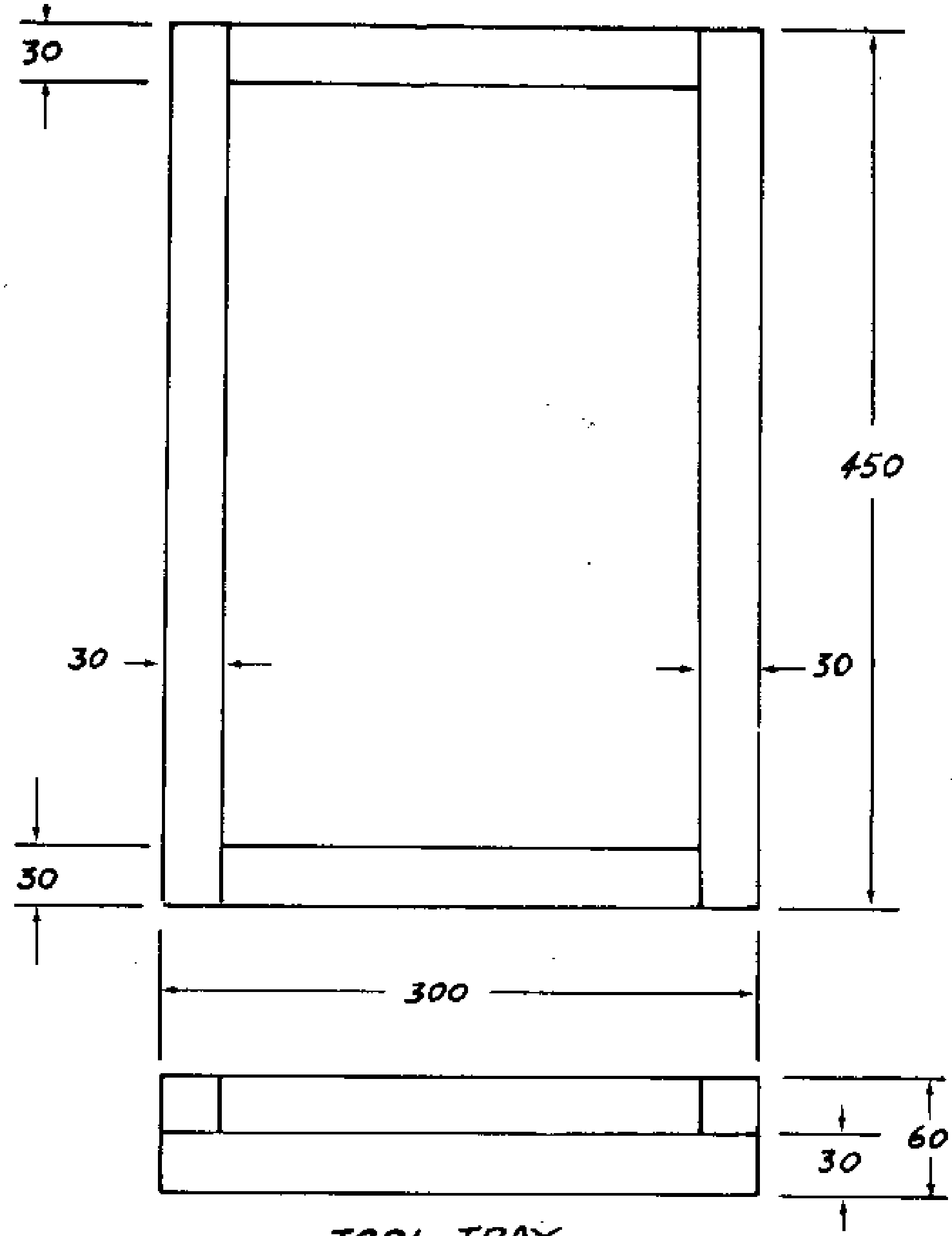


FIGURE 5 TOOL TRAY



TOOL TRAY

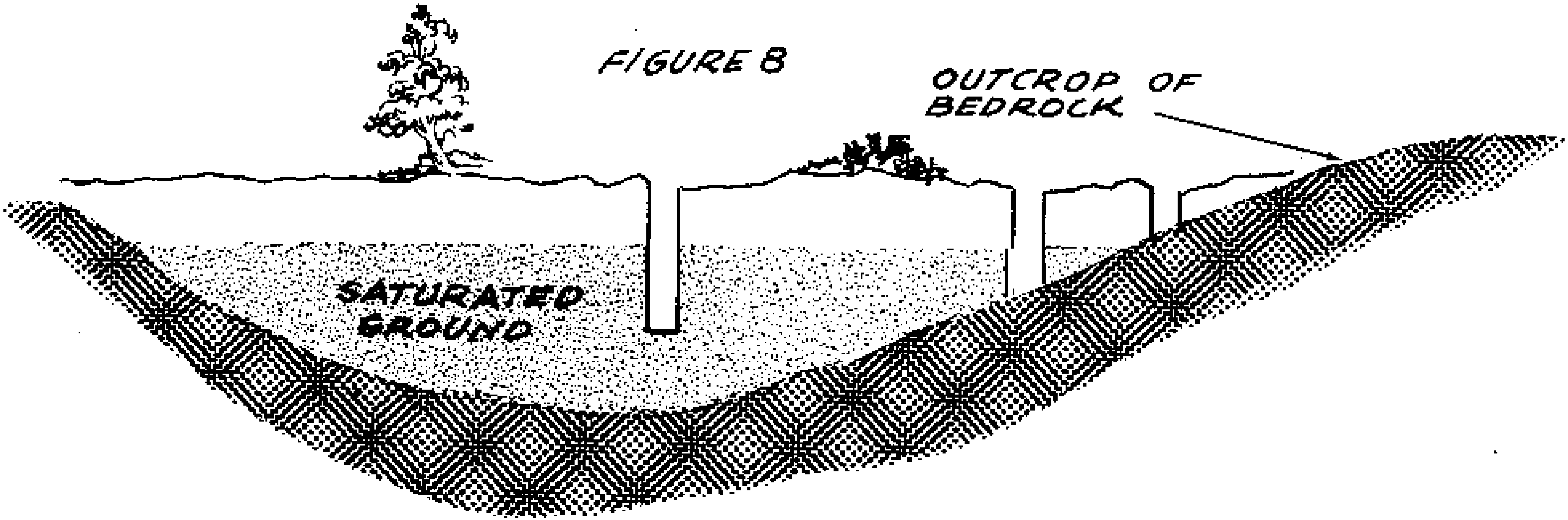
FIGURE 6



TOOL TRAY

FIGURE 6

FIGURE 8



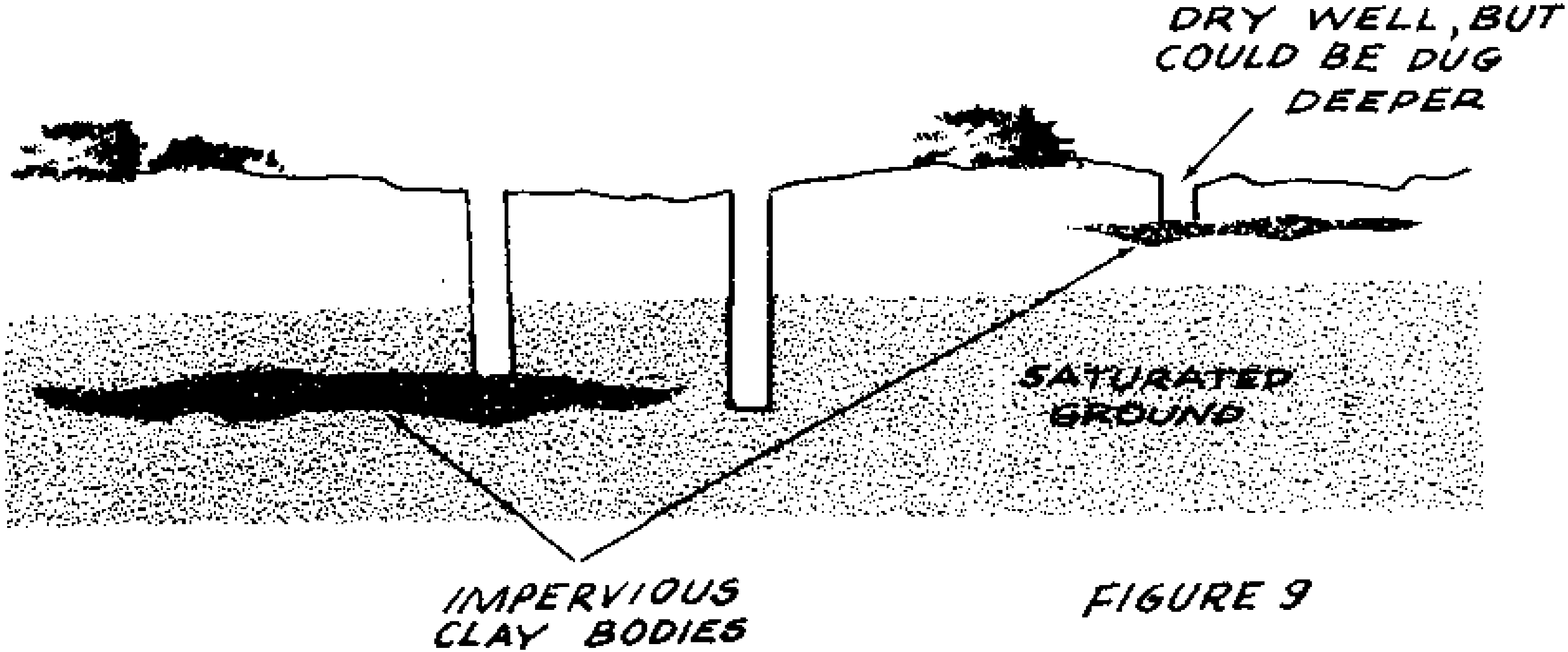
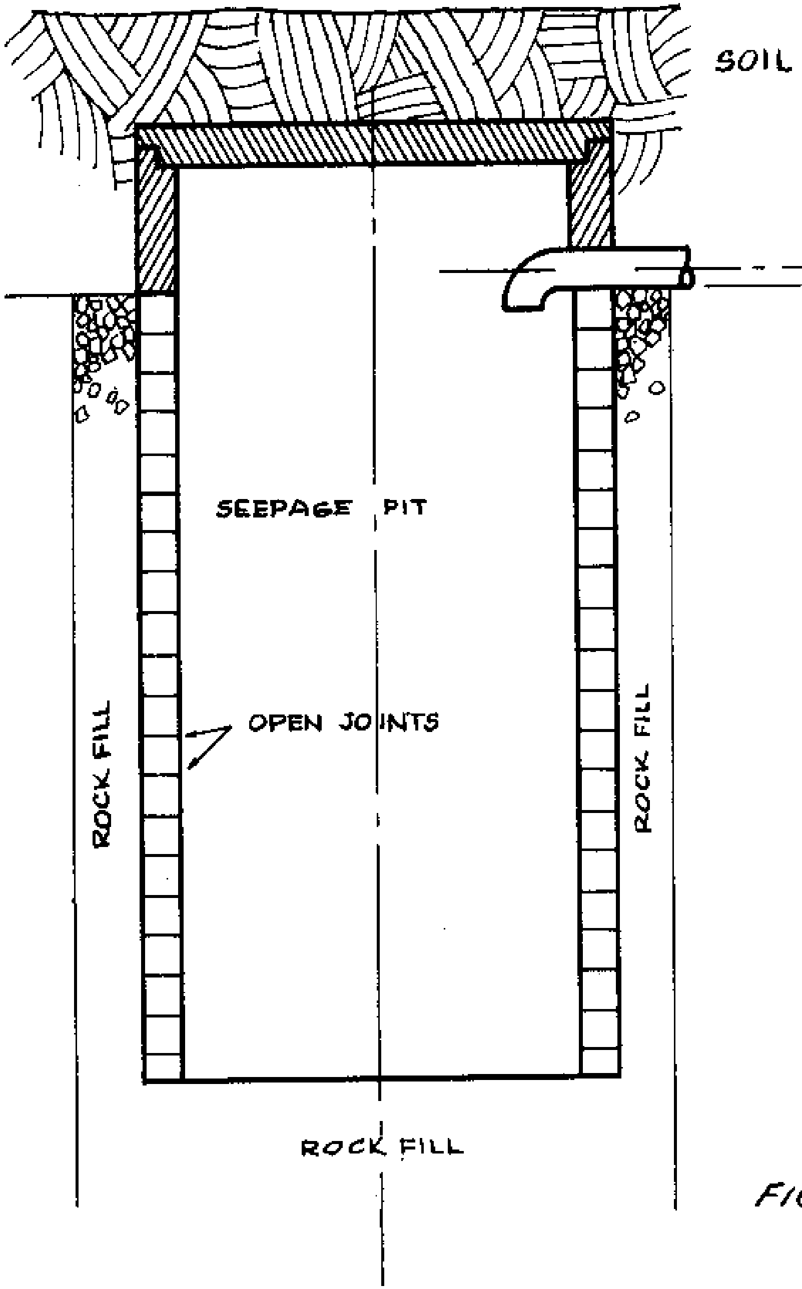
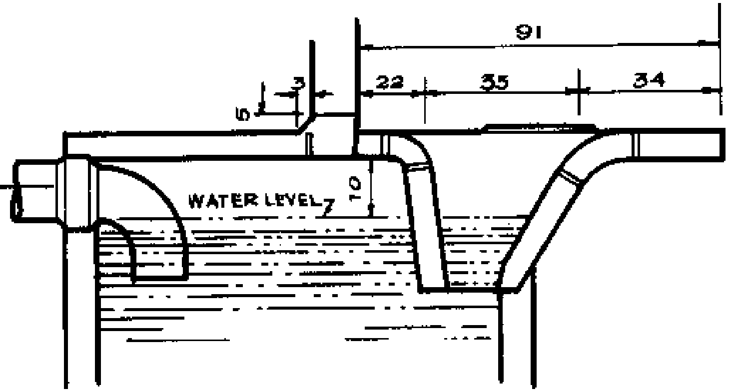

DRY WELL, BUT
COULD BE DUG
DEEPER
SATURATED
GROUND
IMPERVIOUS
CLAY BODIES

FIGURE 9





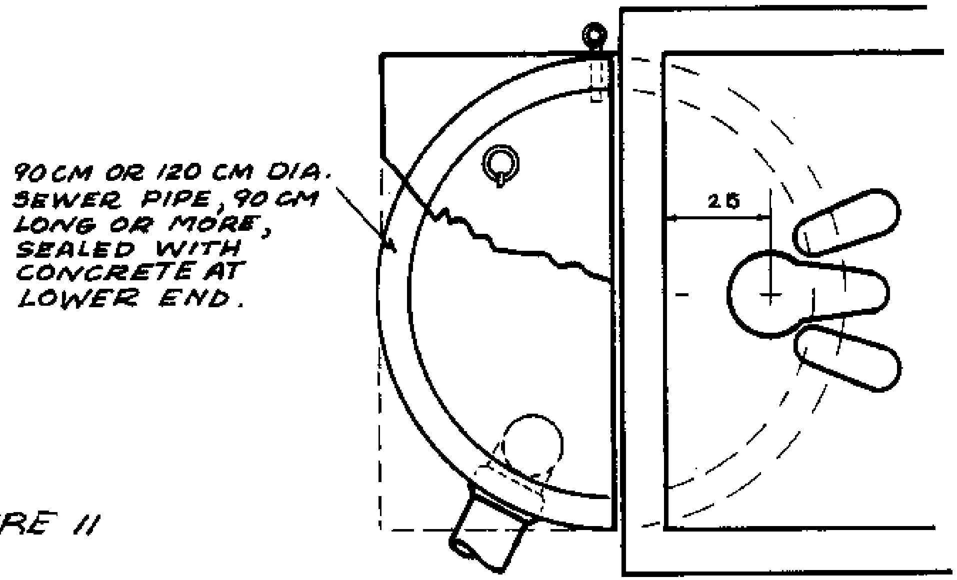


FIGURE 11

Not in Scale
Dimensions in cm.

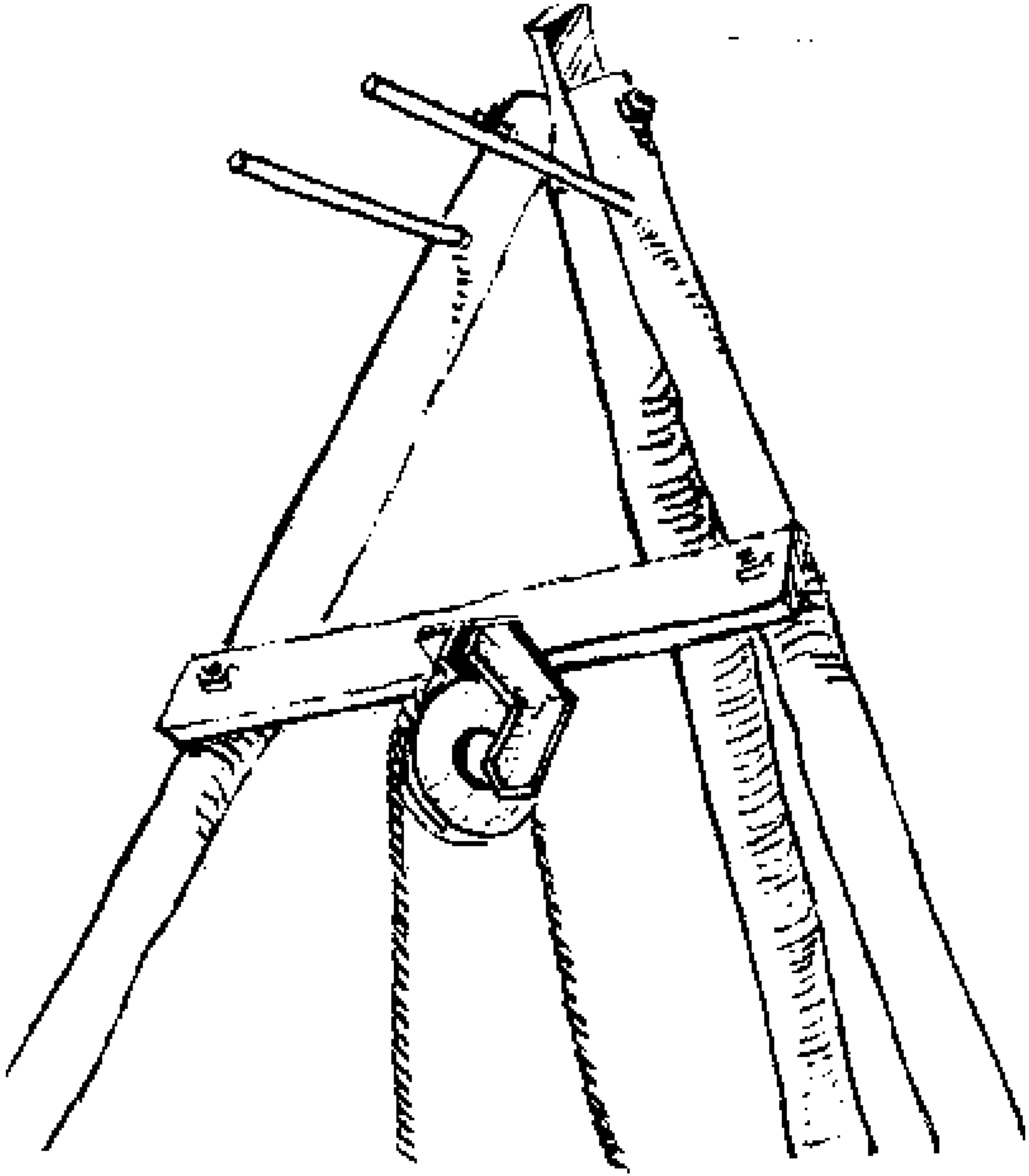


FIGURE 16

NOTE: Two pieces, this and its mirror image, make one pulley bracket. (See tripod drawing.) Attach to crossbar with 12DIA. Bolts.

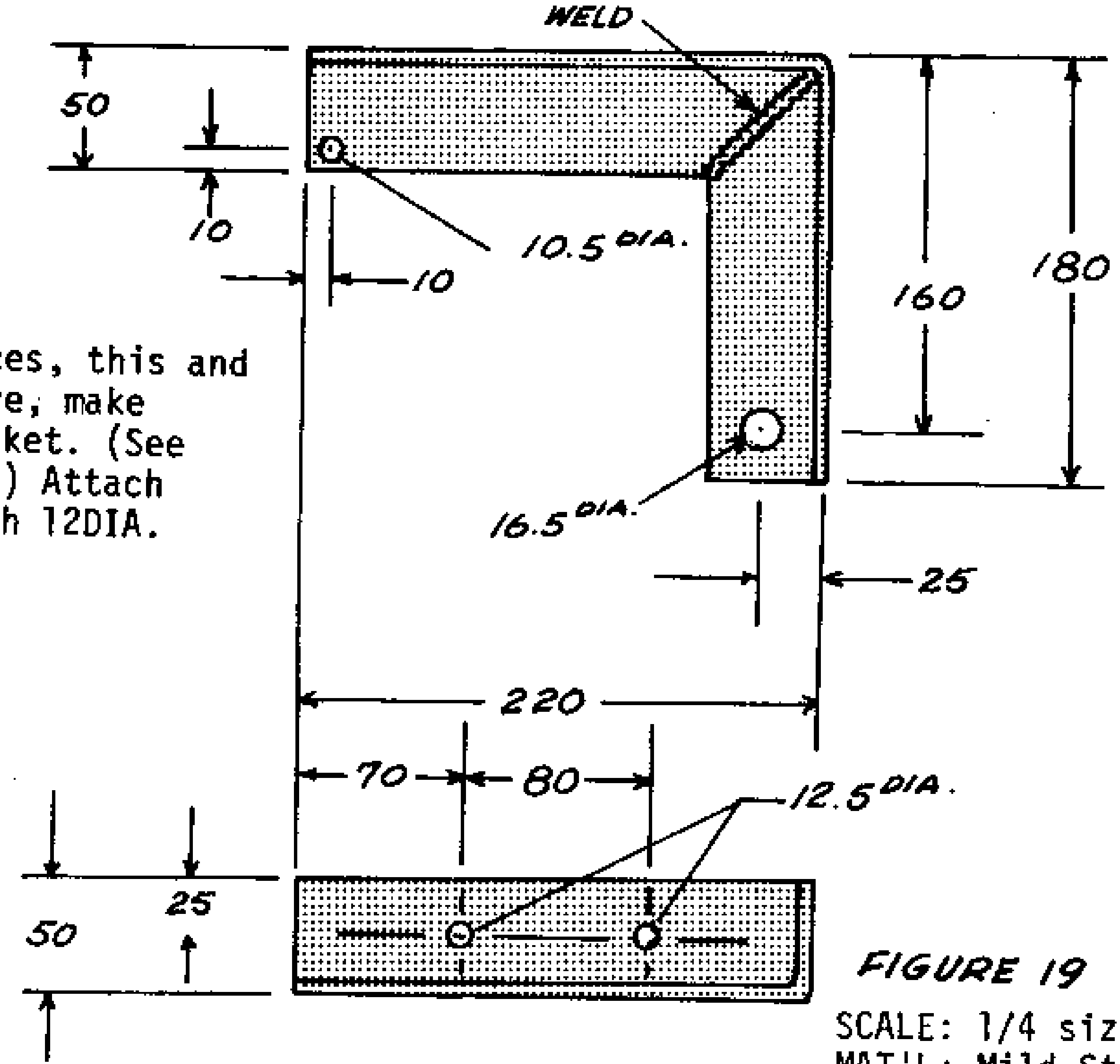


FIGURE 19

SCALE: 1/4 size
MAT'L: Mild Steel

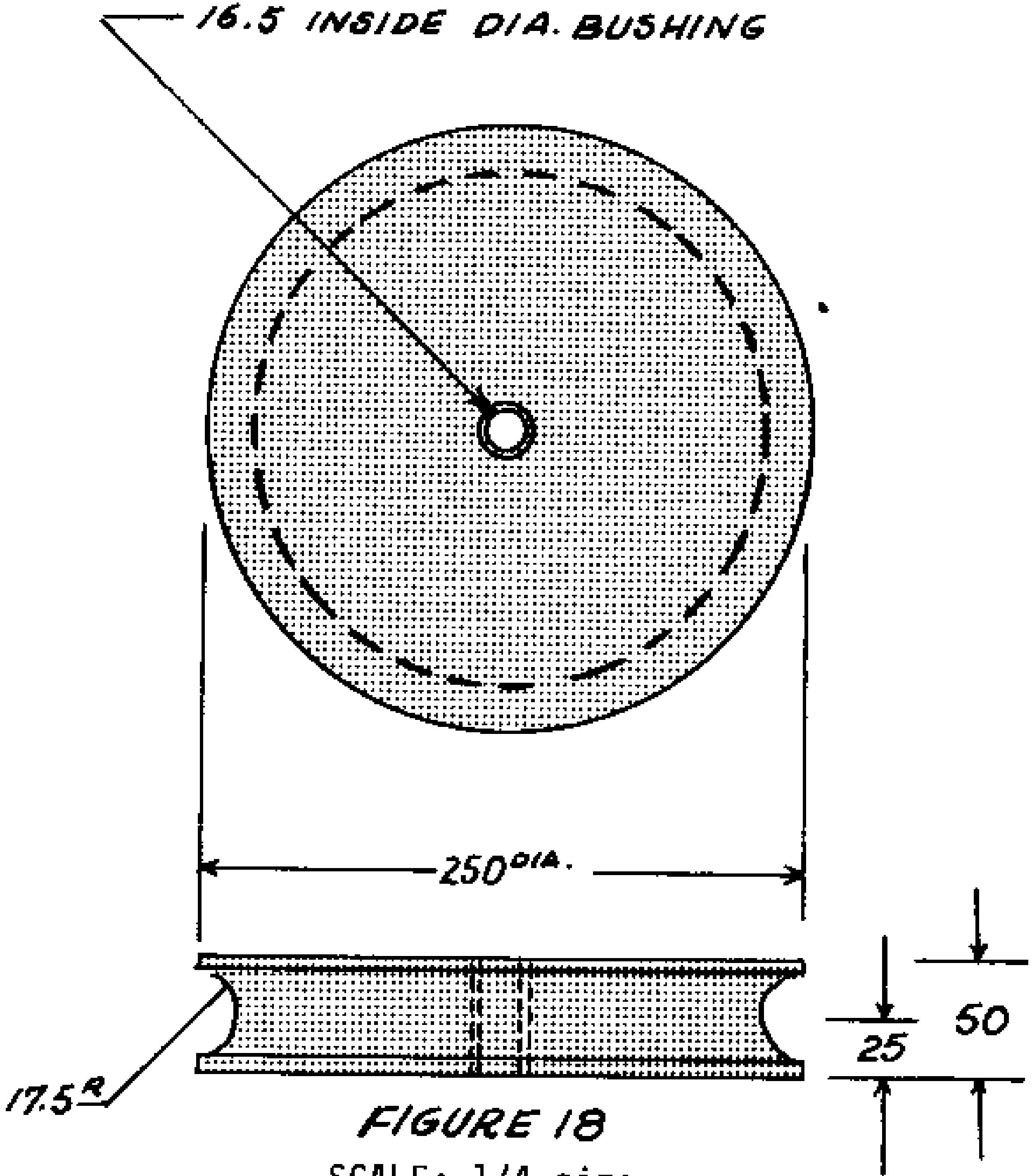


FIGURE 18

SCALE: 1/4 size
MAT'L: HARDWOOD

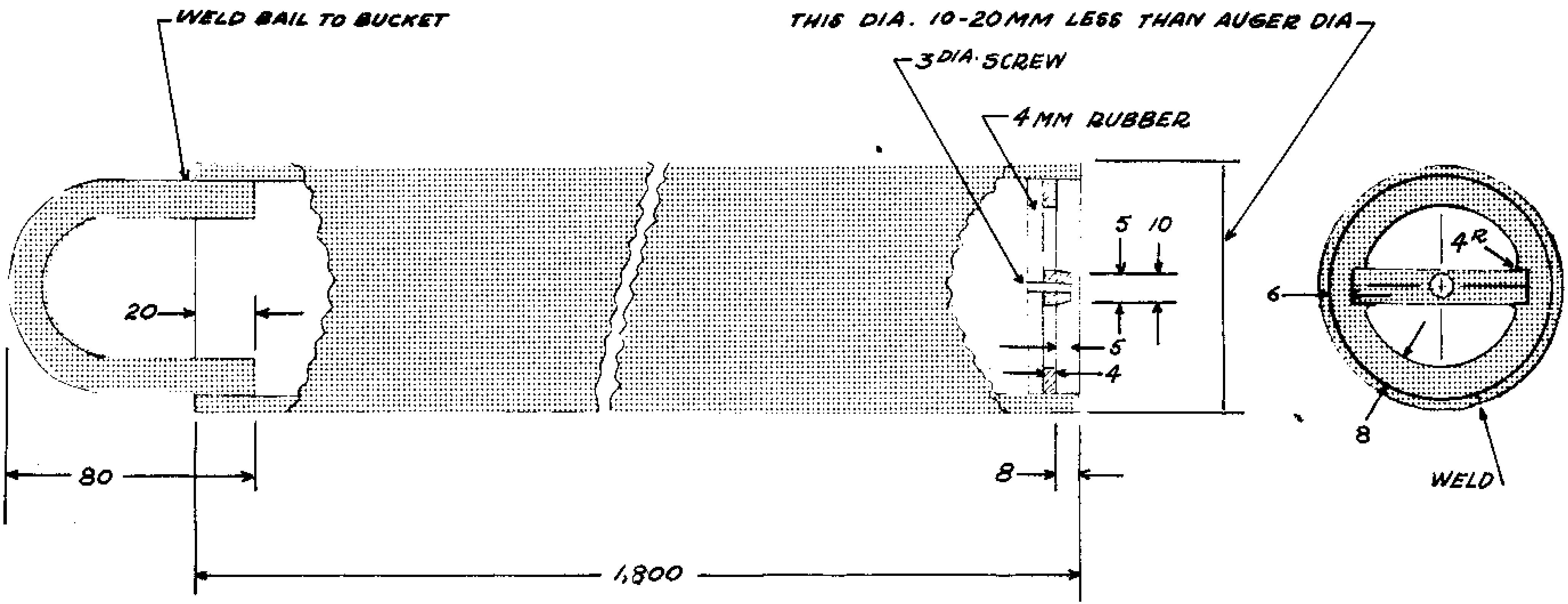
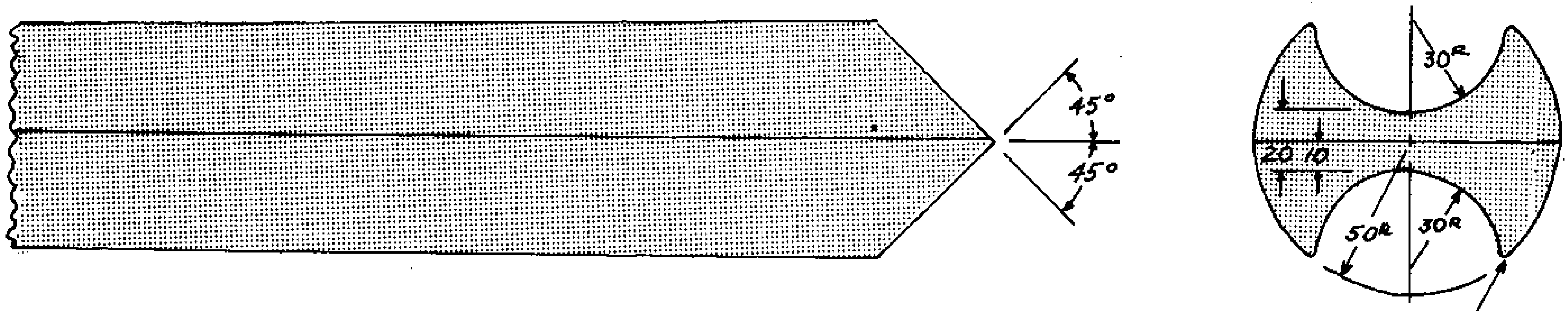


FIGURE 21
MAT'L: MILD STEEL



NOTE: TAPER ALL SURFACES TO BLEND INTO SURFACE OF REMAINDER OF BAR 400-500 MM BEHIND CUTTING HEAD

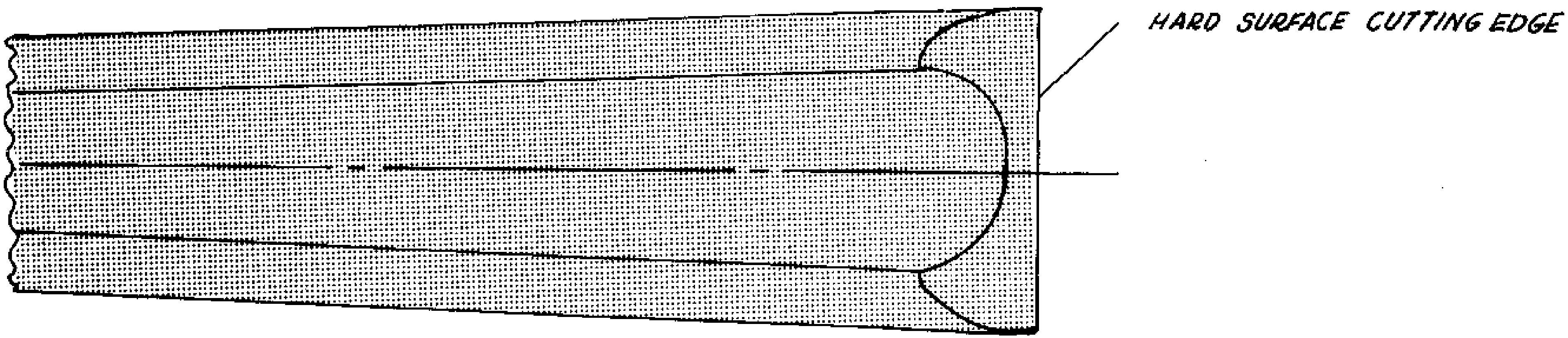


FIGURE 23

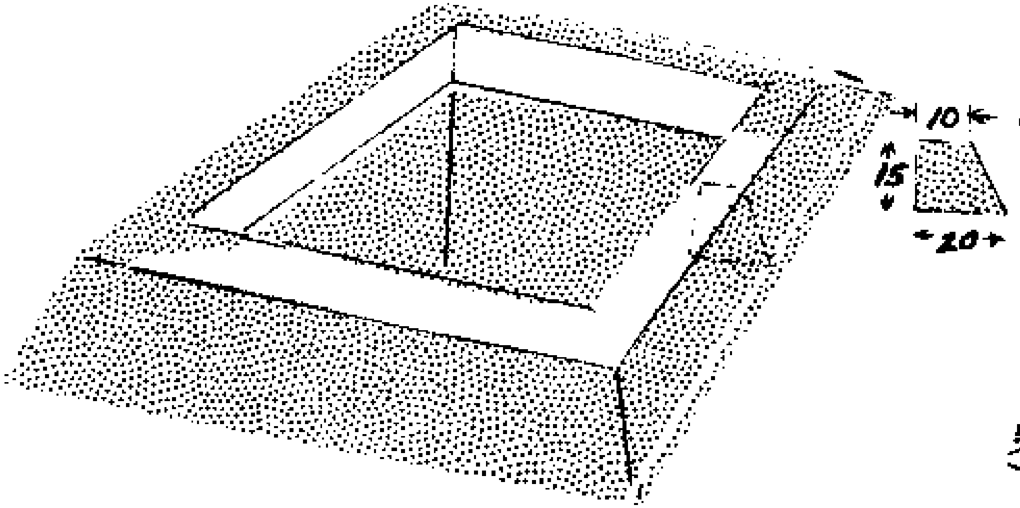


FIGURE 6

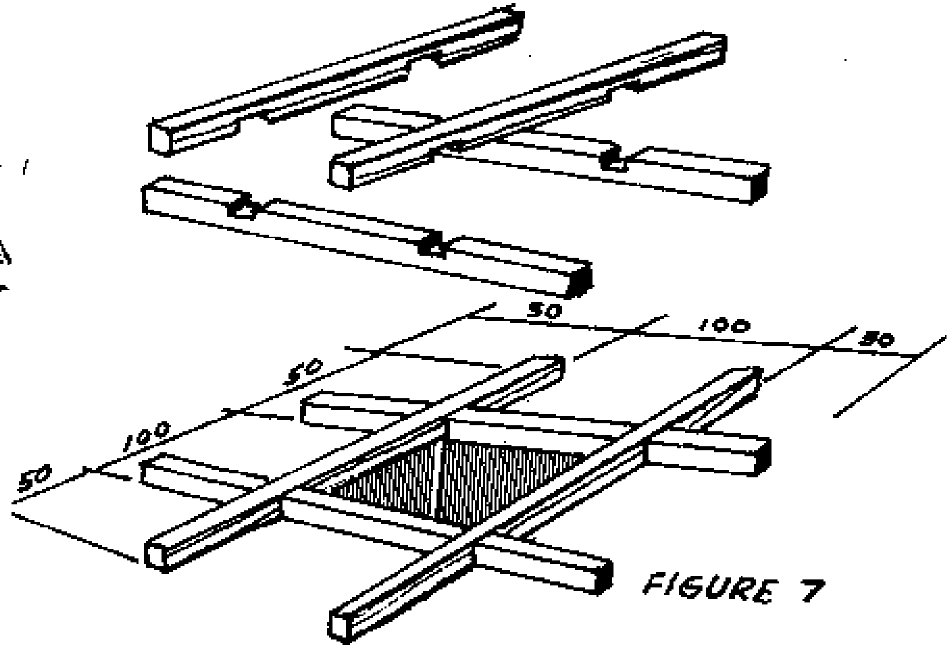
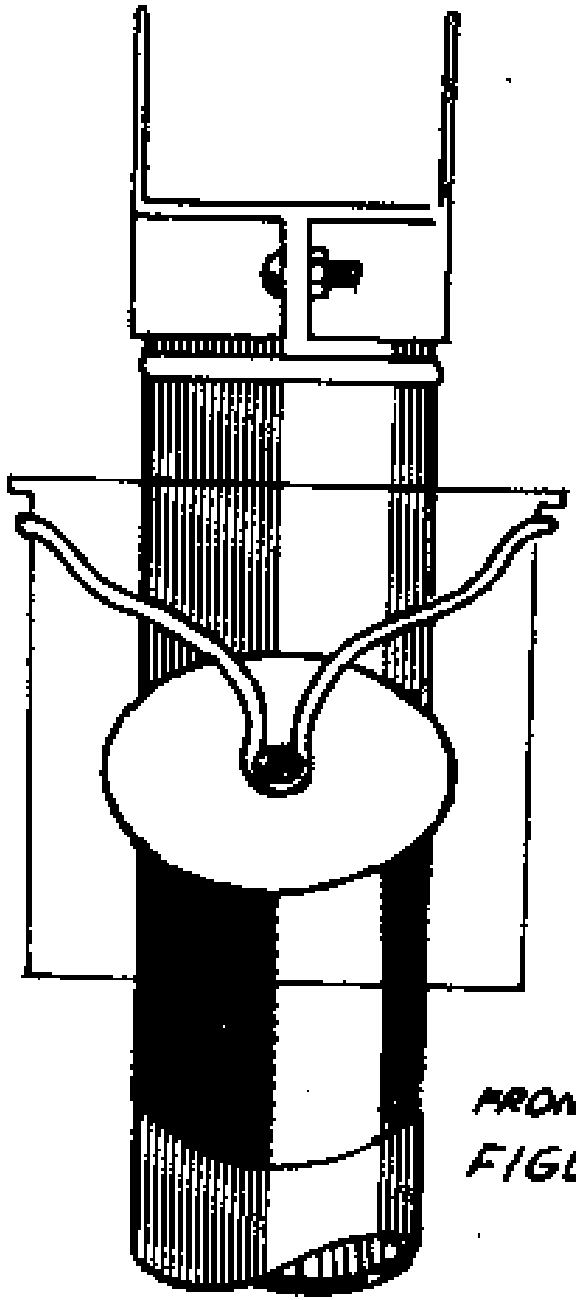


FIGURE 7



FRONT VIEW

FIGURE 5

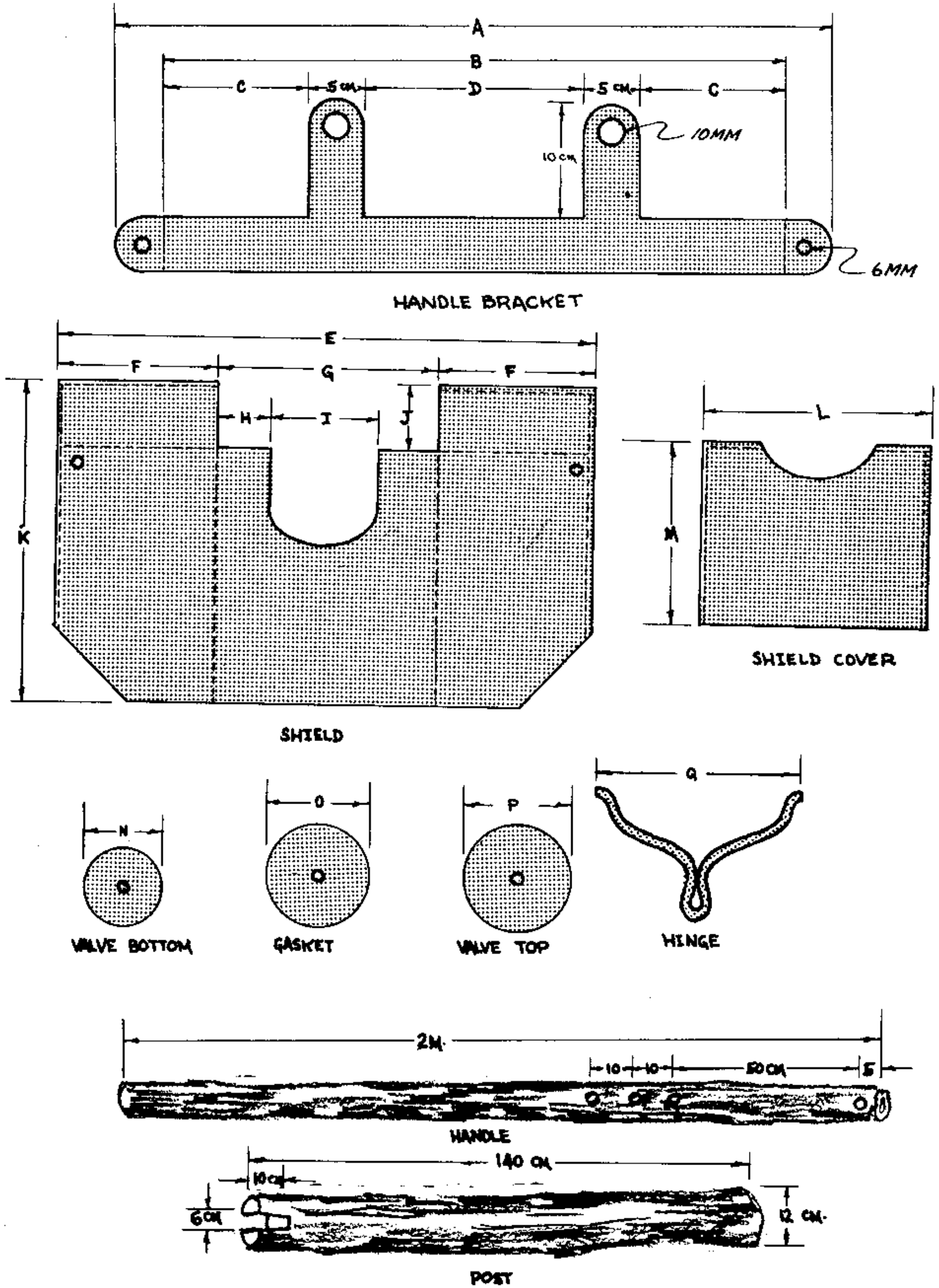

A
B
C
5 CM
D
5 CM
C
10 CM
10MM
6MM
HANDLE BRACKET
E
F
G
F
H
I
J
K
SHIELD
L
M
SHIELD COVER
N
VALVE BOTTOM
O
GASKET
P
VALVE TOP
Q
HINGE
2M
10
10
50 CM
5
HANDLE
140 CM
10 CM
6 CM
12 CM
POST

FIGURE 6

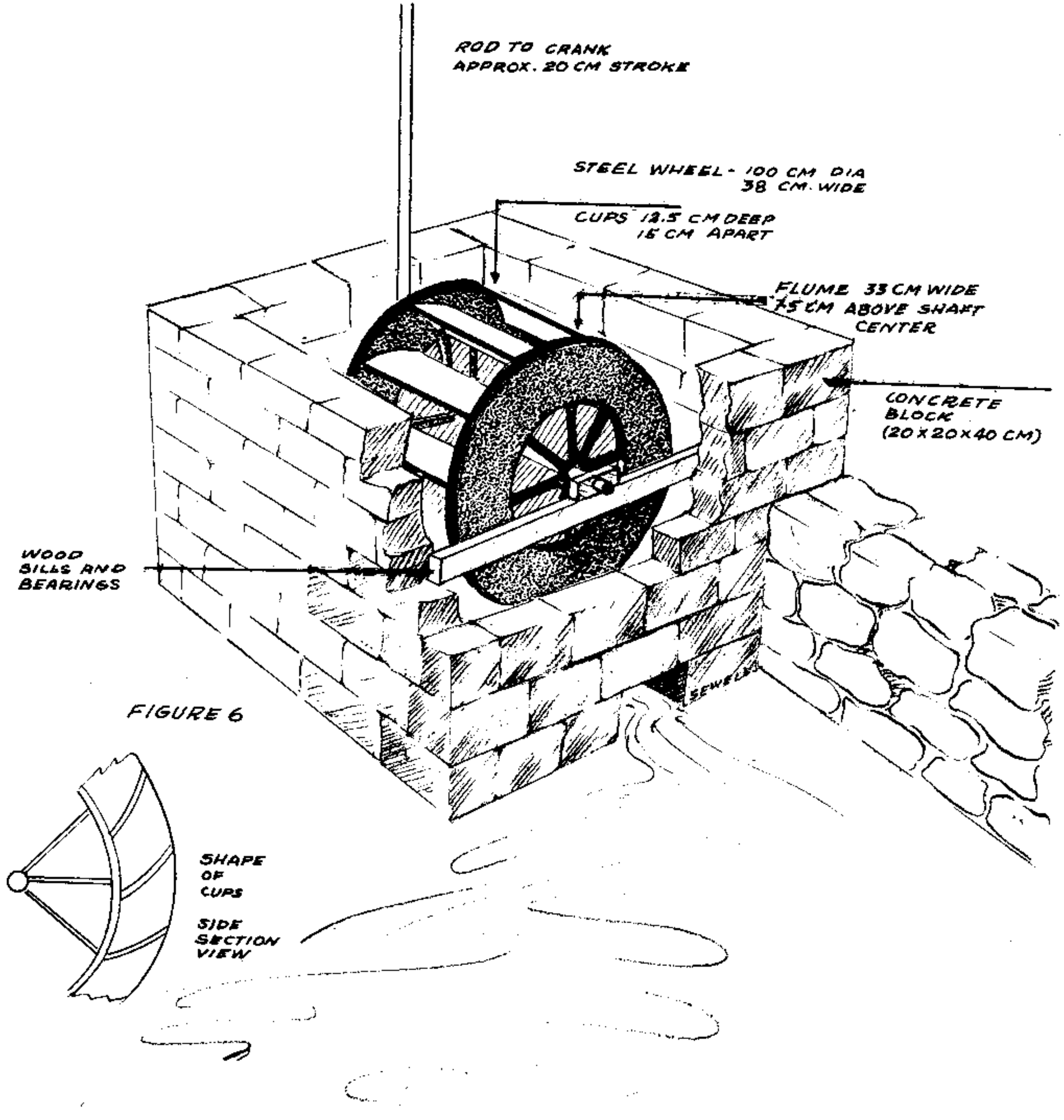
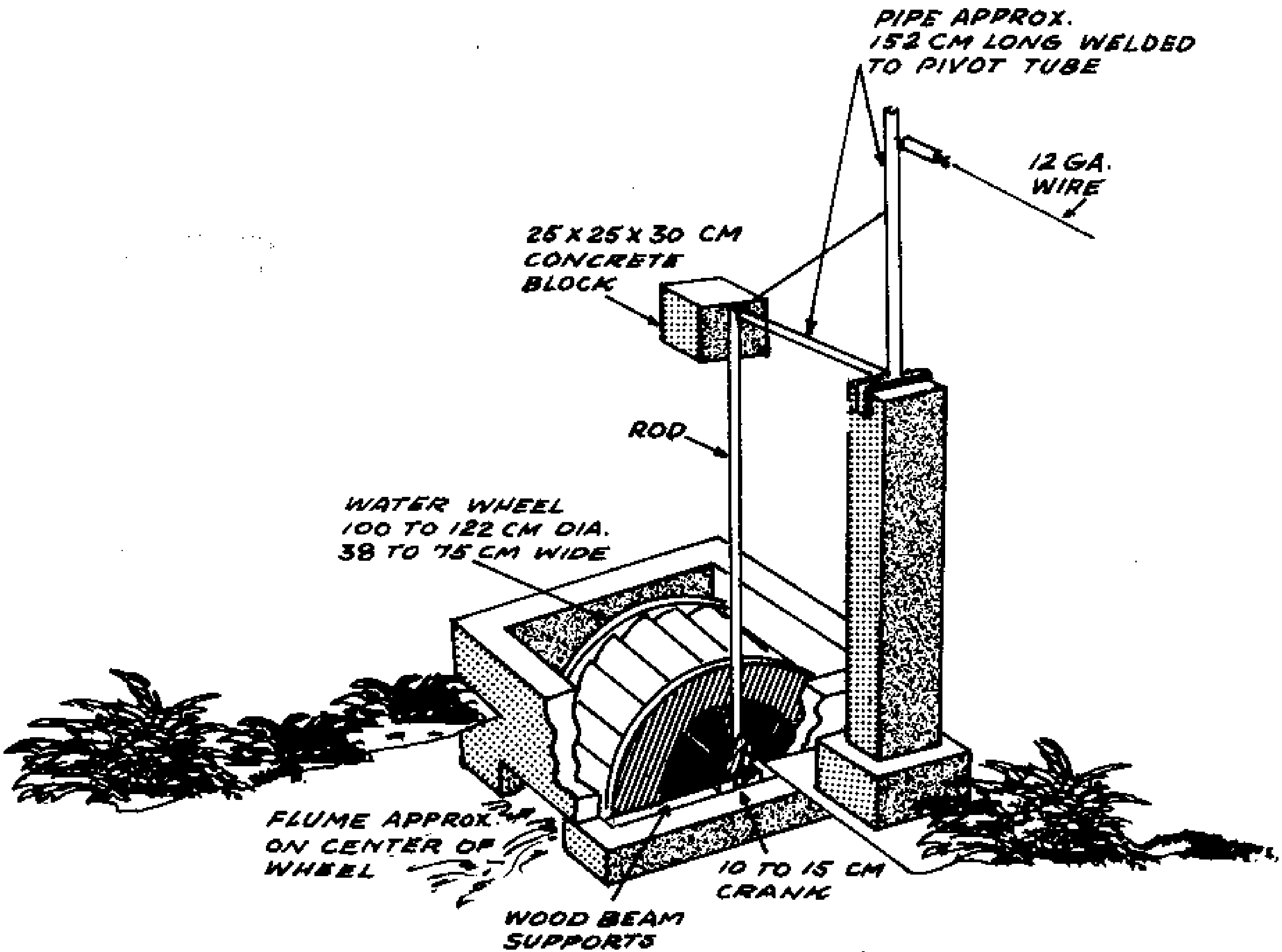

ROD TO CRANK
APPROX. 20 CM STROKE
STEEL WHEEL - 100 CM DIA
38 CM. WIDE
CUPS 12.5 CM DEEP
15 CM APART
FLUME 33 CM WIDE
7.5 CM ABOVE SHAFT
CENTER
CONCRETE
BLOCK
(20 X 20 X 40 CM)
WOOD
SILLS AND
BEARINGS
SEWELL
SHAPE
OF
CUPS
SIDE
SECTION
VIEW

FIGURE 6



NOTE: CRANK CAN BE ADDED TO OTHER END OF SHAFT AT 90° ANGLE TO FIRST CRANK TO ATTACH MORE POWER TRANSMITTING WIRES

FIGURE 7

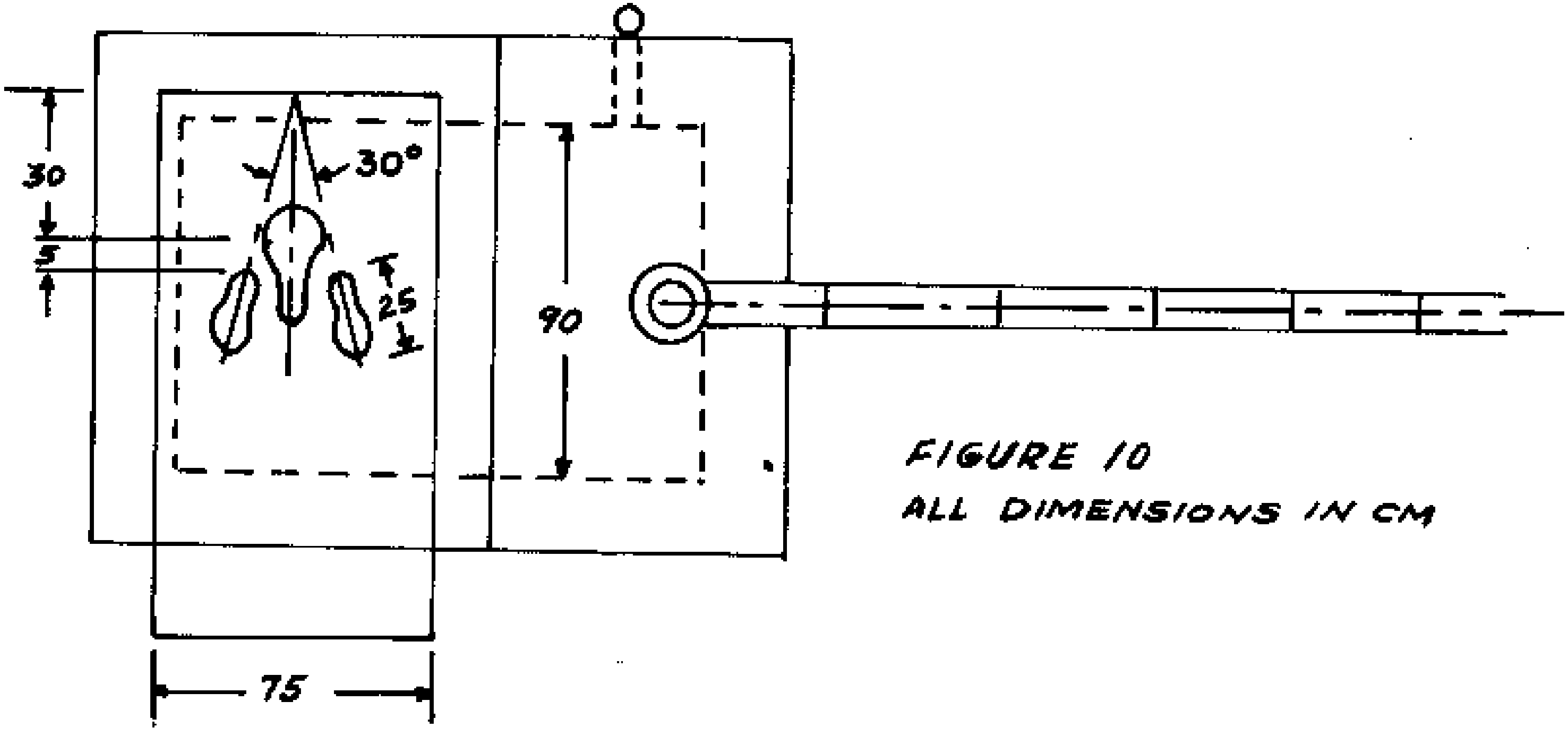


FIGURE 10

ALL DIMENSIONS IN CM

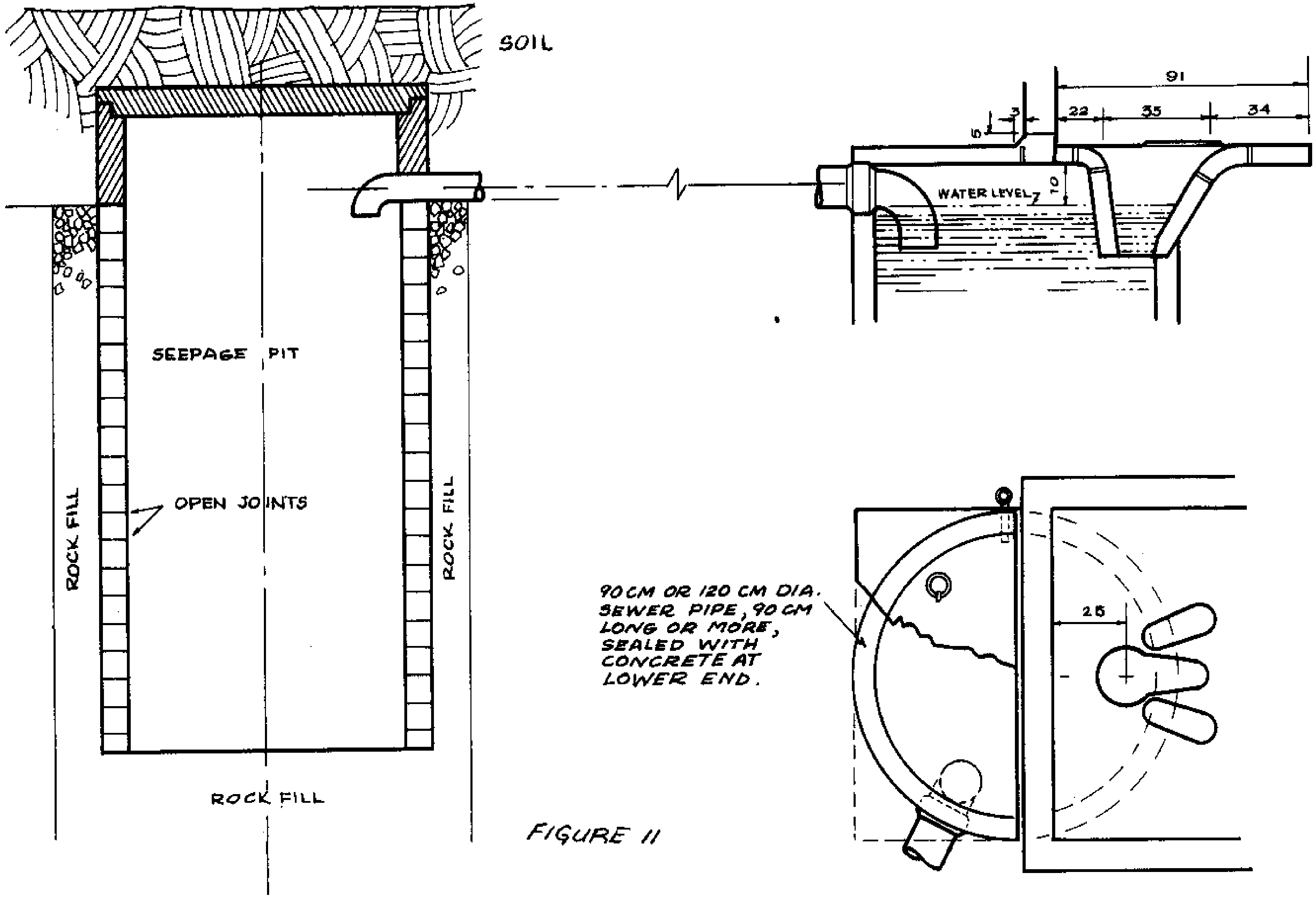


FIGURE 11

Not in Scale
Dimensions in cm.

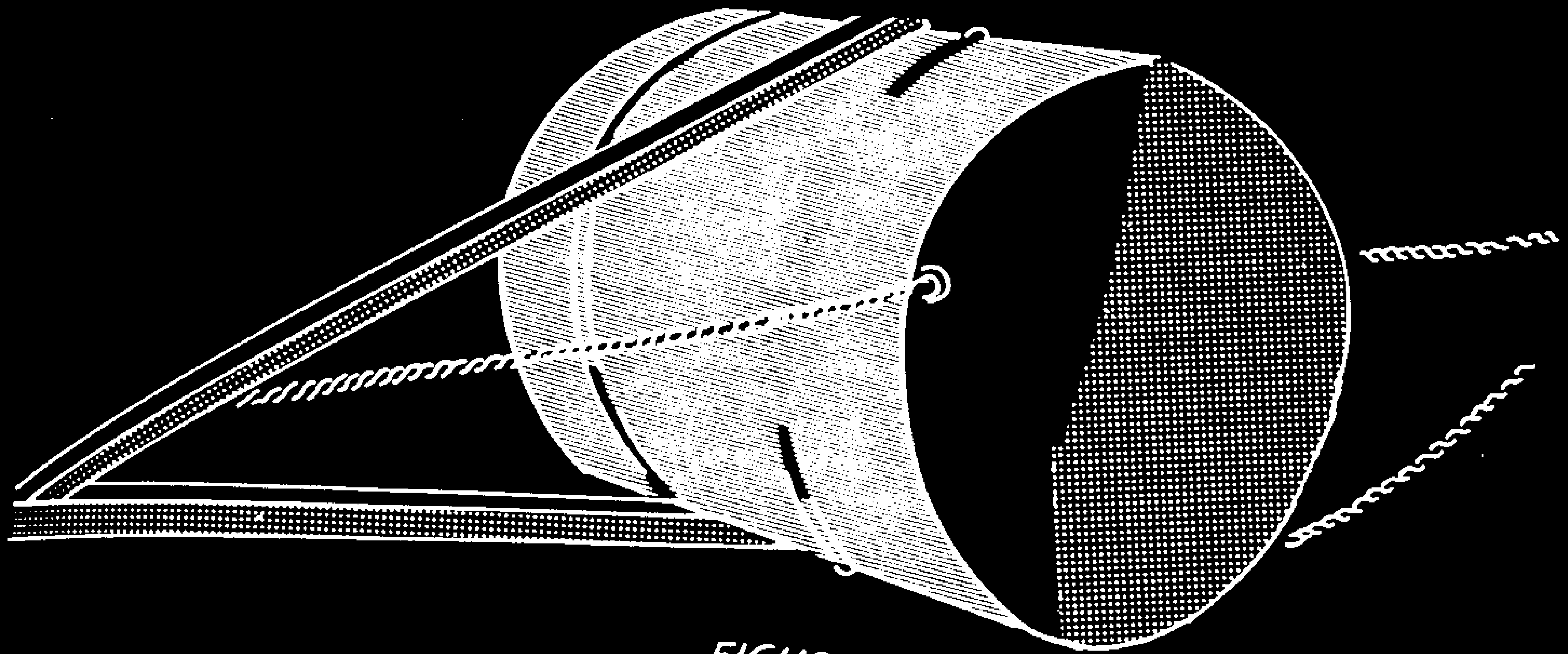


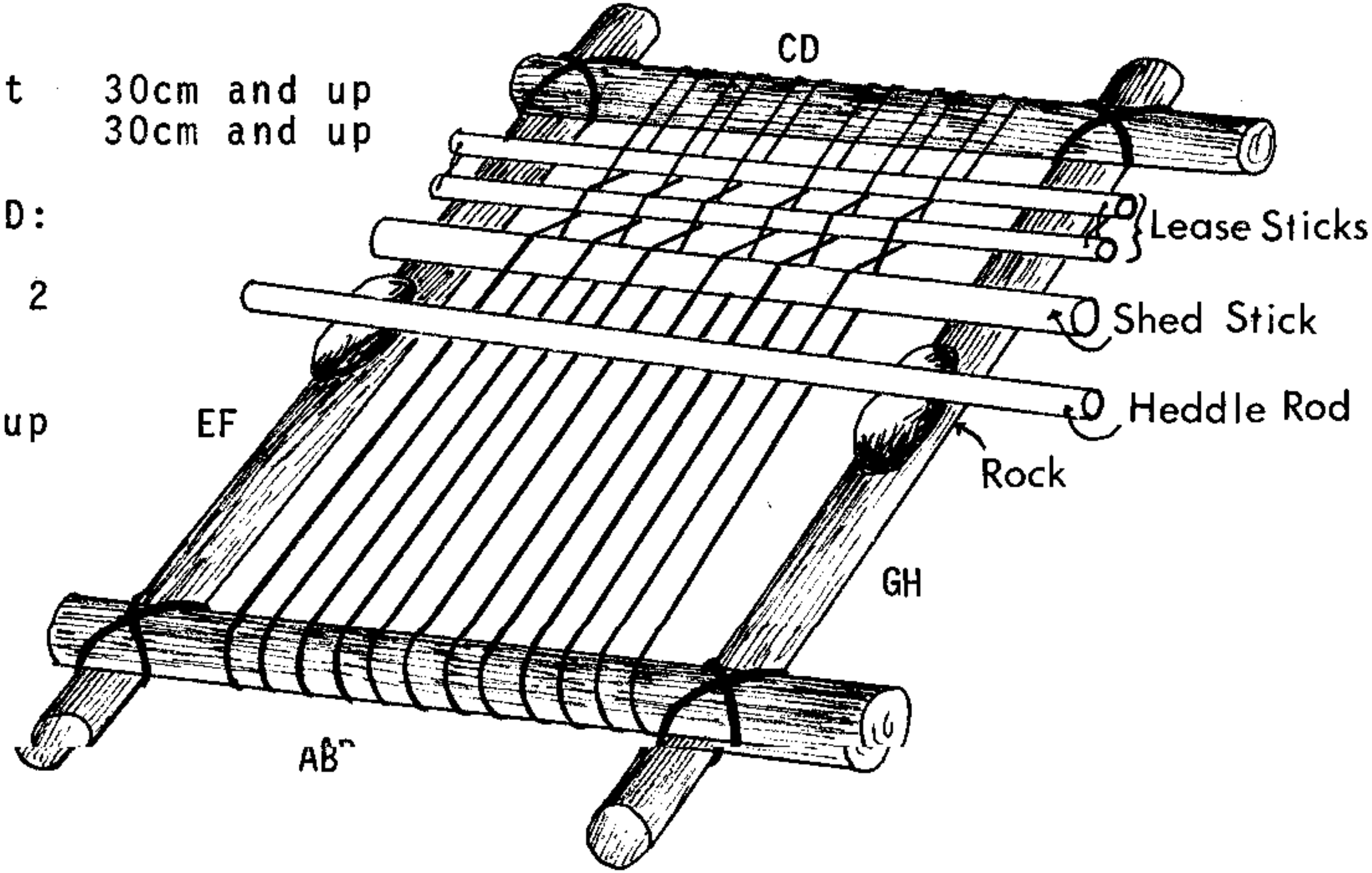
FIGURE 2.

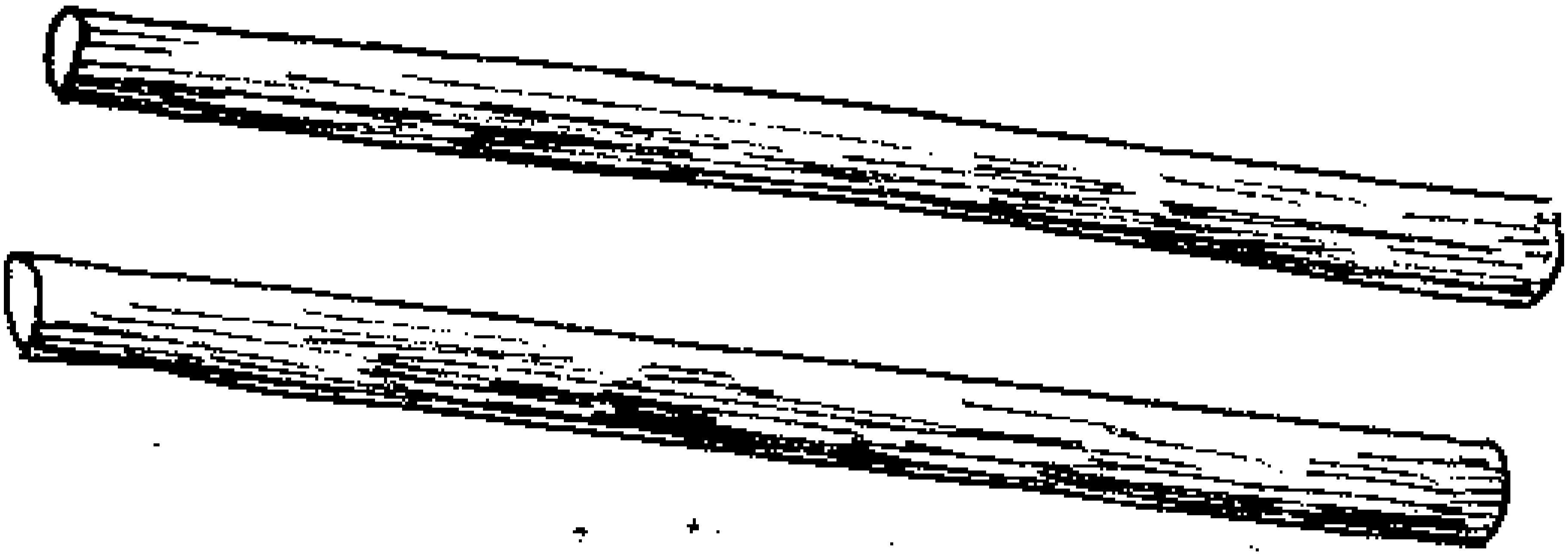
DIMENSIONS: Height 30cm and up
Width 30cm and up

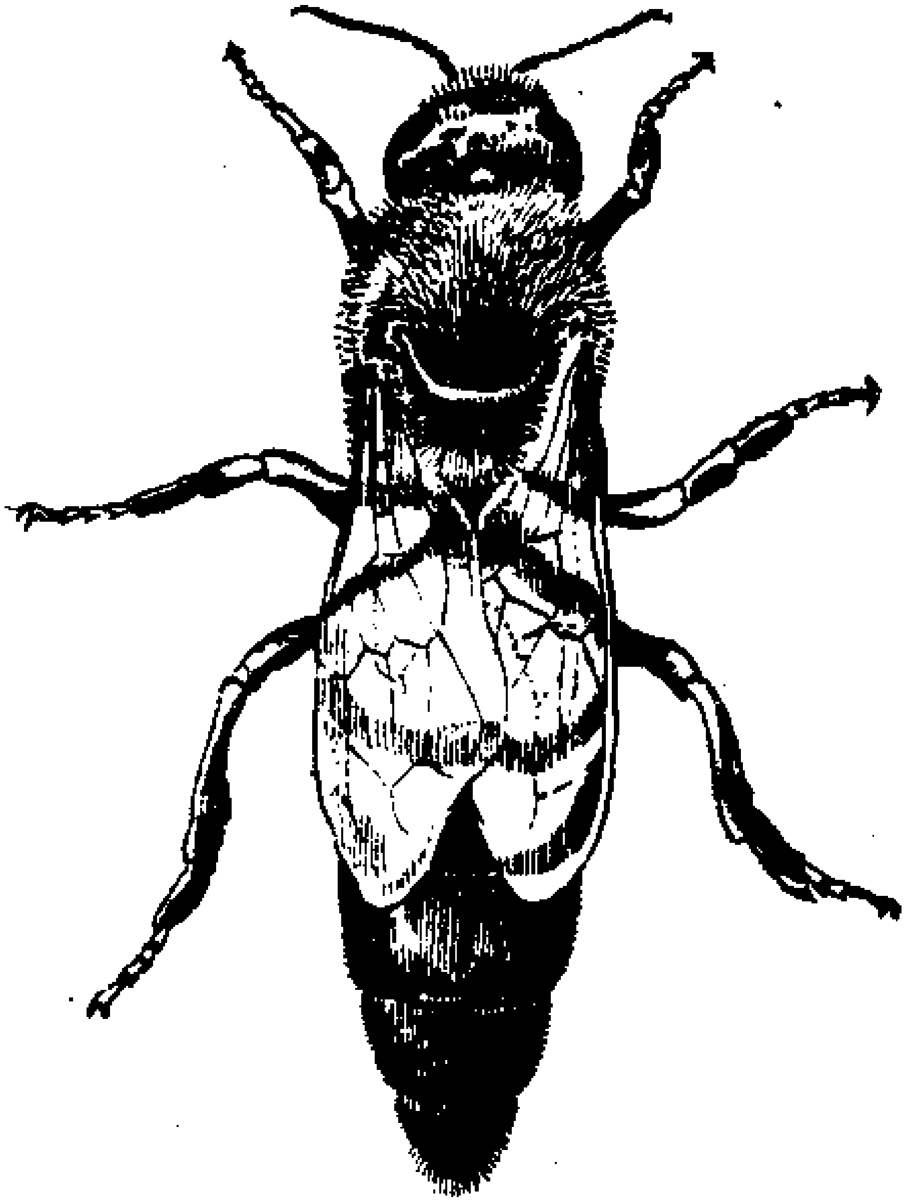
LENGTH OF WARP HELD:

The Height X 2

WIDTH OF FINISHED
CLOTH: 4cm and up







LA REINE

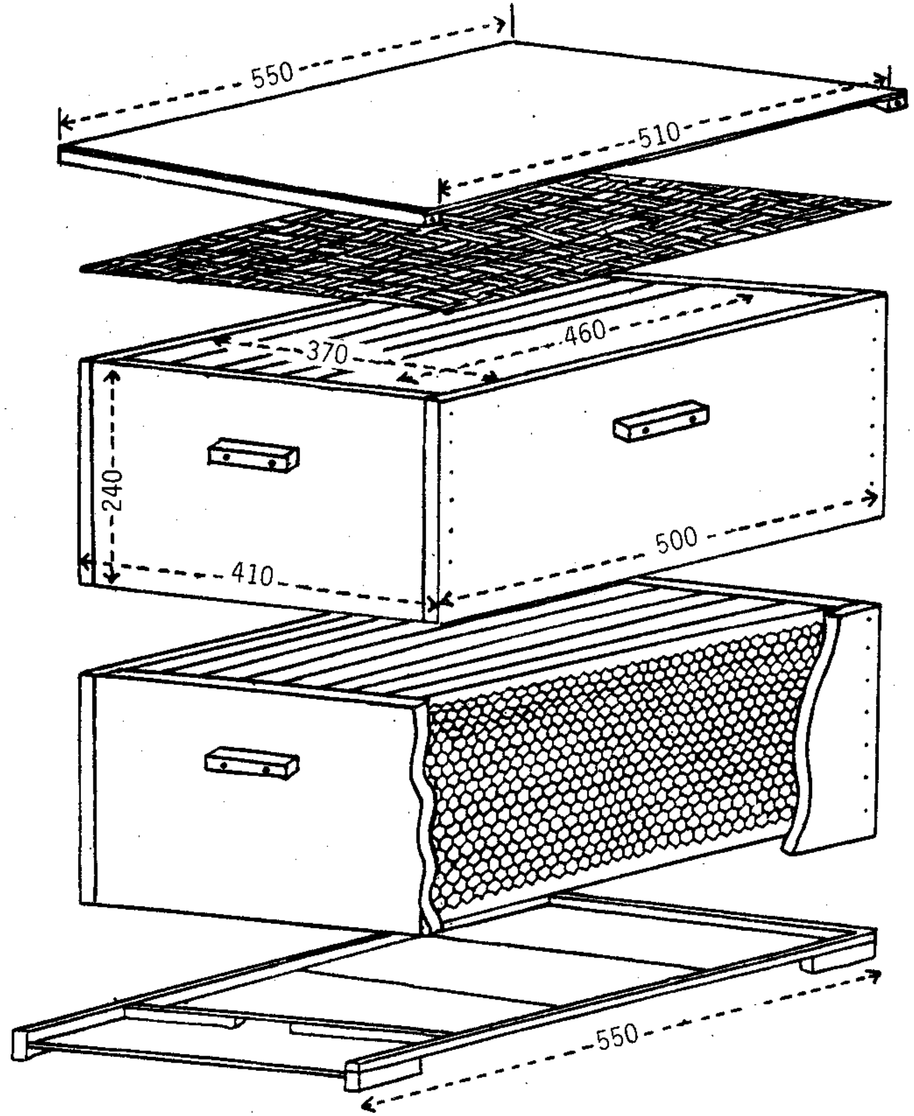
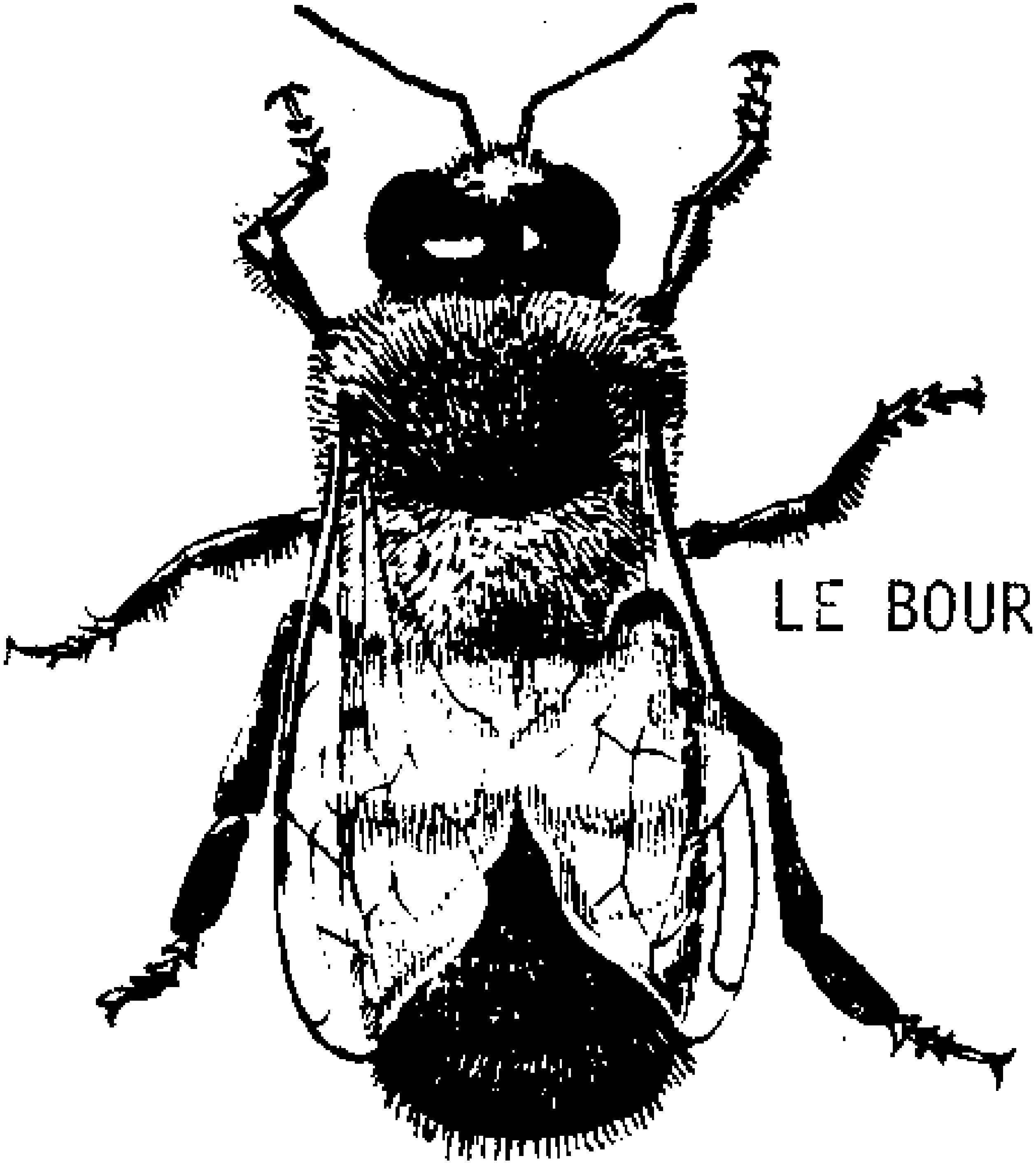


Figure 1
Dimensions en mm



LE BOURDON

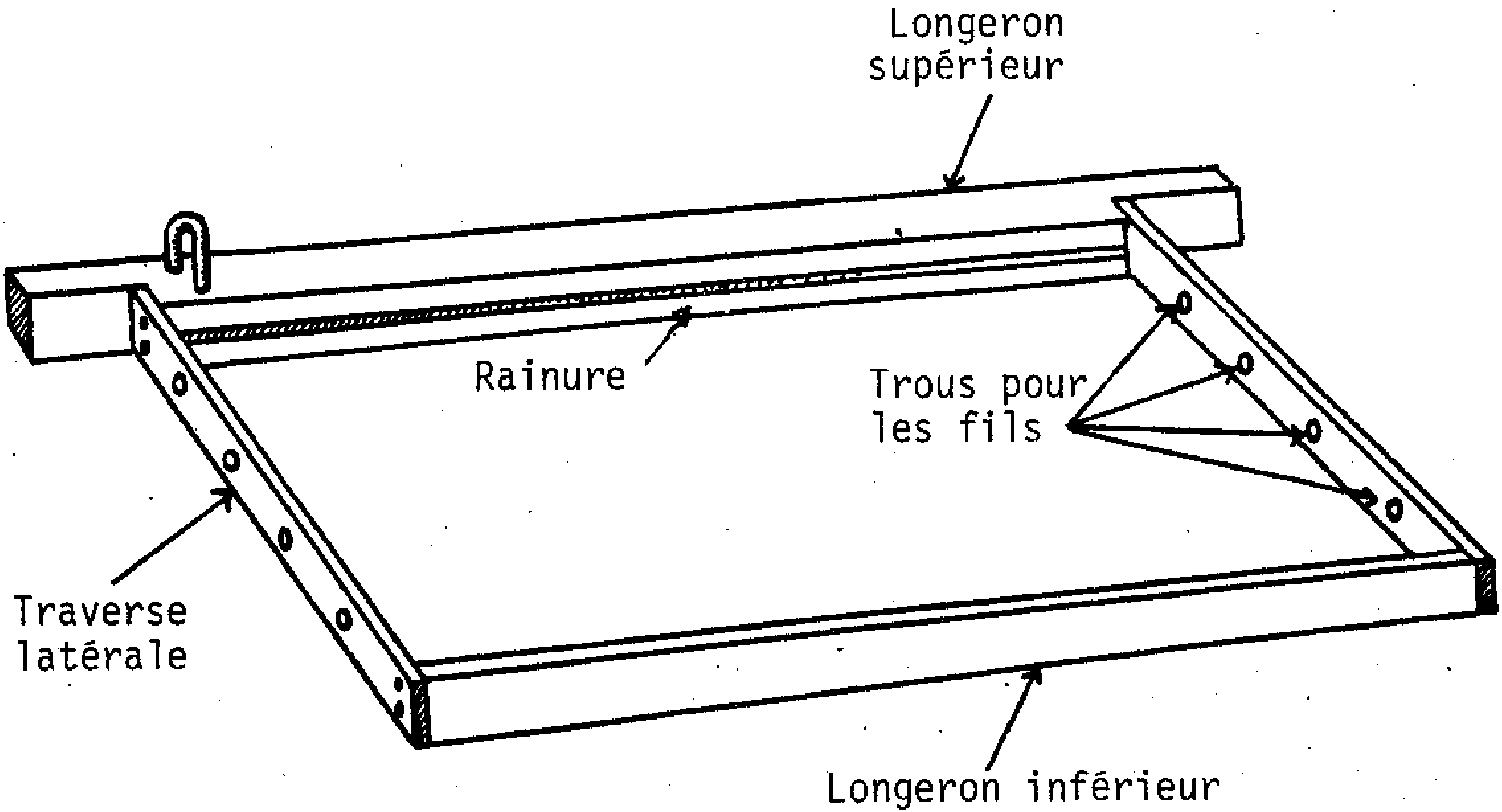

Longeron
supérieur
Rainure
Trous pour
les fils
Traverse
latérale
Longeron inférieur

Figure 2

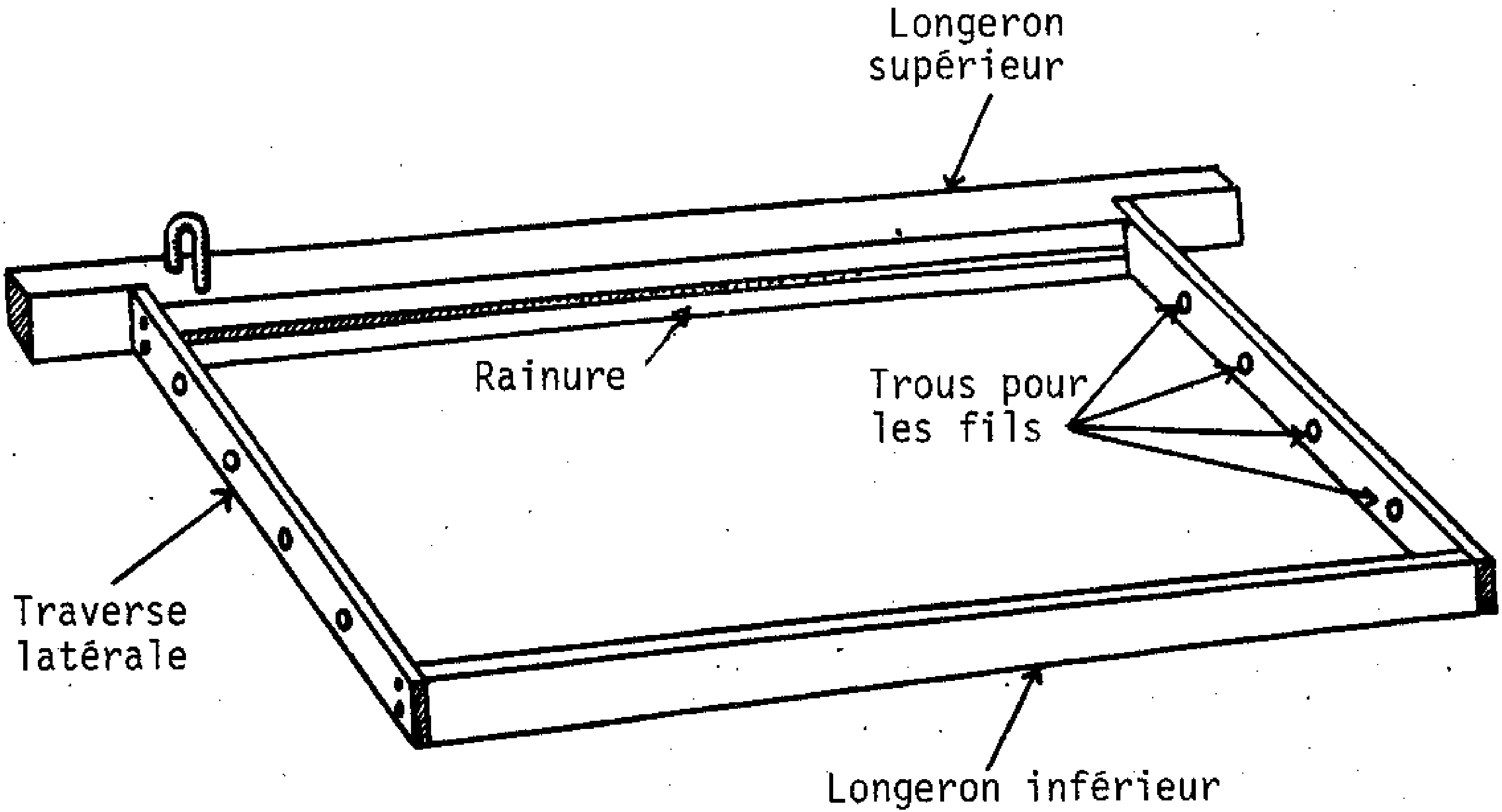

Longeron supérieur
Rainure
Trous pour les fils
Traverse latérale
Longeron inférieur

Figure 2

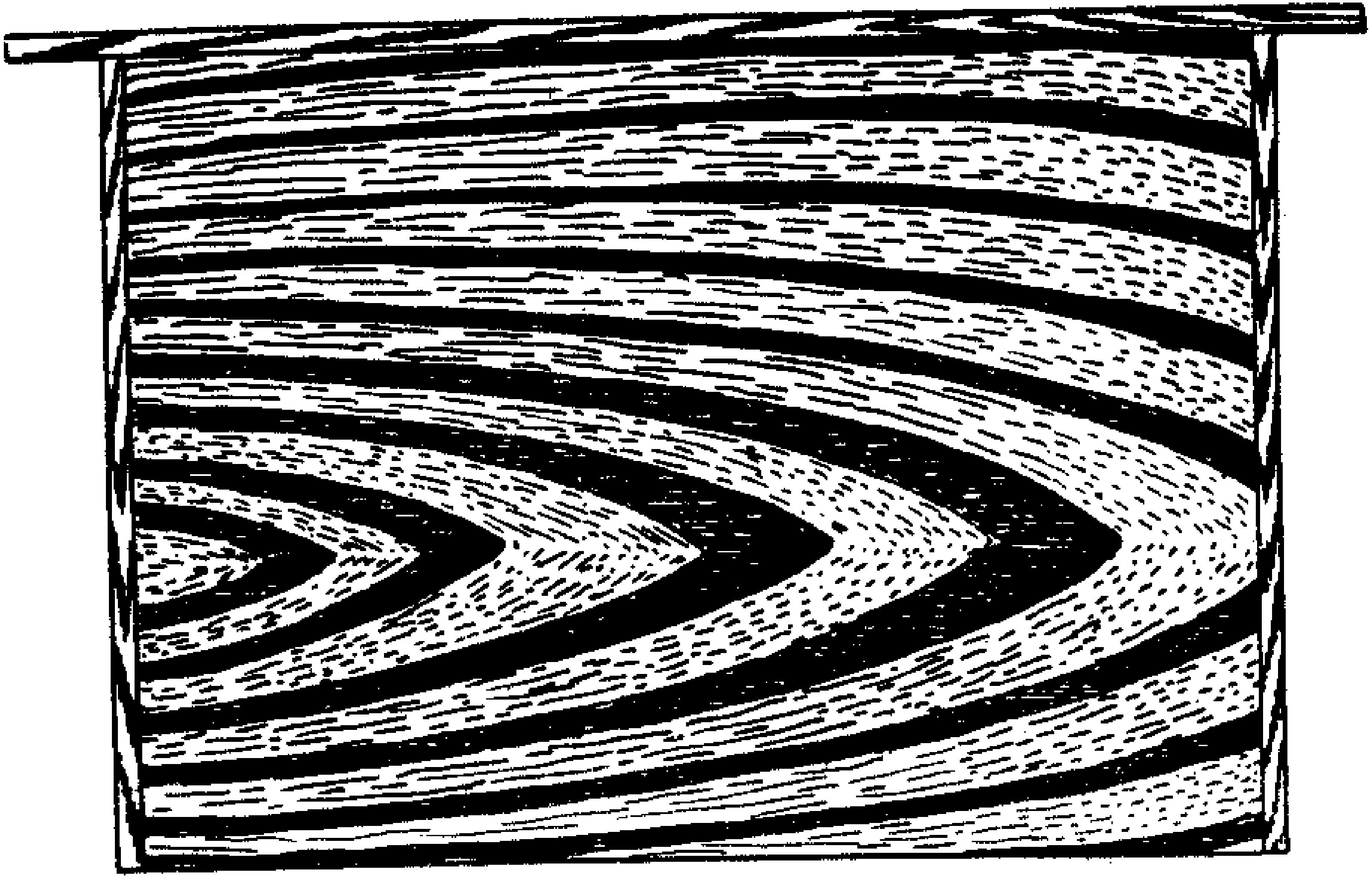
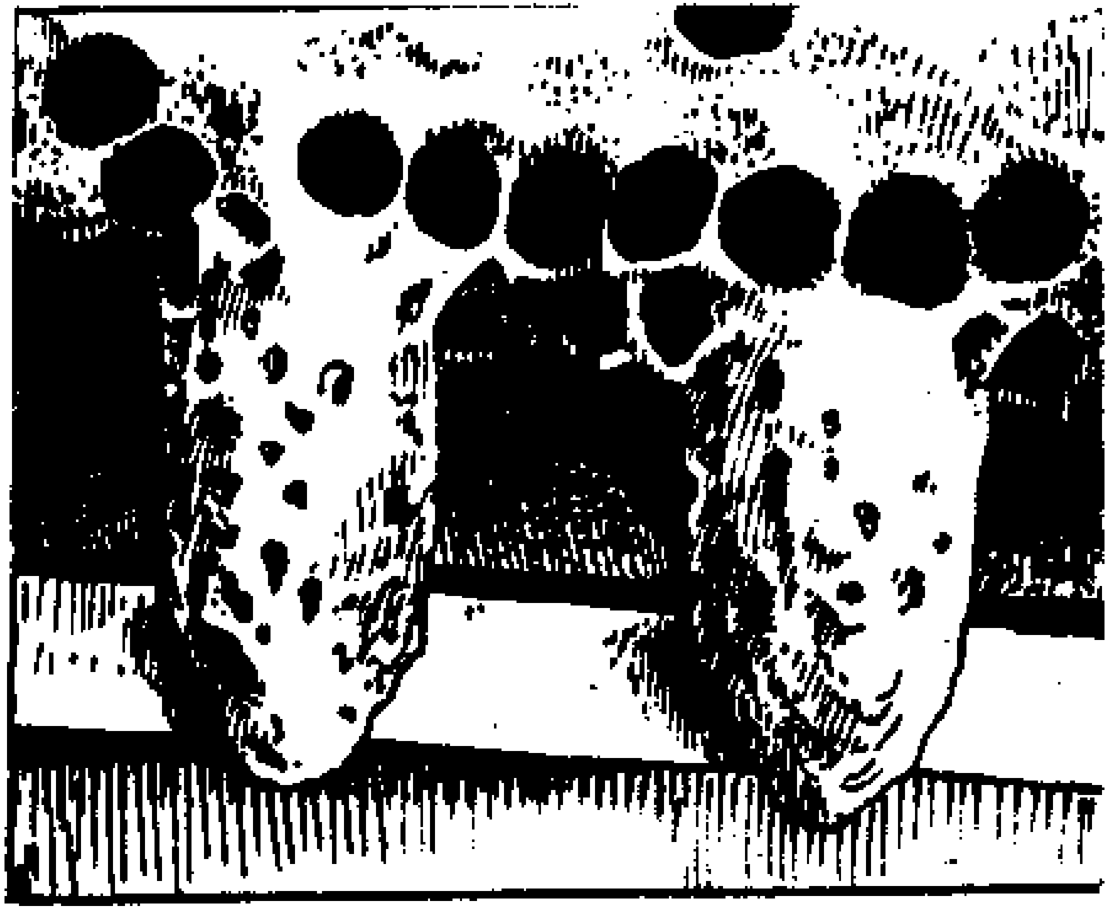


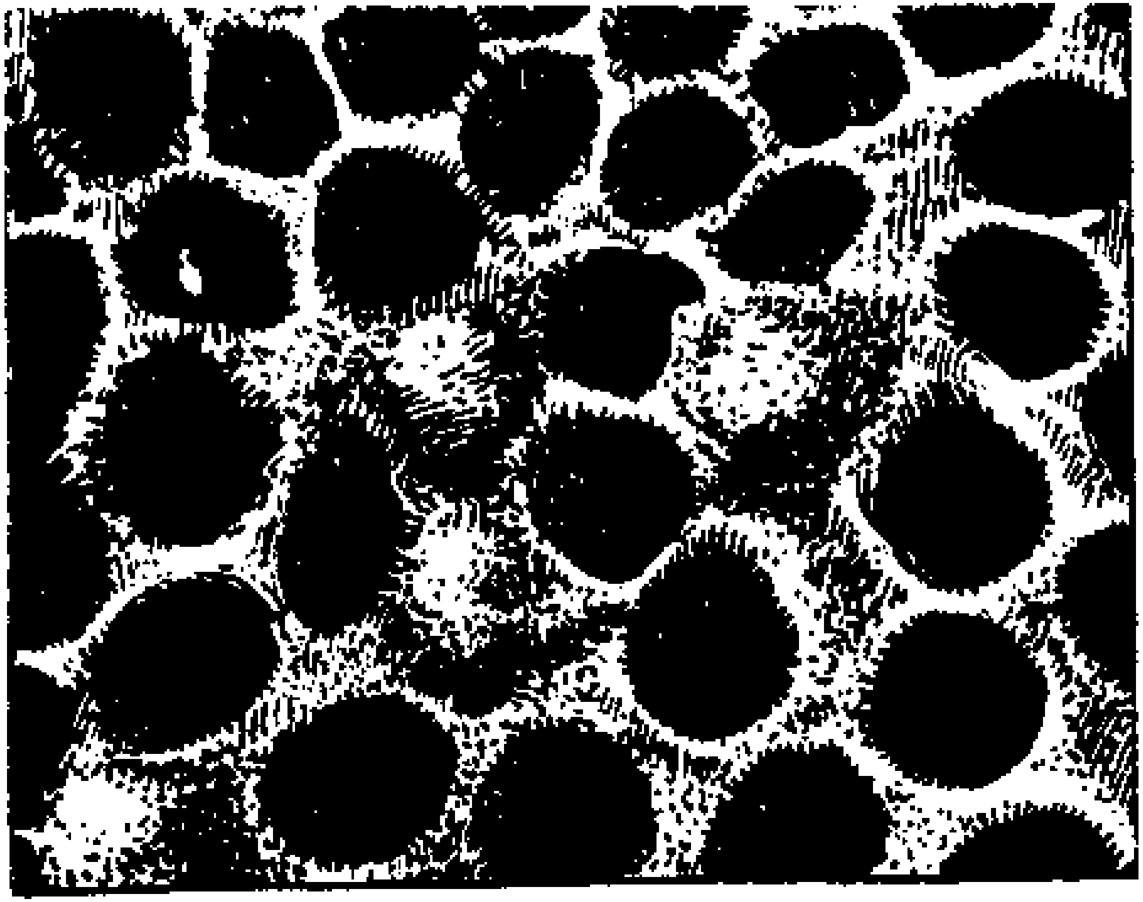
Planche de séparation

Figure 3



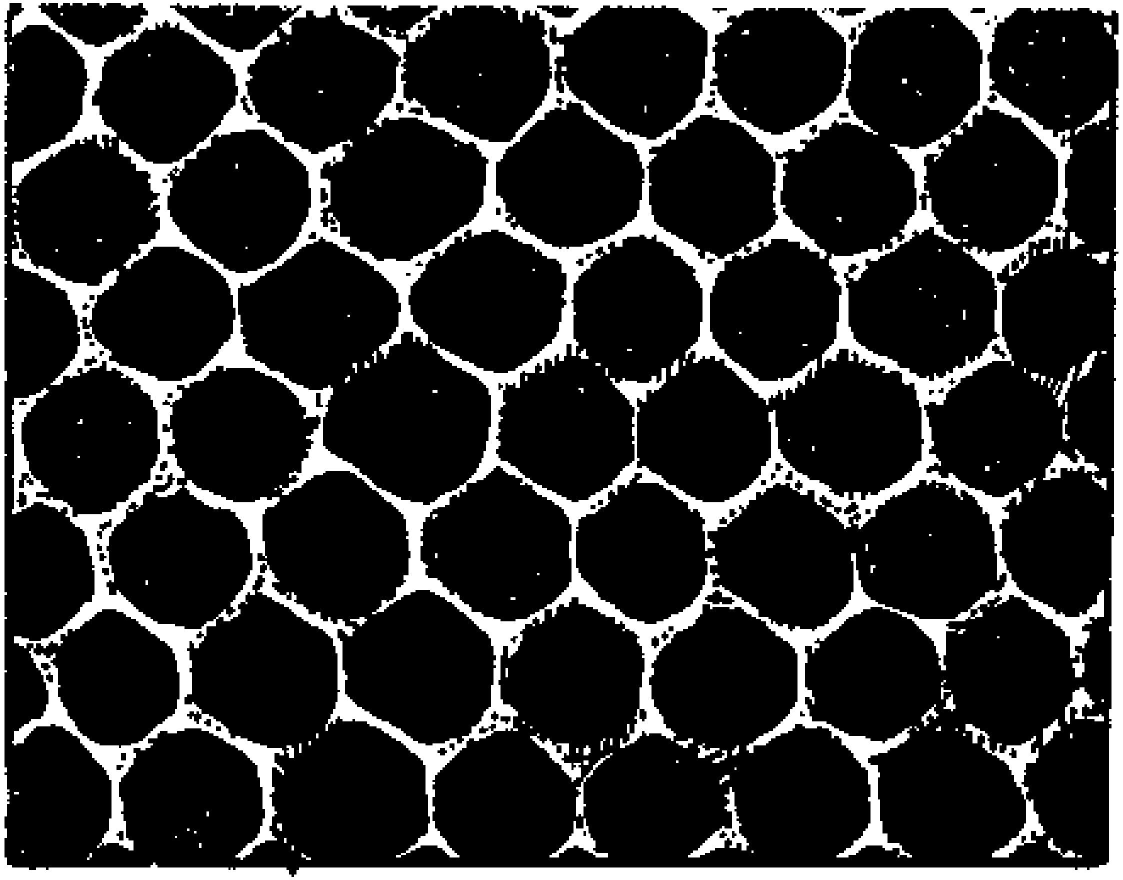
CELLULES DE REINE

Figure 4



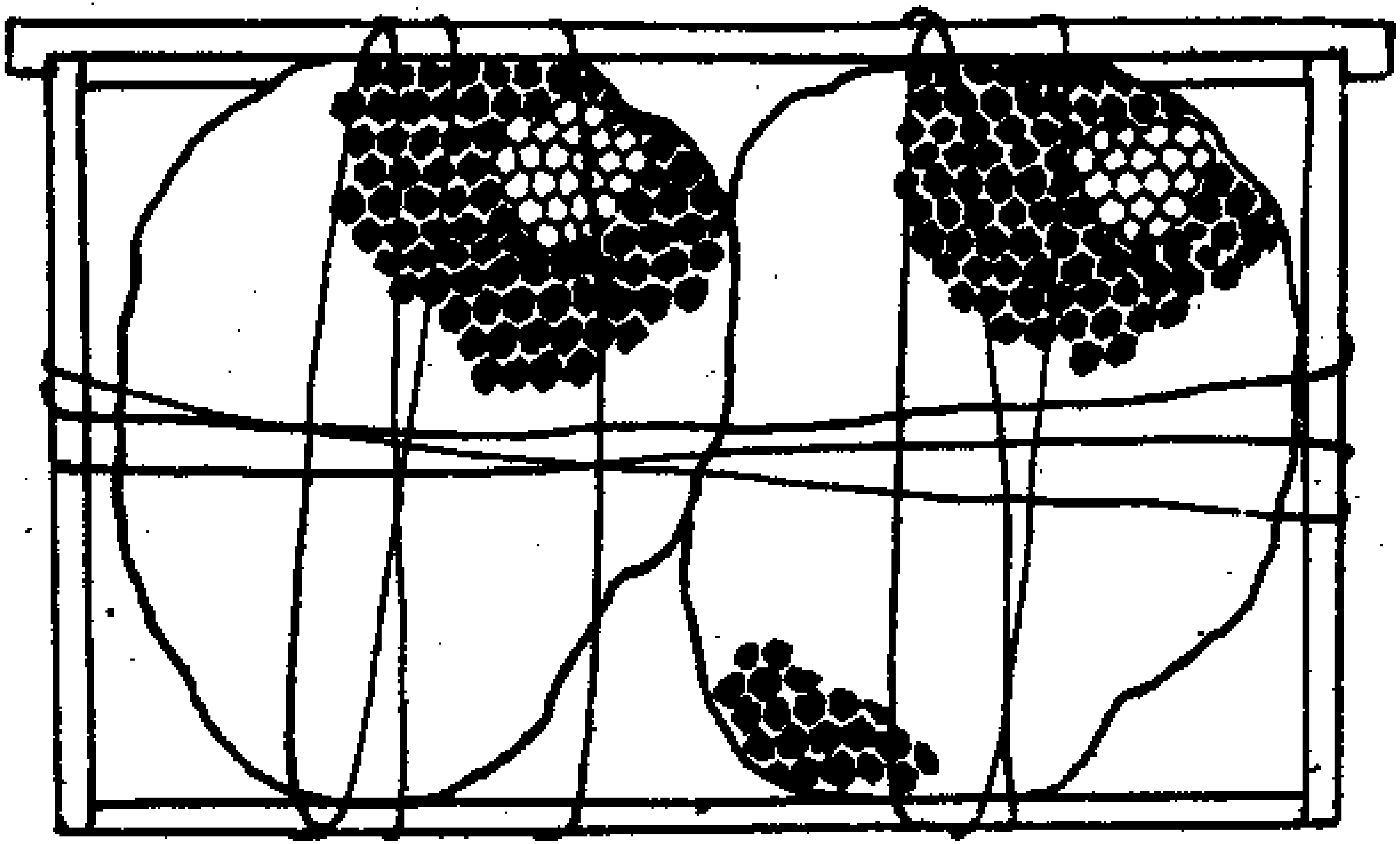
CELLULES DE BOURDON

Figure 5



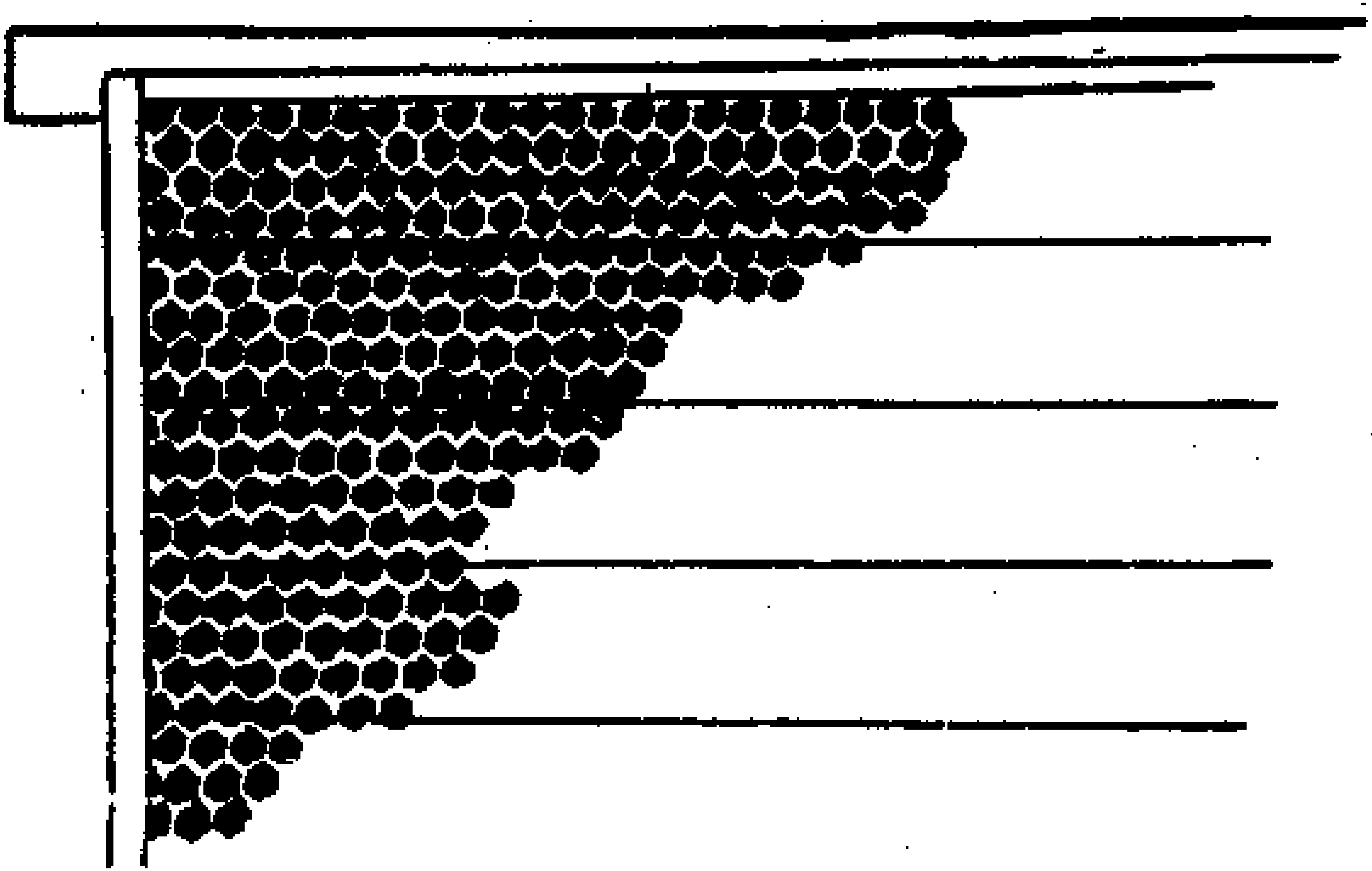
CELLULES D'OUVRIERES

Figure 6



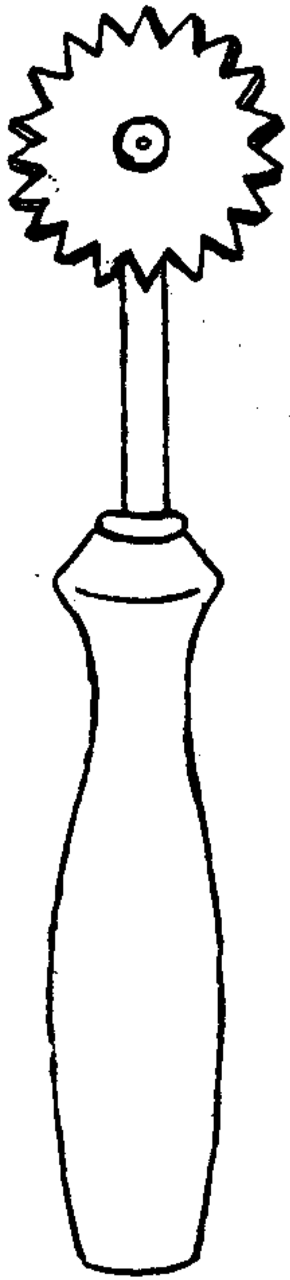
FIXATION D'UN VIEUX RAYON A
UN CADRE

Figure 7



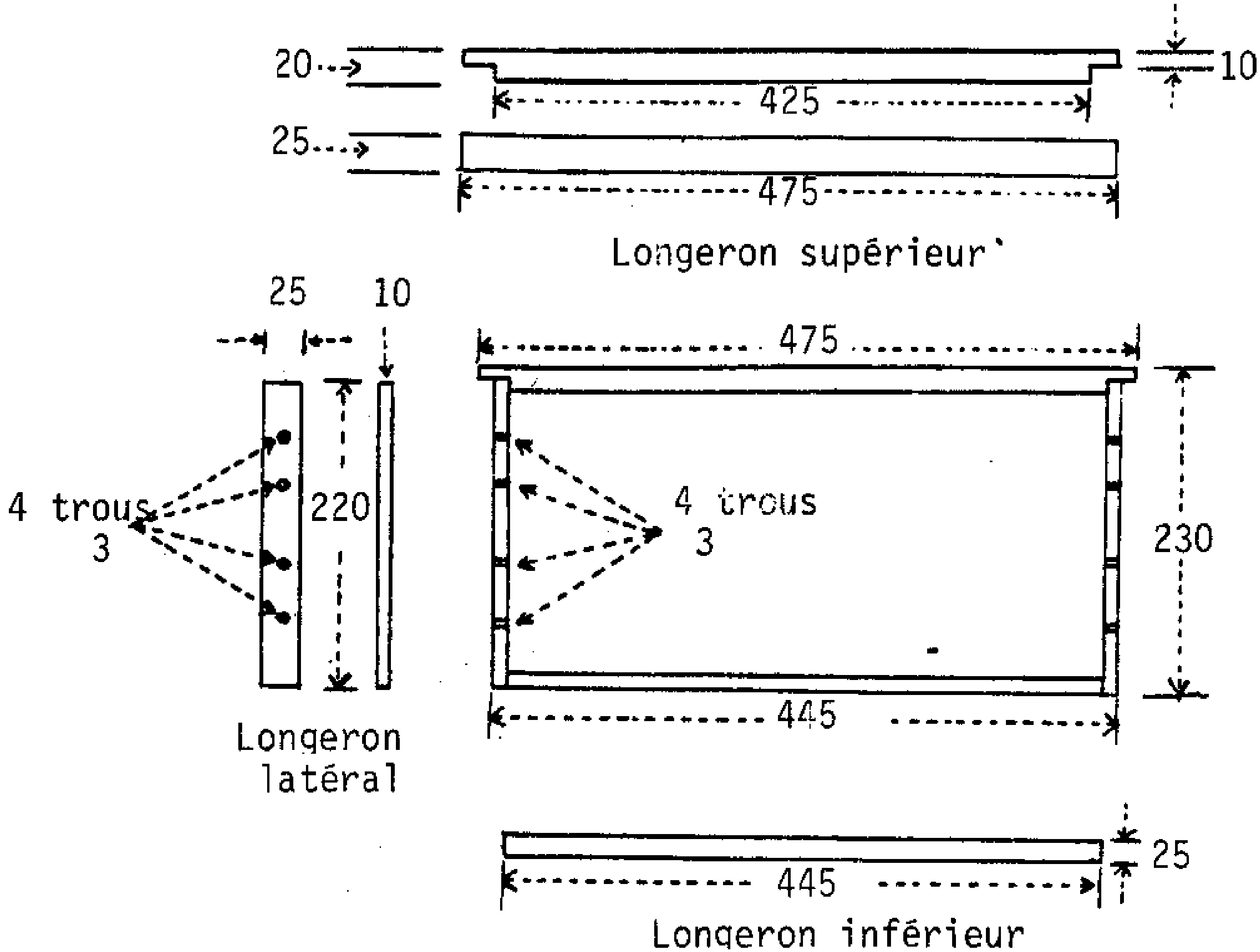
PLAQUE DE BASE EN CIRE

Figure 8



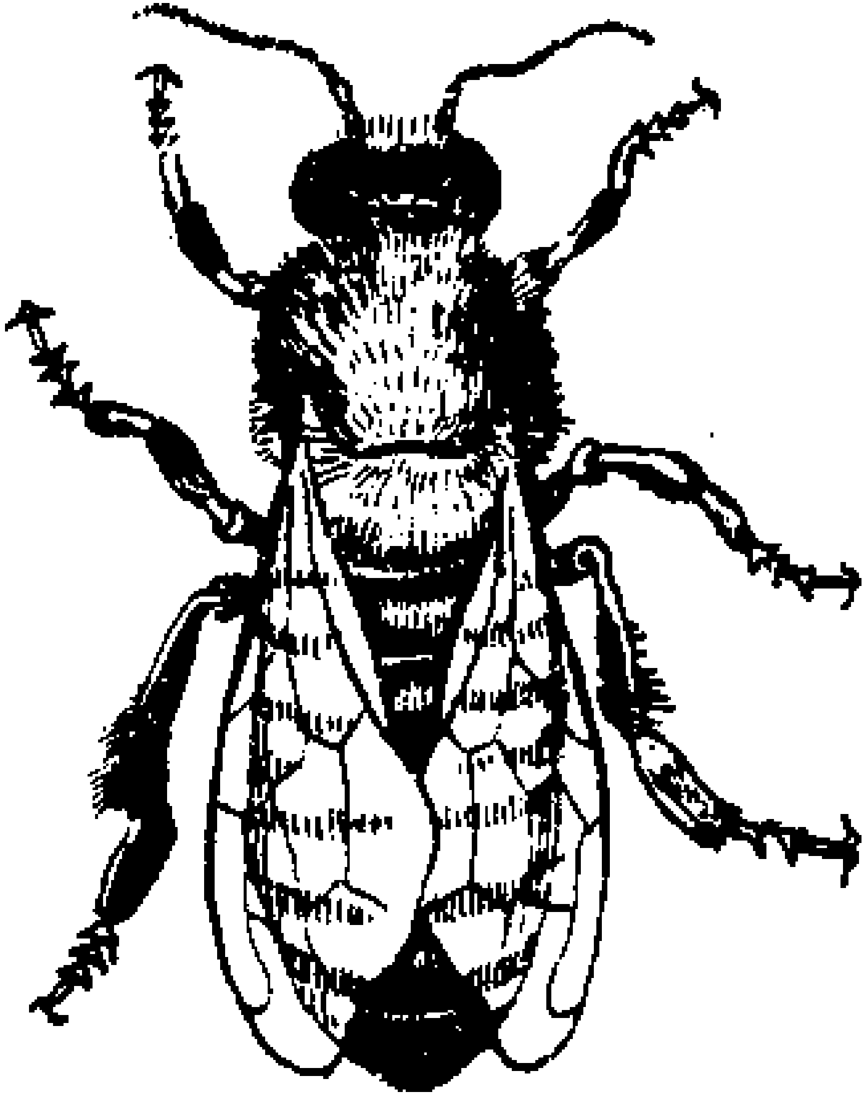
ROULETTE

Figure 9



CADRE DE LANGSTROTH

Figure 10



L'OUVRIERE

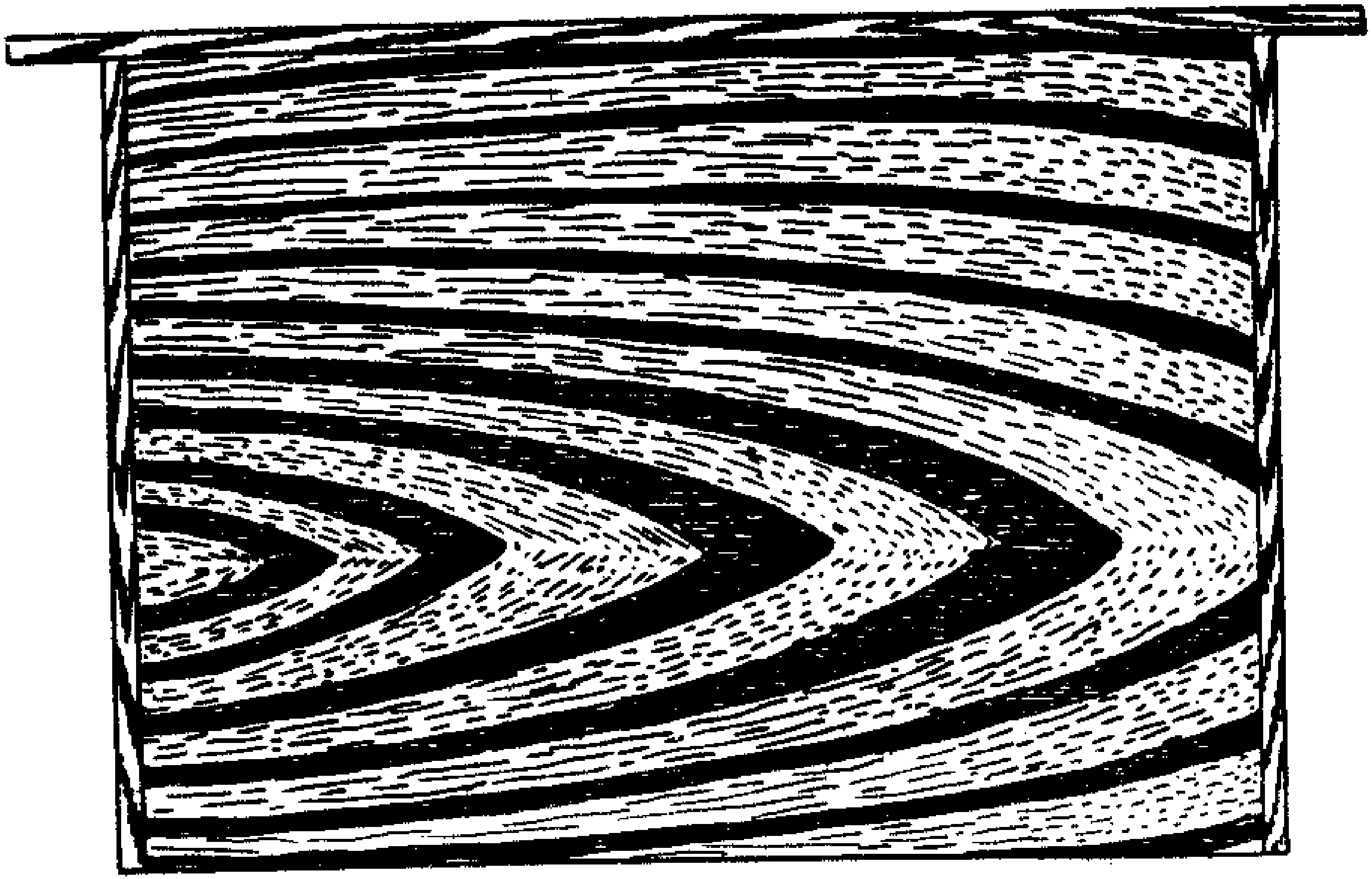
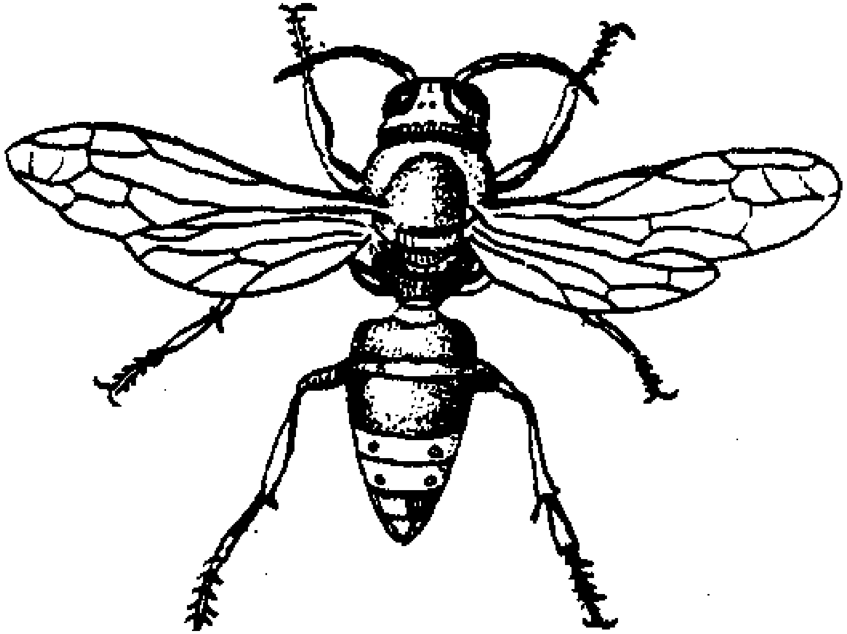
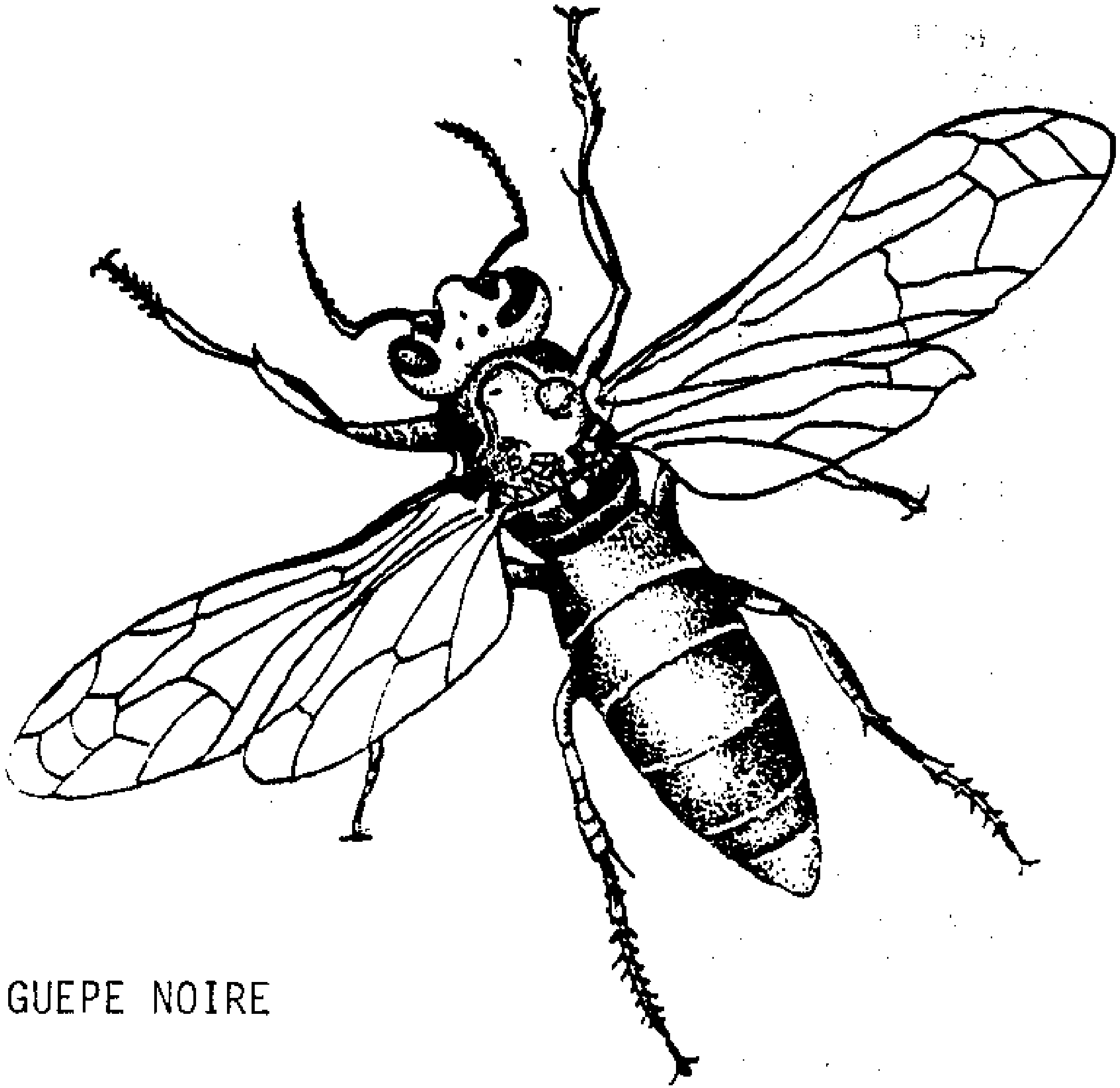


Planche de séparation

Figure 3

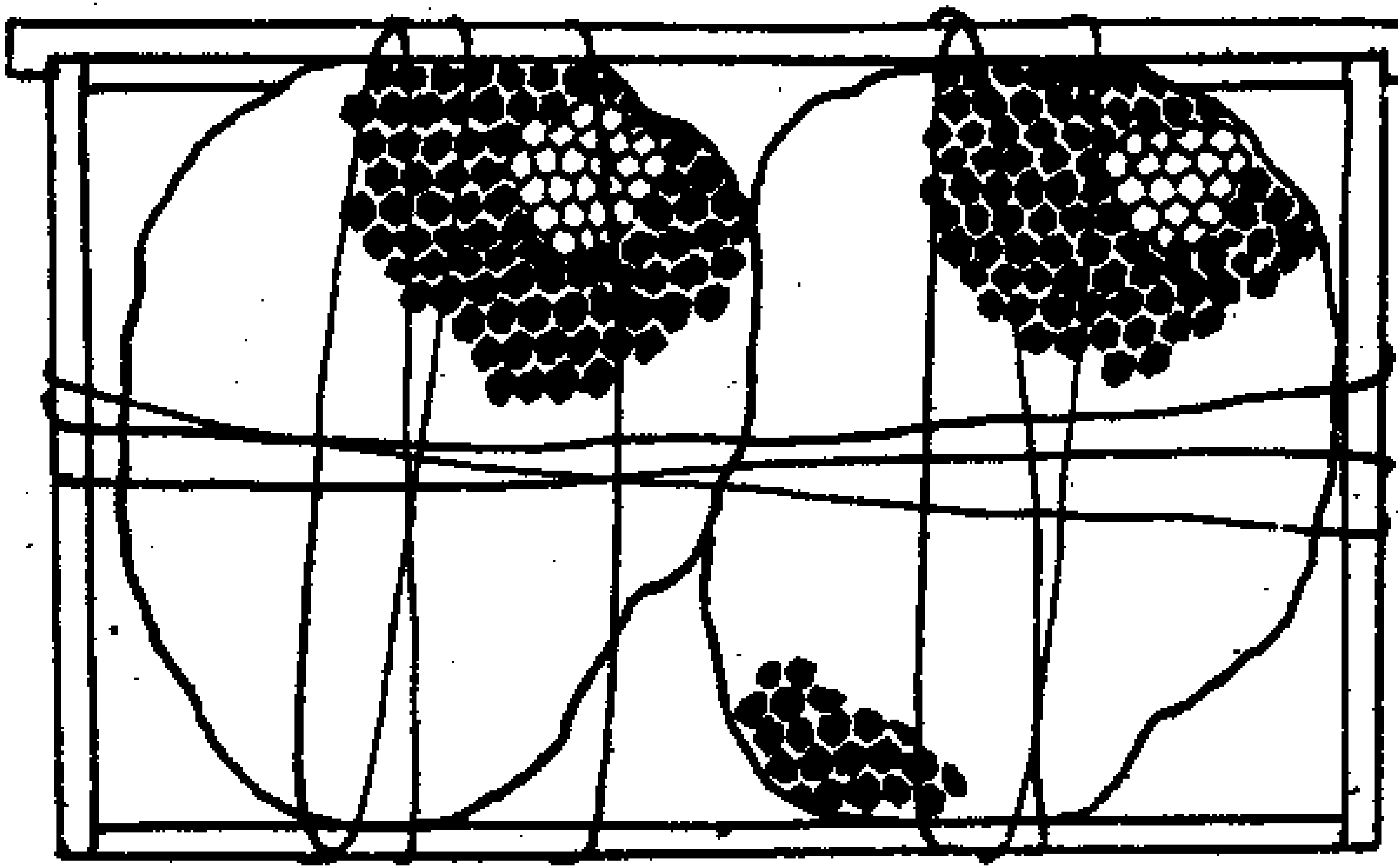


GUEPE BRUNE



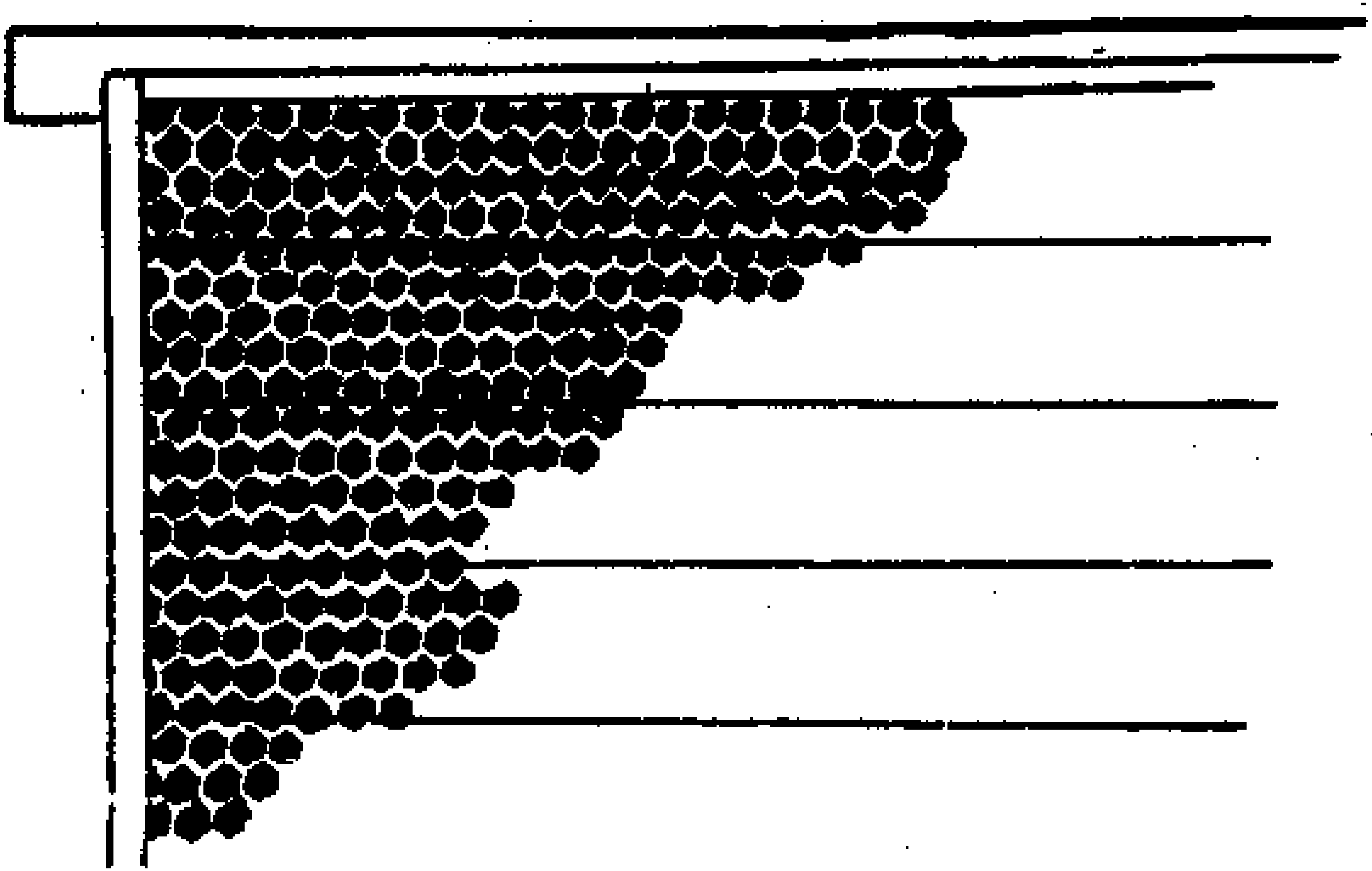
GUEPE NOIRE

DE QUOI LES ABEILLES ONT-ELLES BESOIN POUR VIVRE?



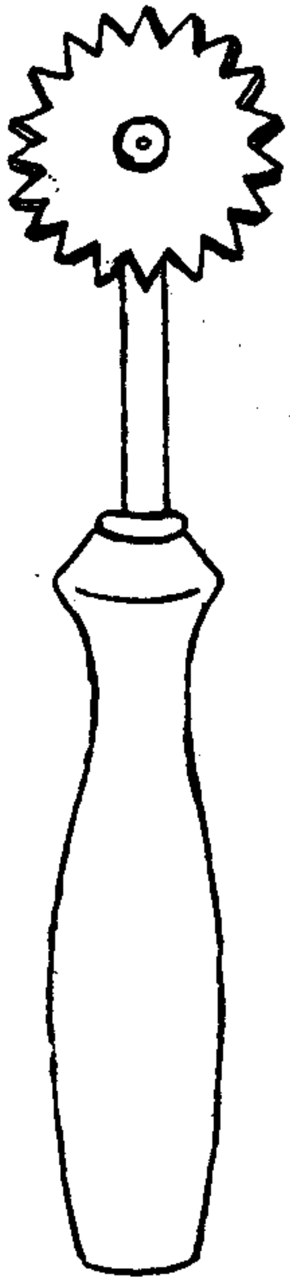
FIXATION D'UN VIEUX RAYON A UN CADRE

Figure 7



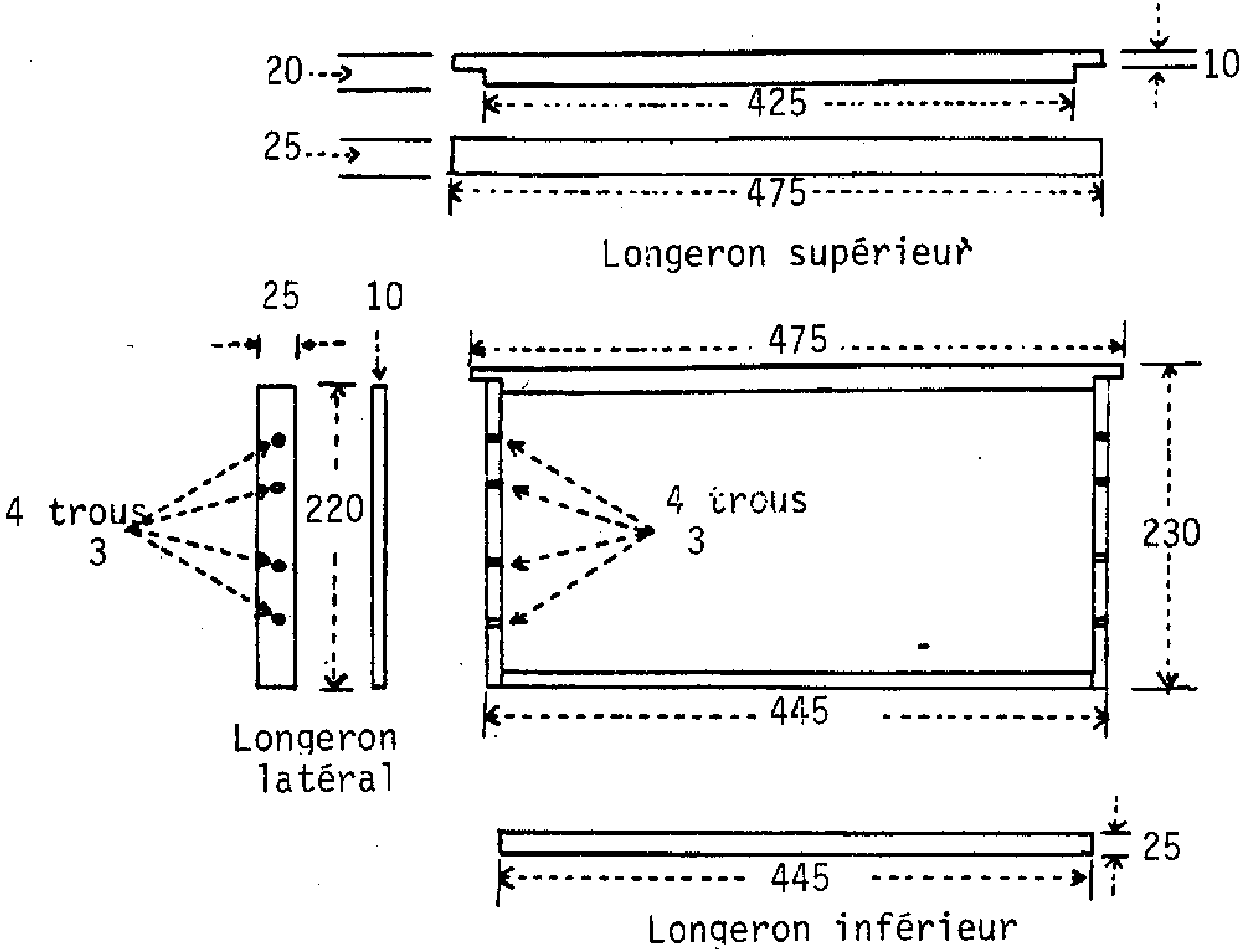
PLAQUE DE BASE EN CIRE

Figure 8



ROULETTE

Figure 9



CADRE DE LANGSTROTH

Figure 10

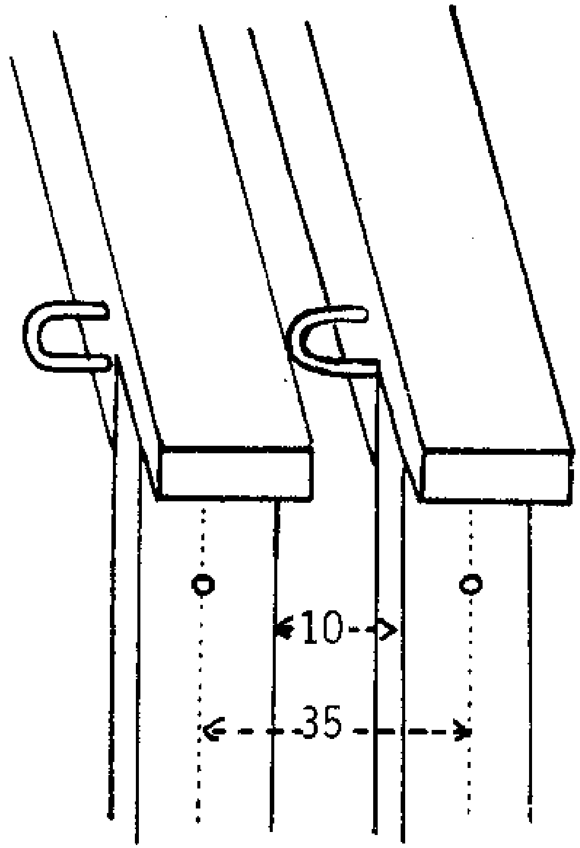
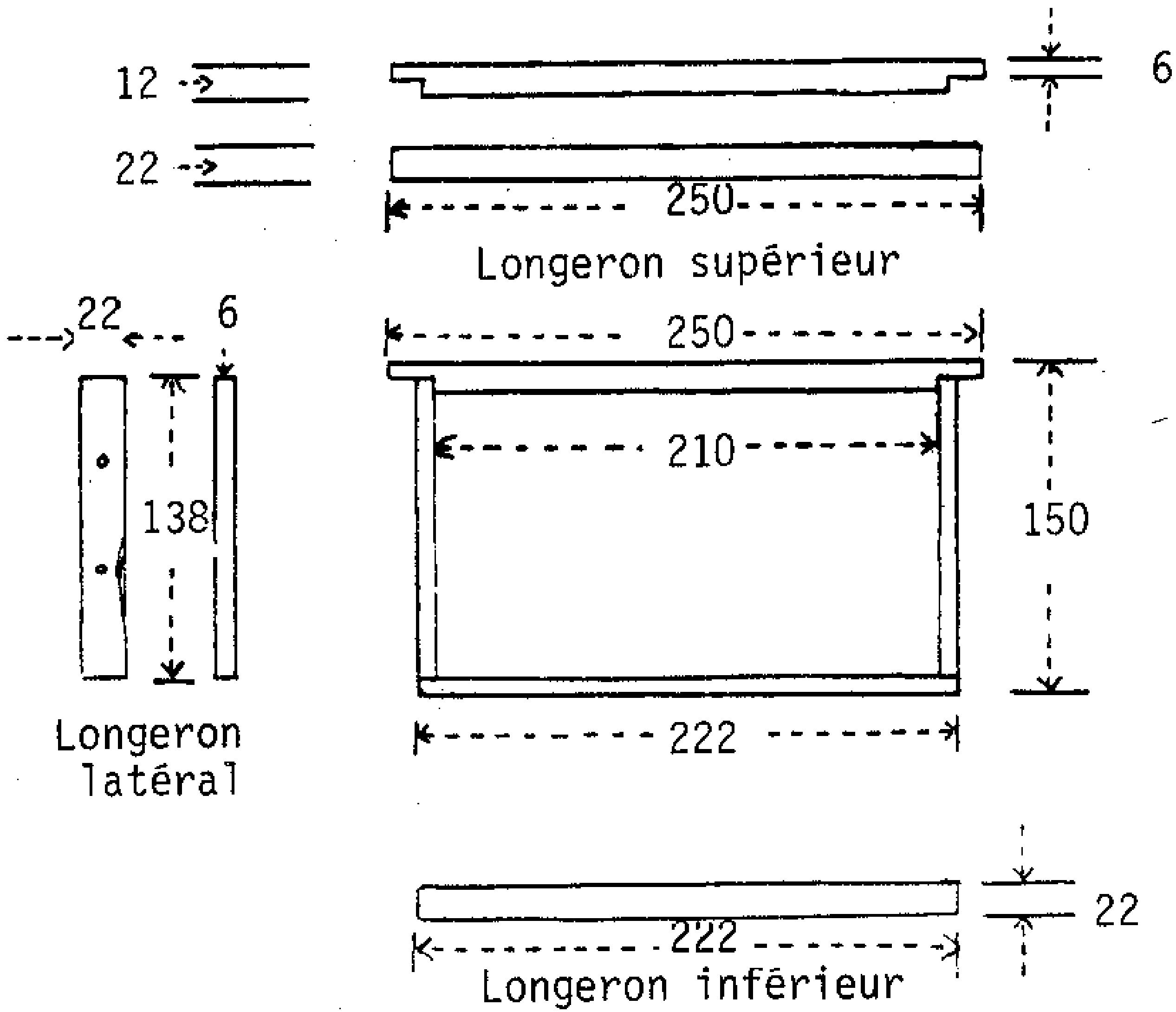


Figure 12



CADRE DE NEWTON

Figure 11 (Dimensions en mm)

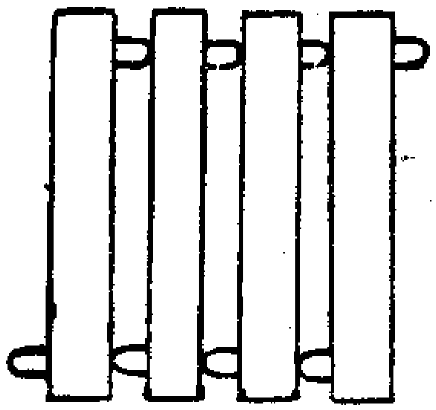


Figure 13

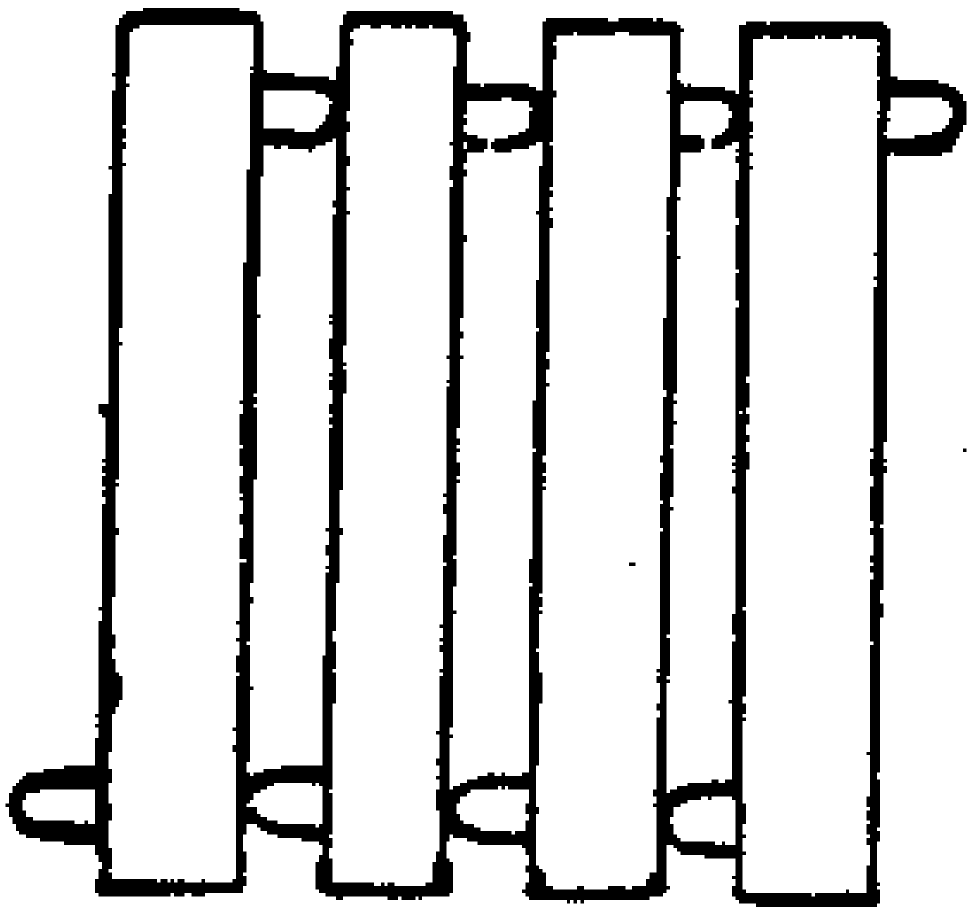
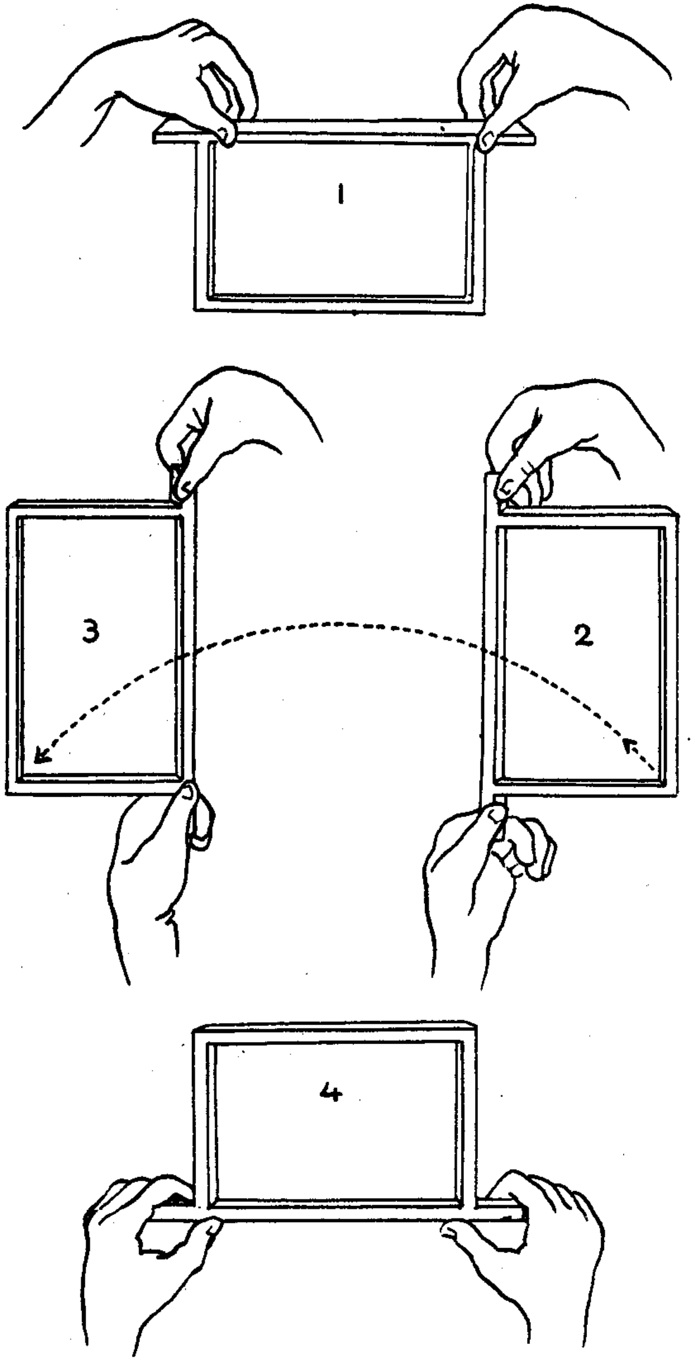
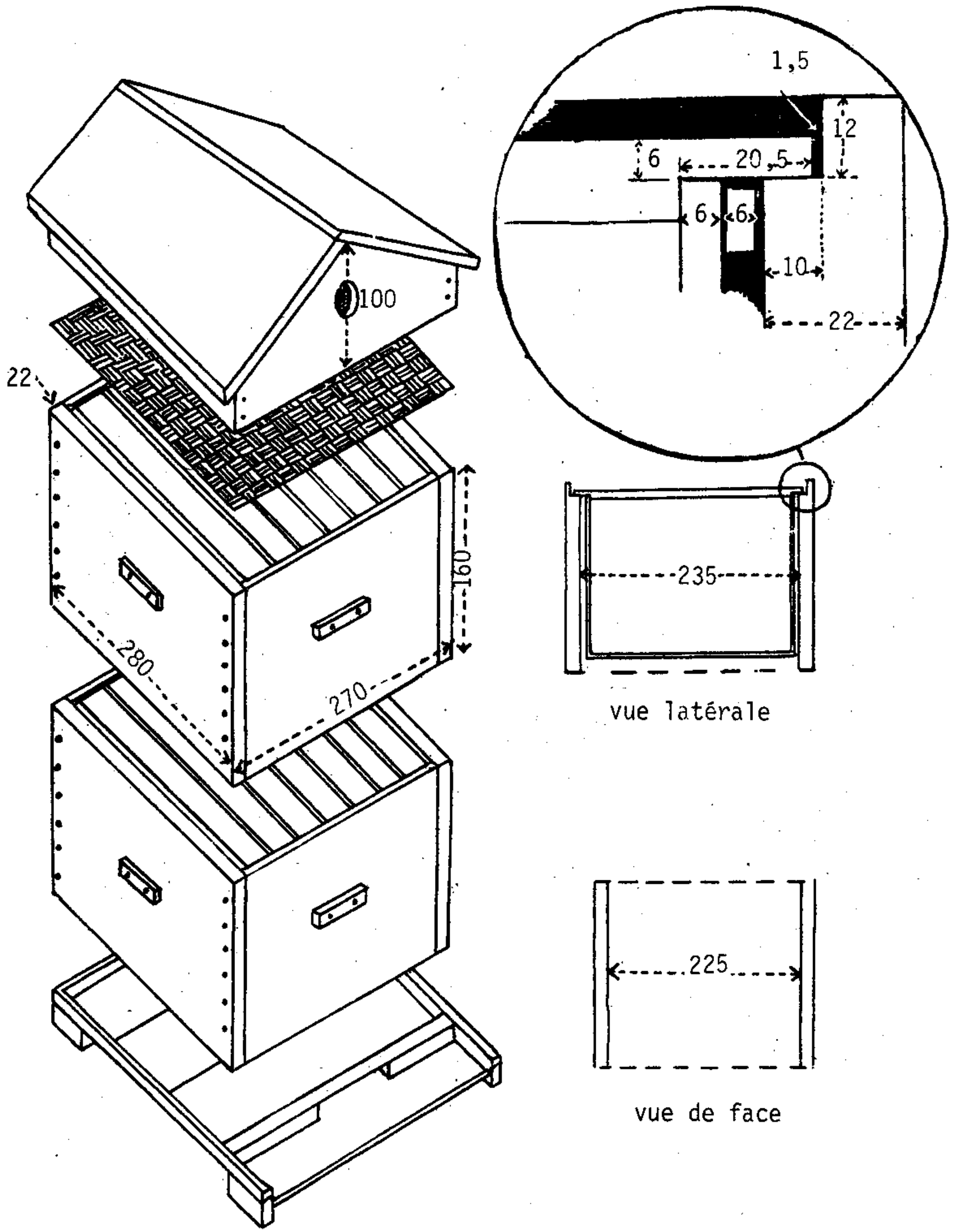


Figure 13



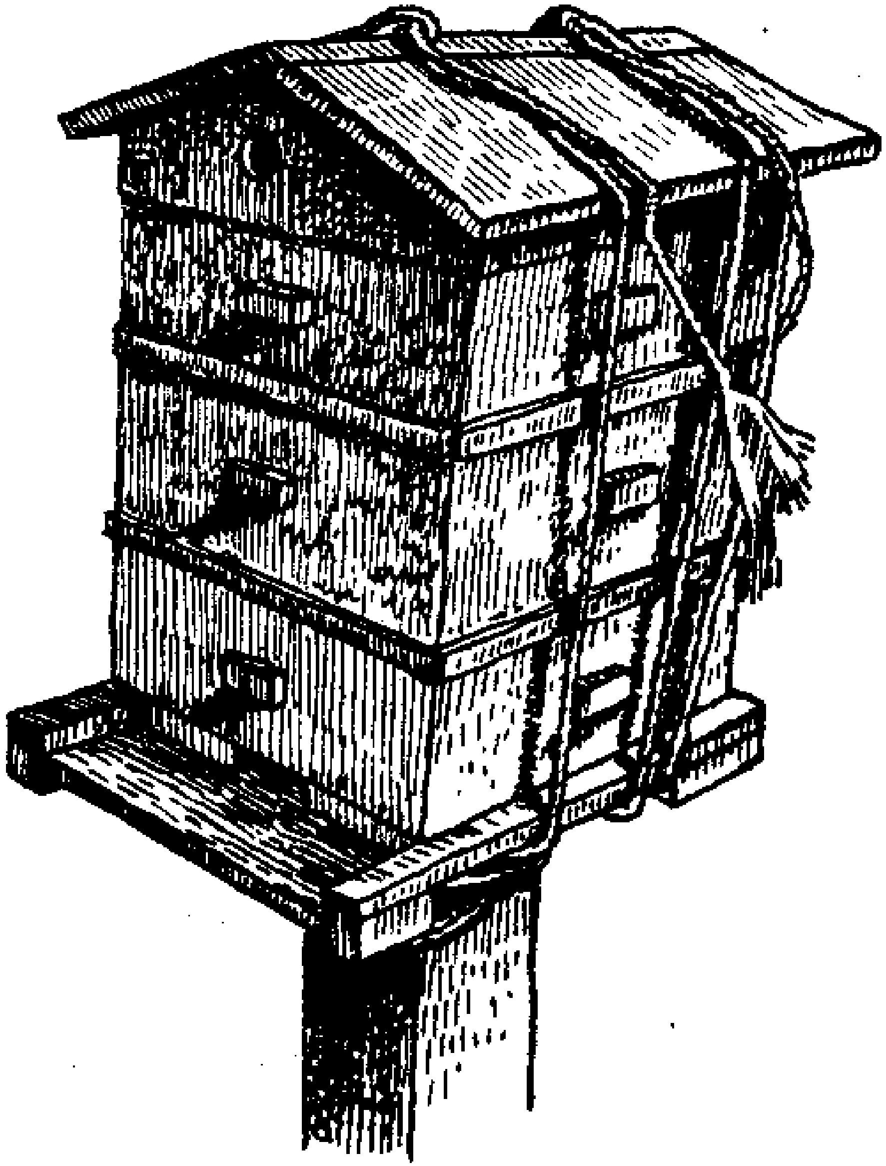
MANIEMENT D'UN CADRE

Figure 14



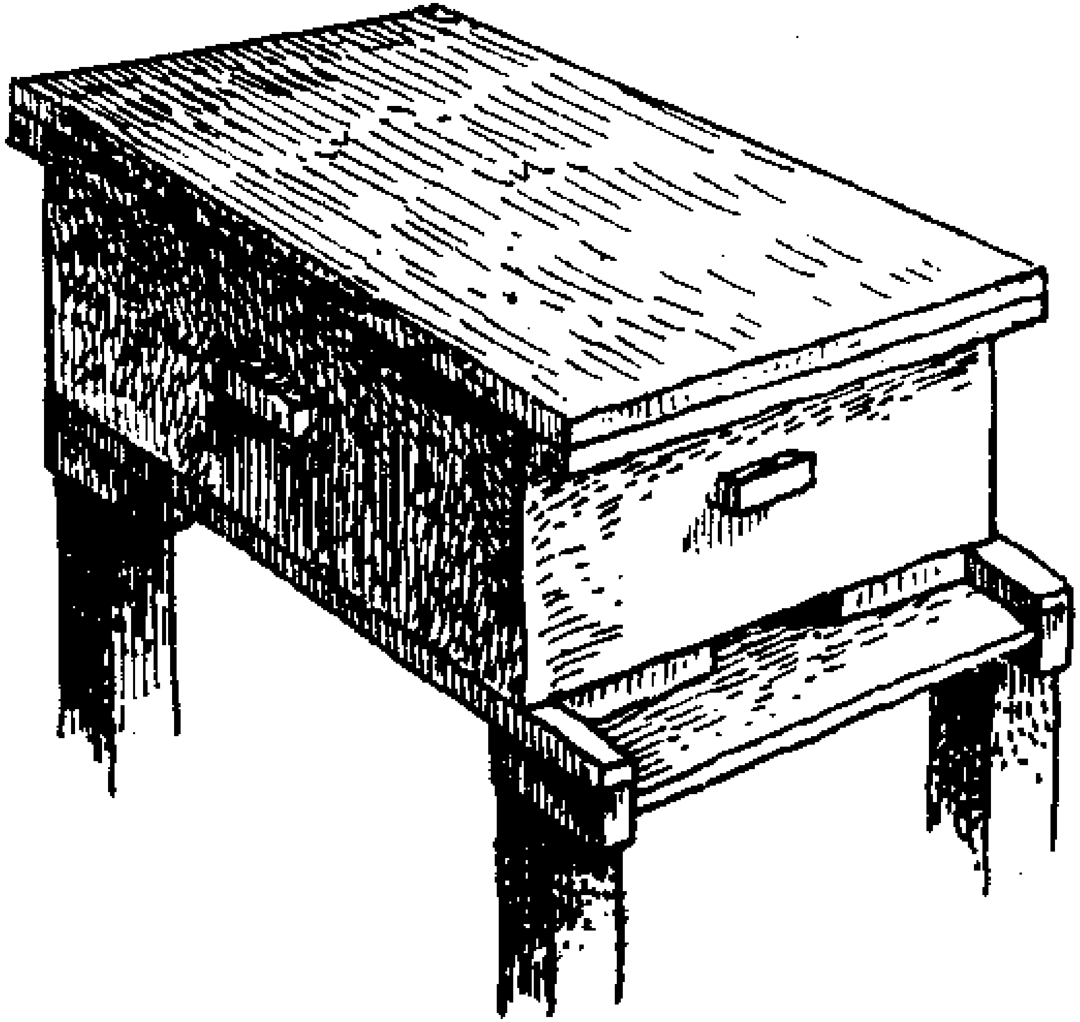
RUCHE DE NEWTON

Figure 15 (dimensions en mm)



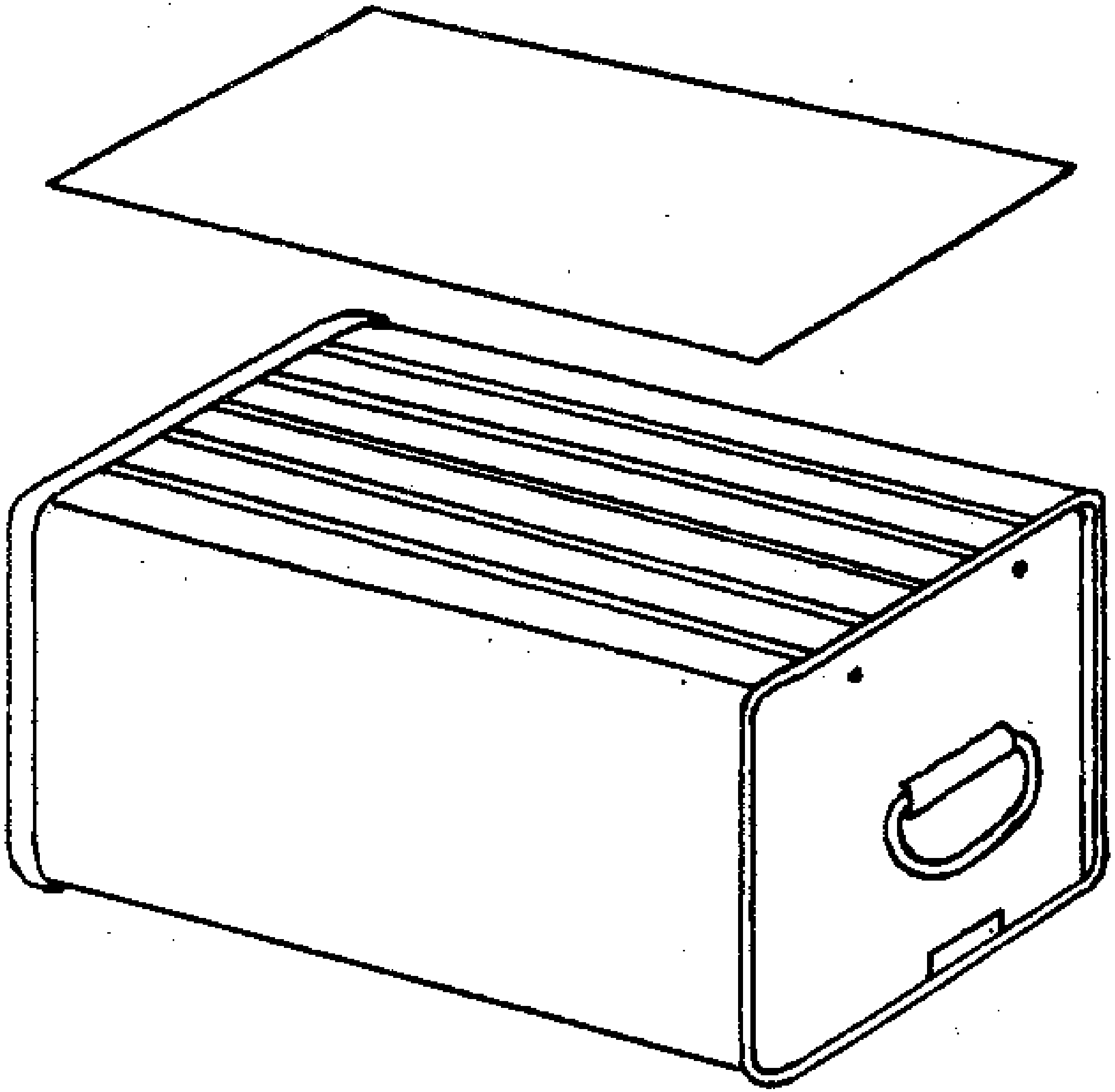
POTEAU SUPPORT

Figure 16



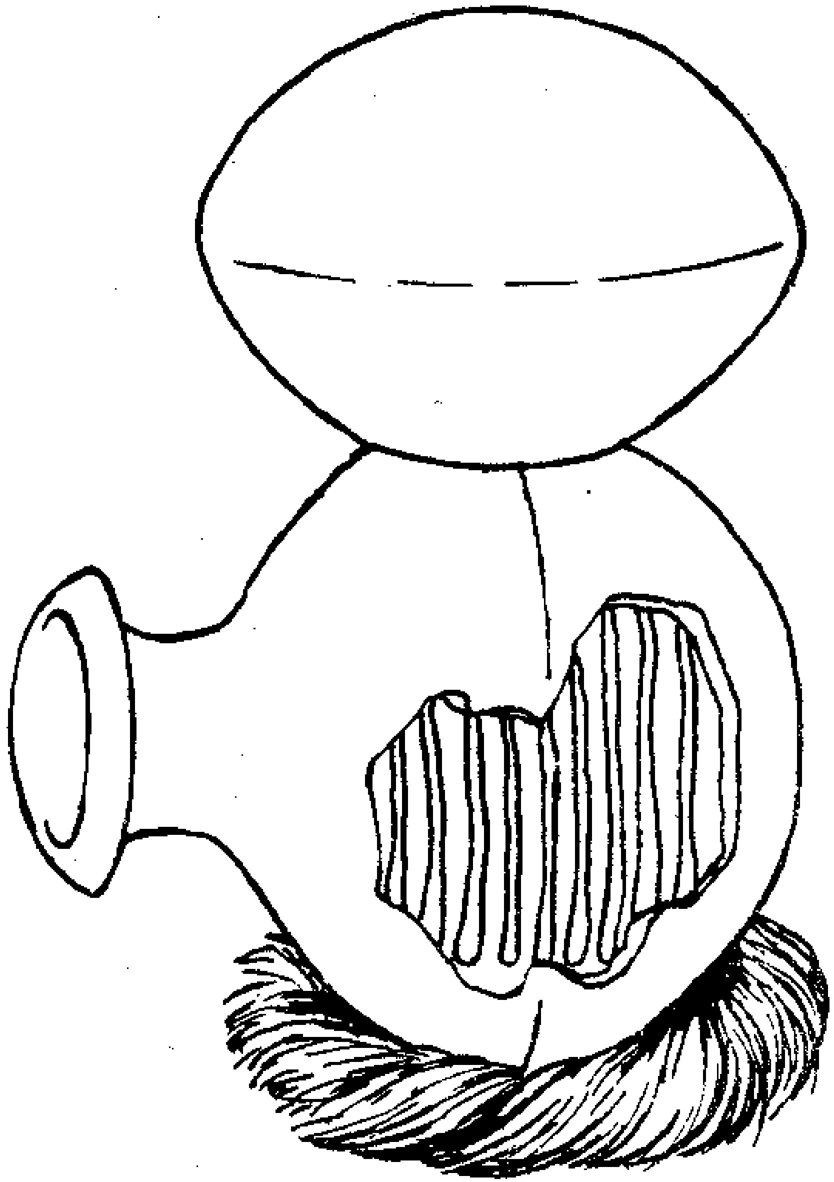
PIED SUPPORT

Figure 17



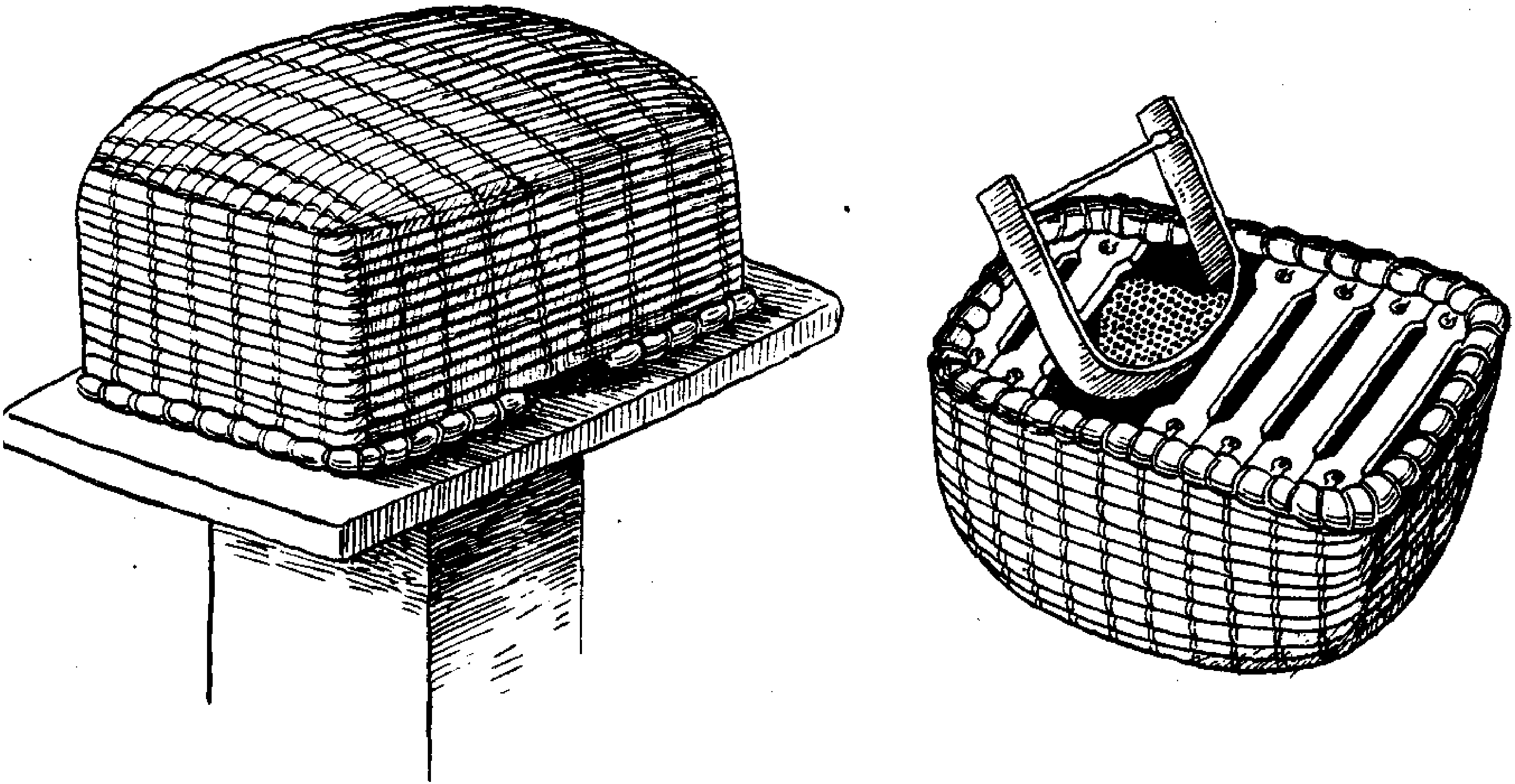
RUCHE EN FER BLANC

Figure 18



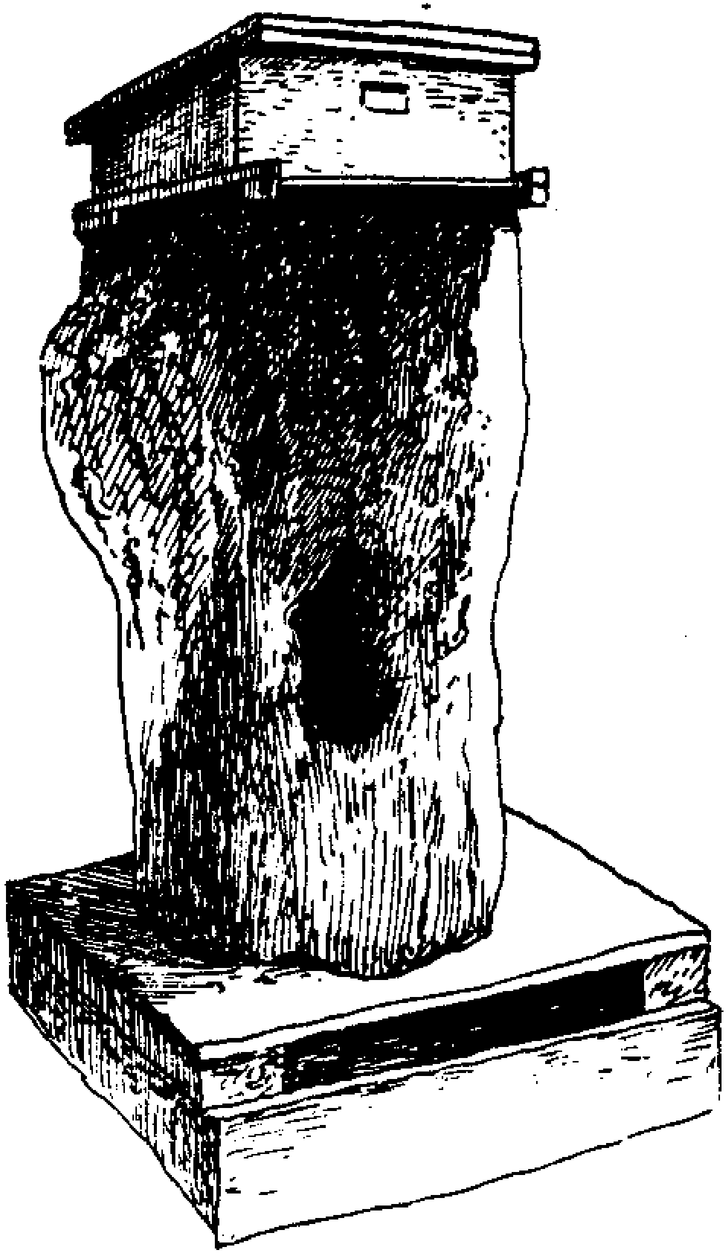
RUCHE EN POT

Figure 19



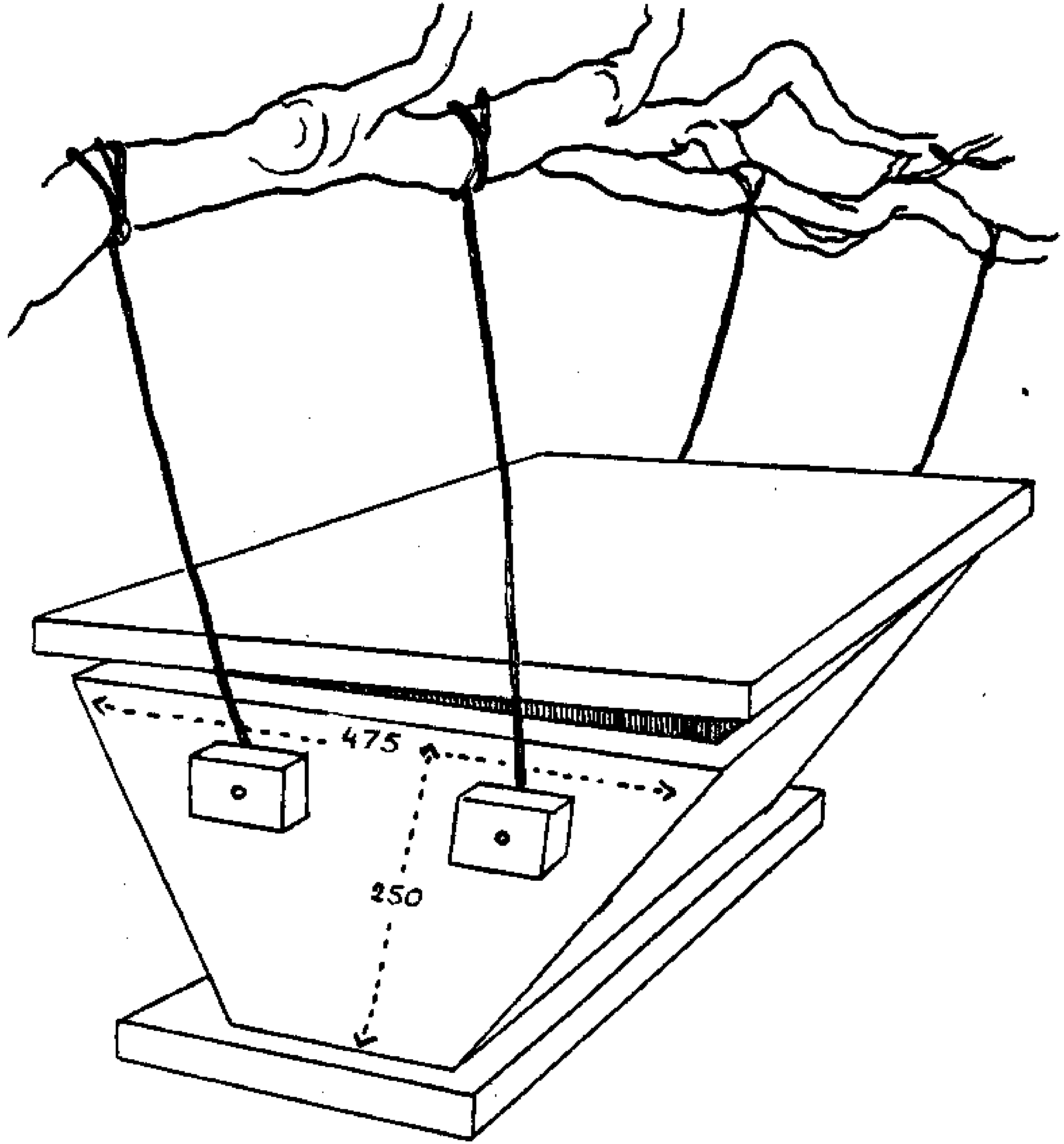
RUCHE EN PAILLE D'OSIER

Figure 20



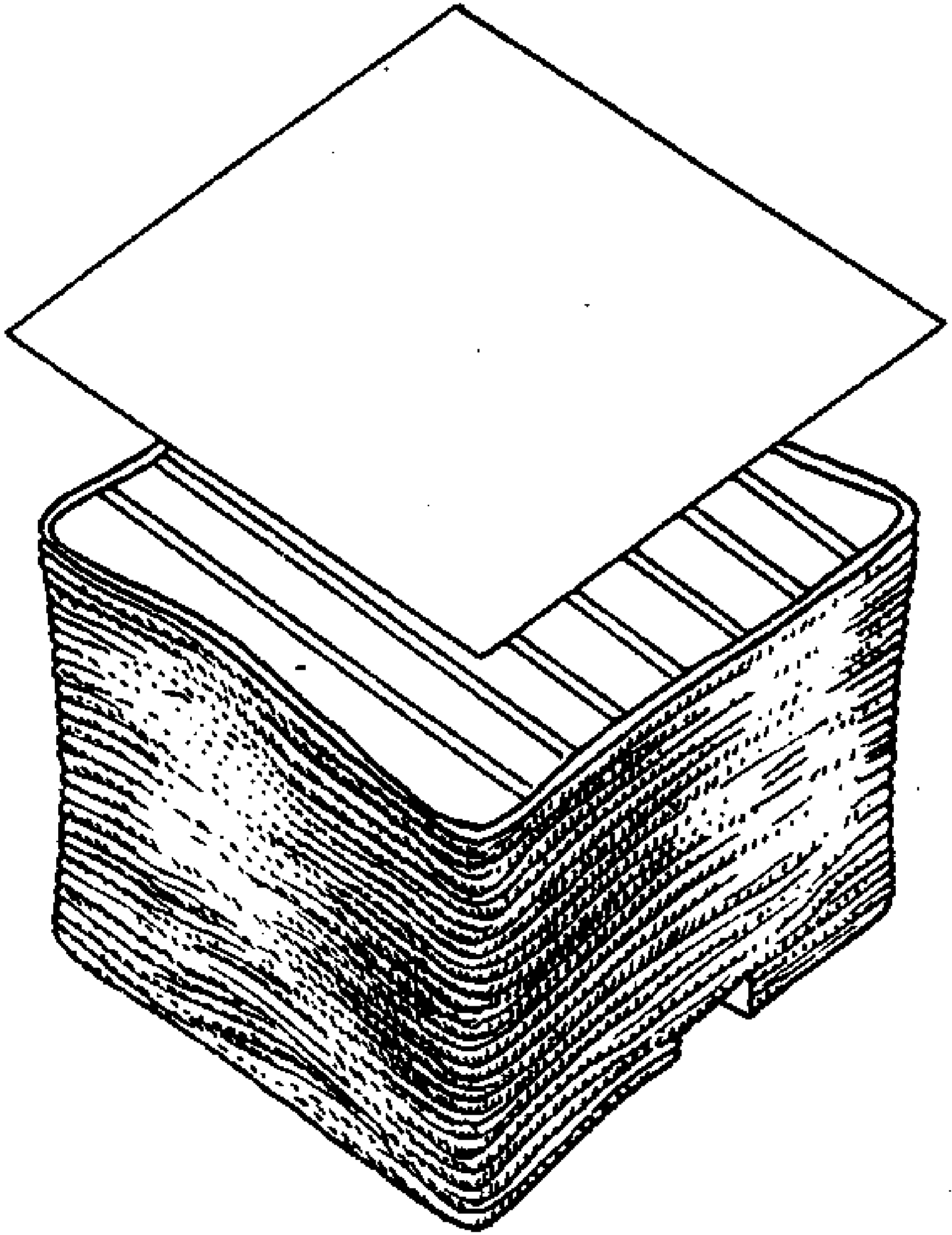
RUCHE DE TRONC

Figure 21



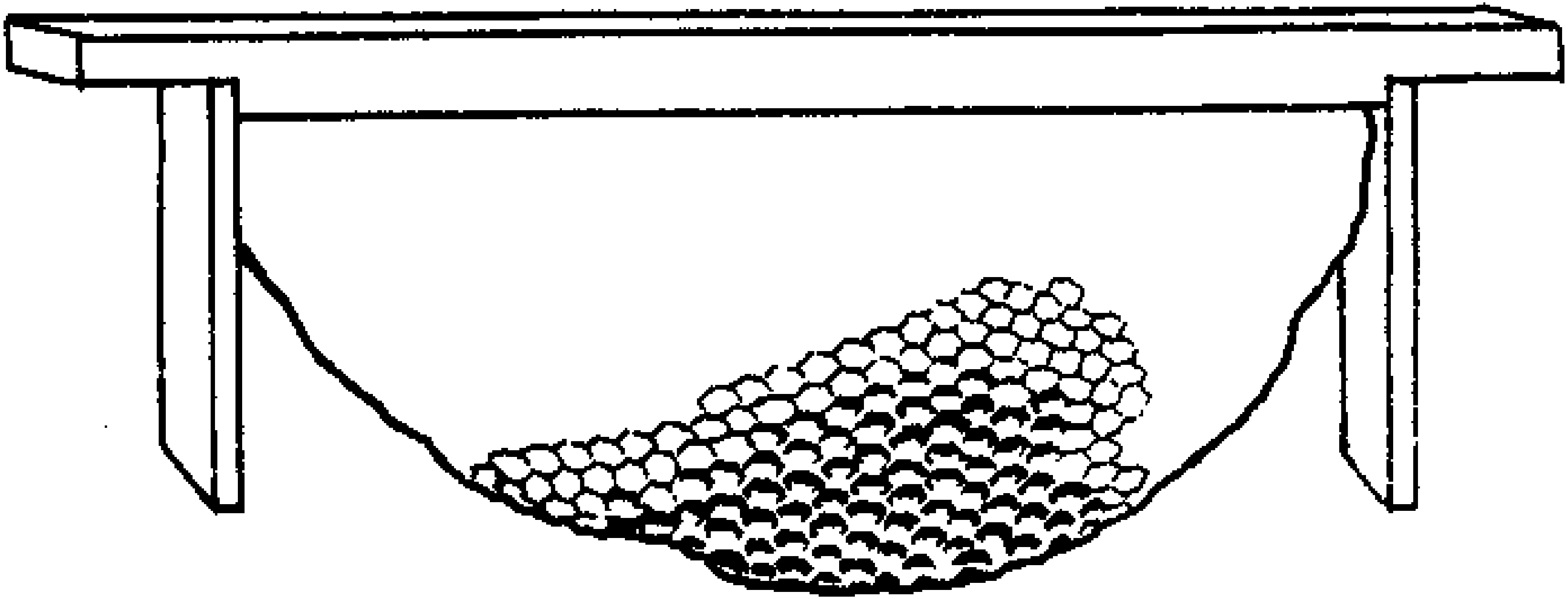
RUCHE DE TRANSITION EST-AFRICAINE

Figure 22



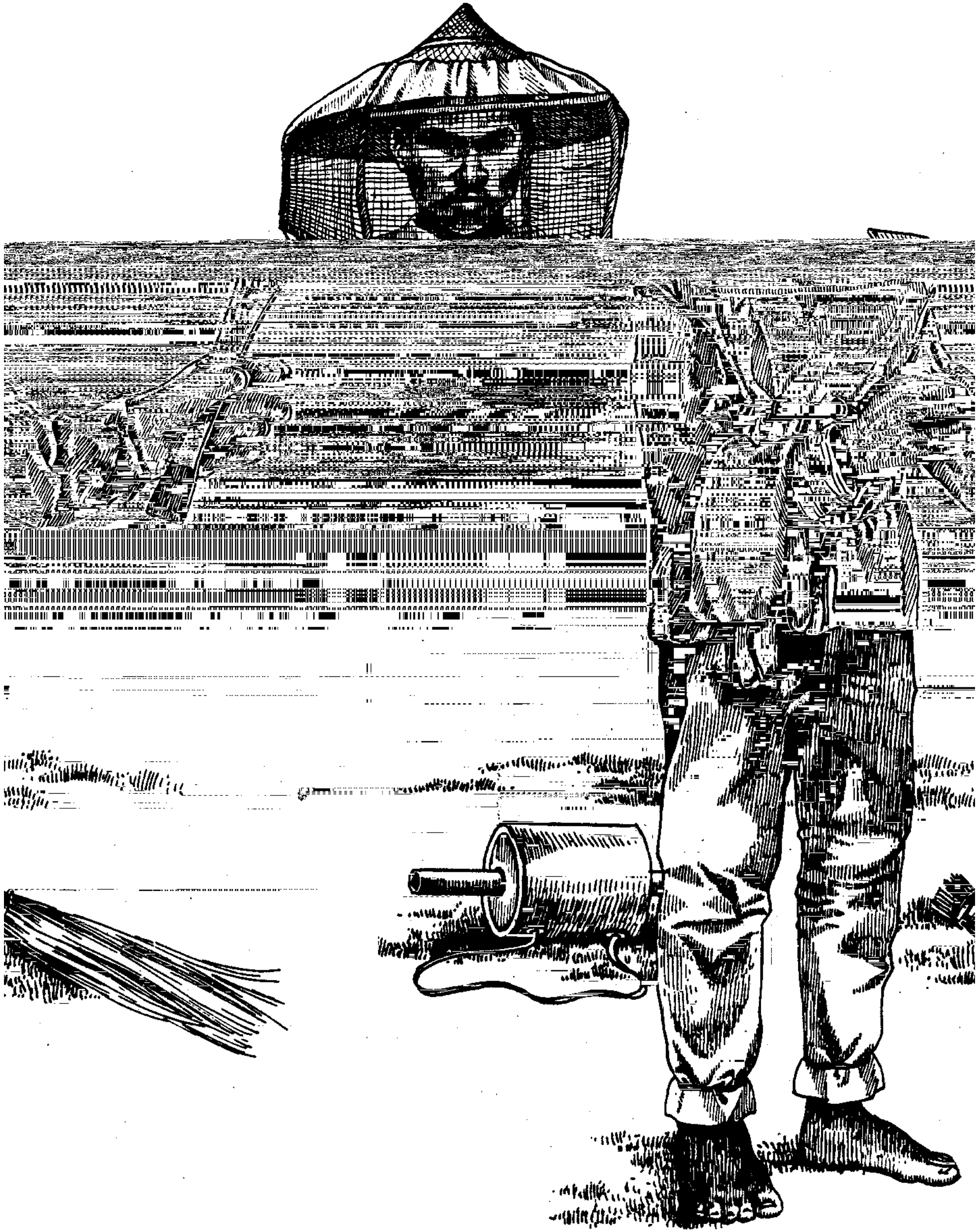
RUCHE TRANSVERSALE TRESSEE

Figure 24



CADRE DE TRANSITION

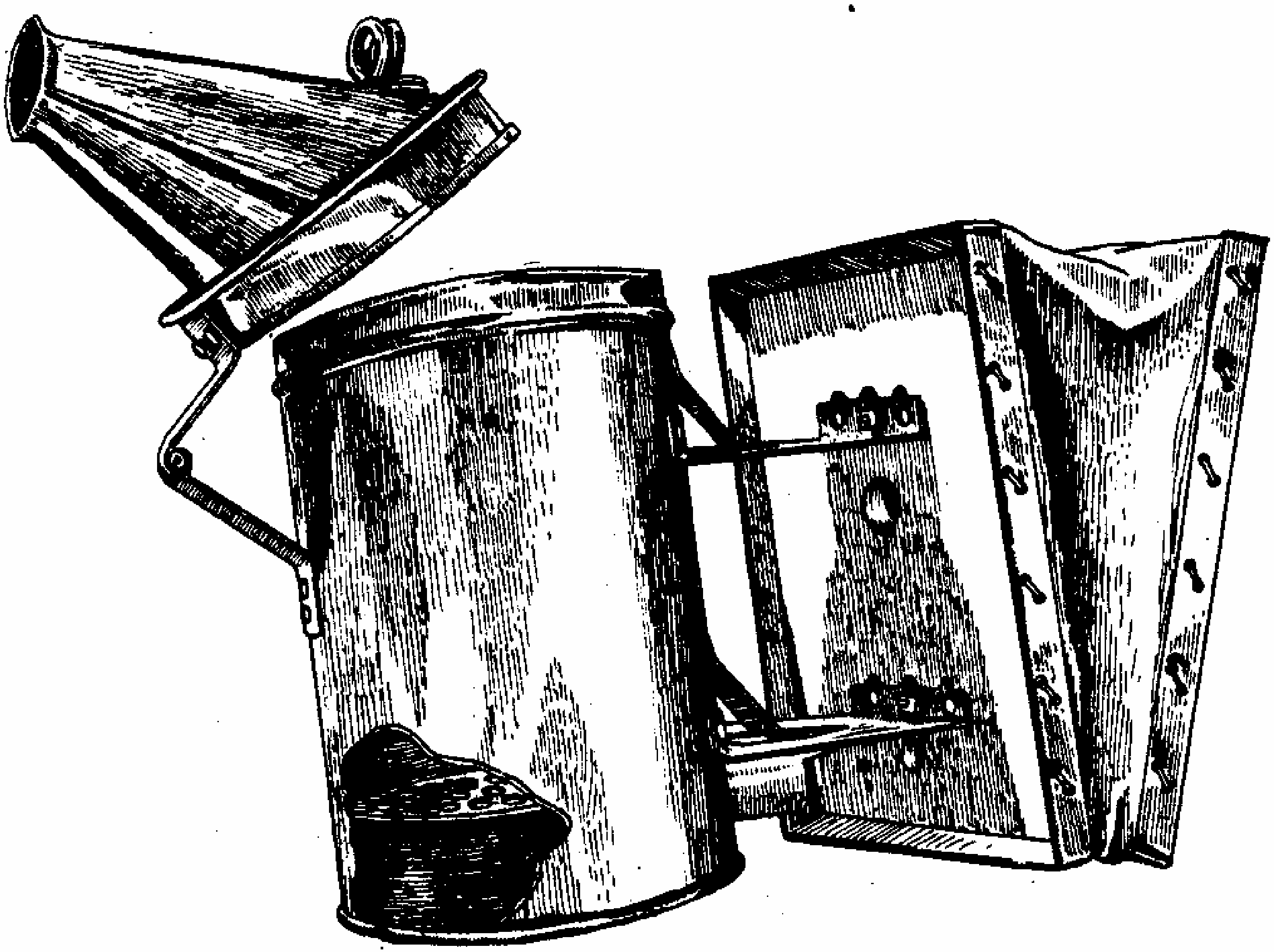
Figure 25

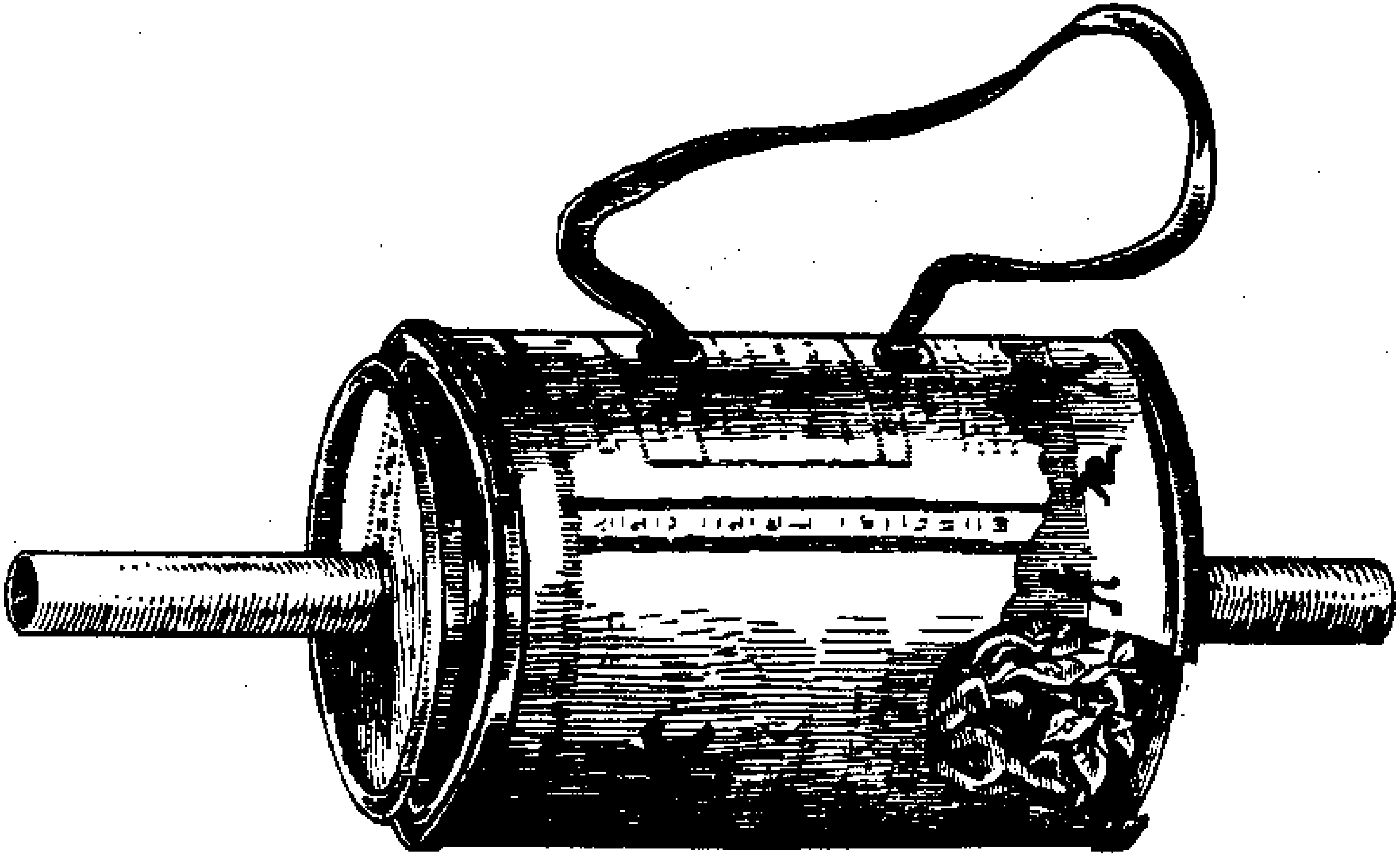


VETEMENT D'APICULTEUR
Figure 26

ENFUMOIR A SOUFFLET

Figure 27

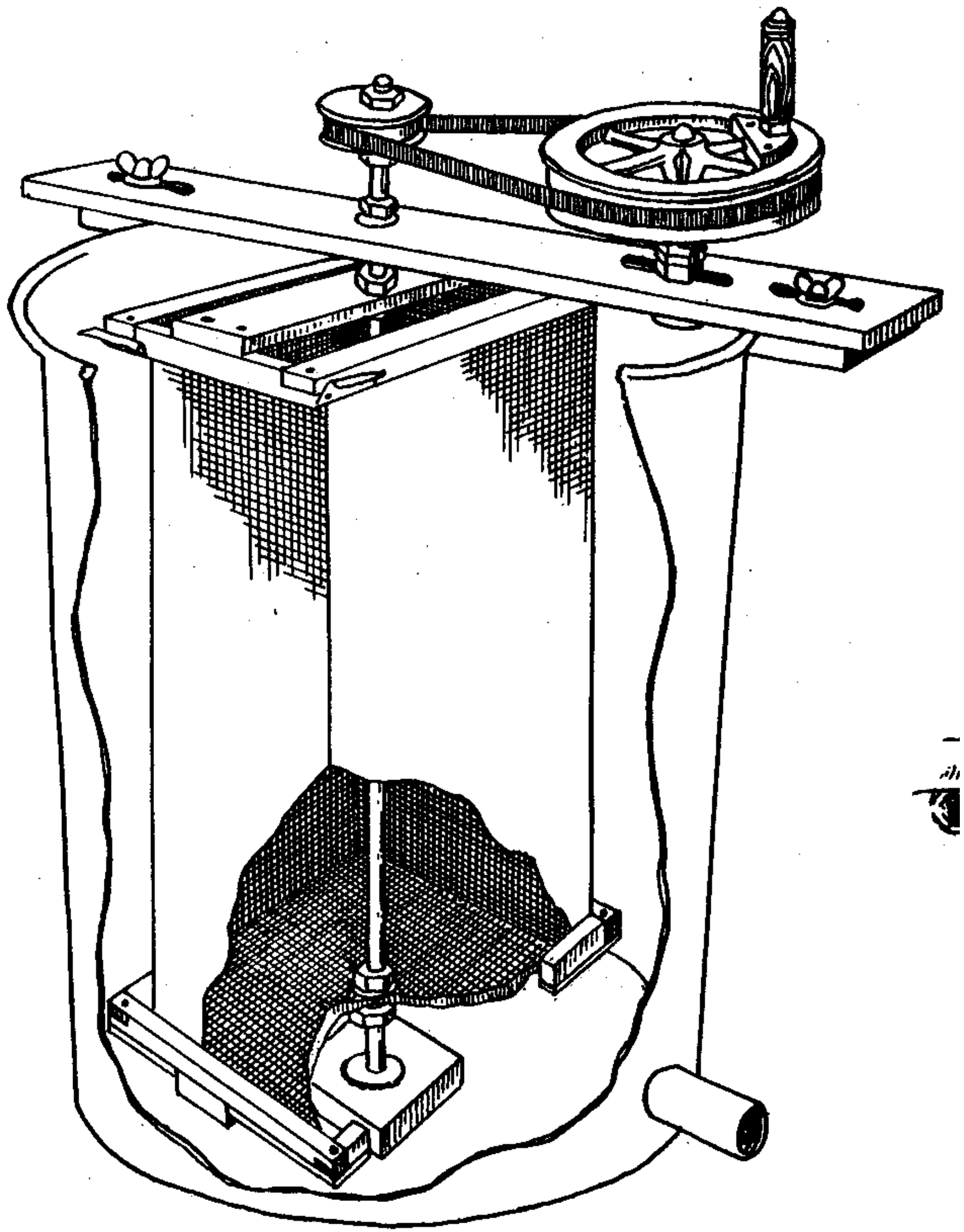




BOITE SERVANT D'ENFUMOIR

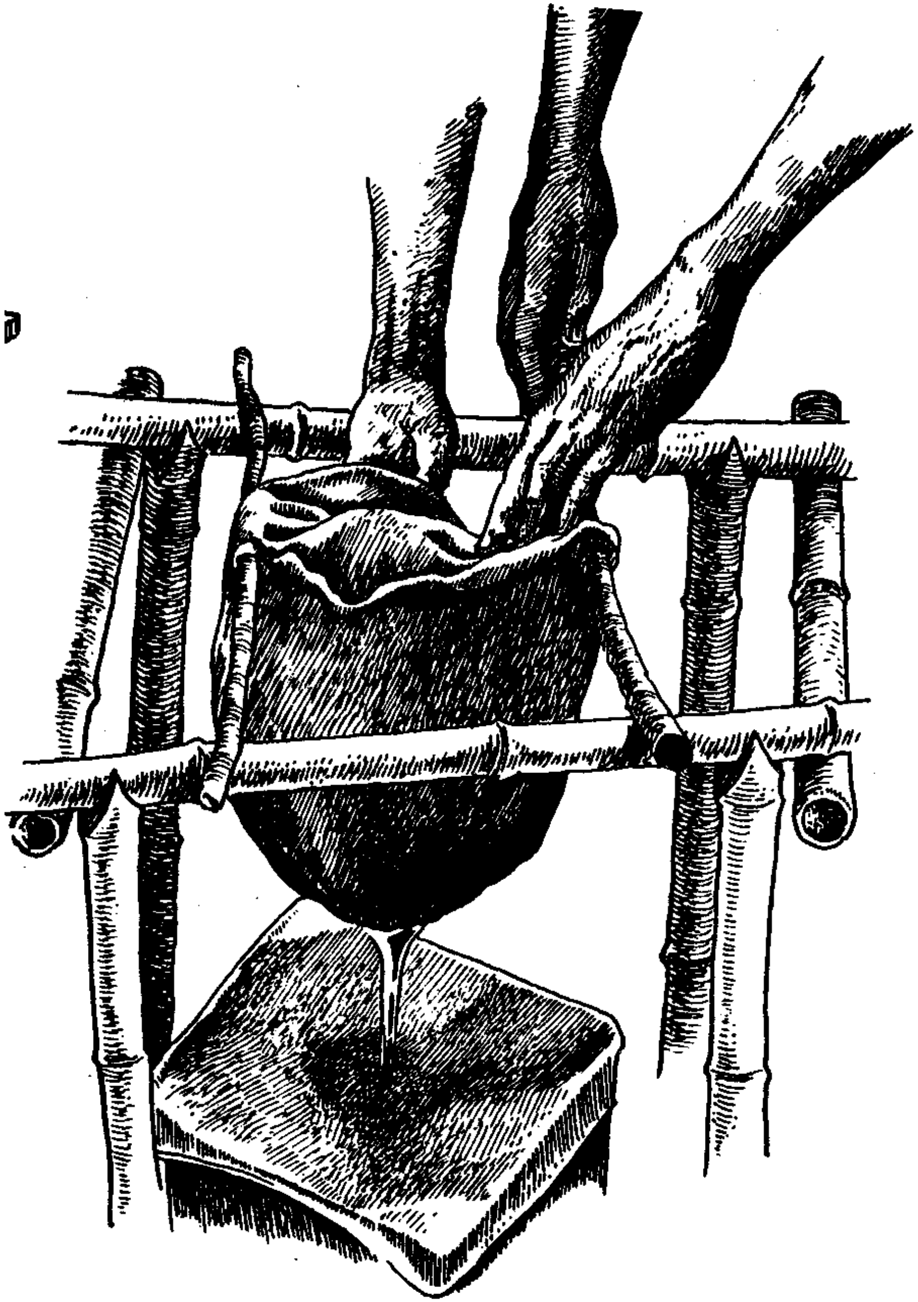
Figure 28

COLLECTE D'UN ESSAIM
Figure 29



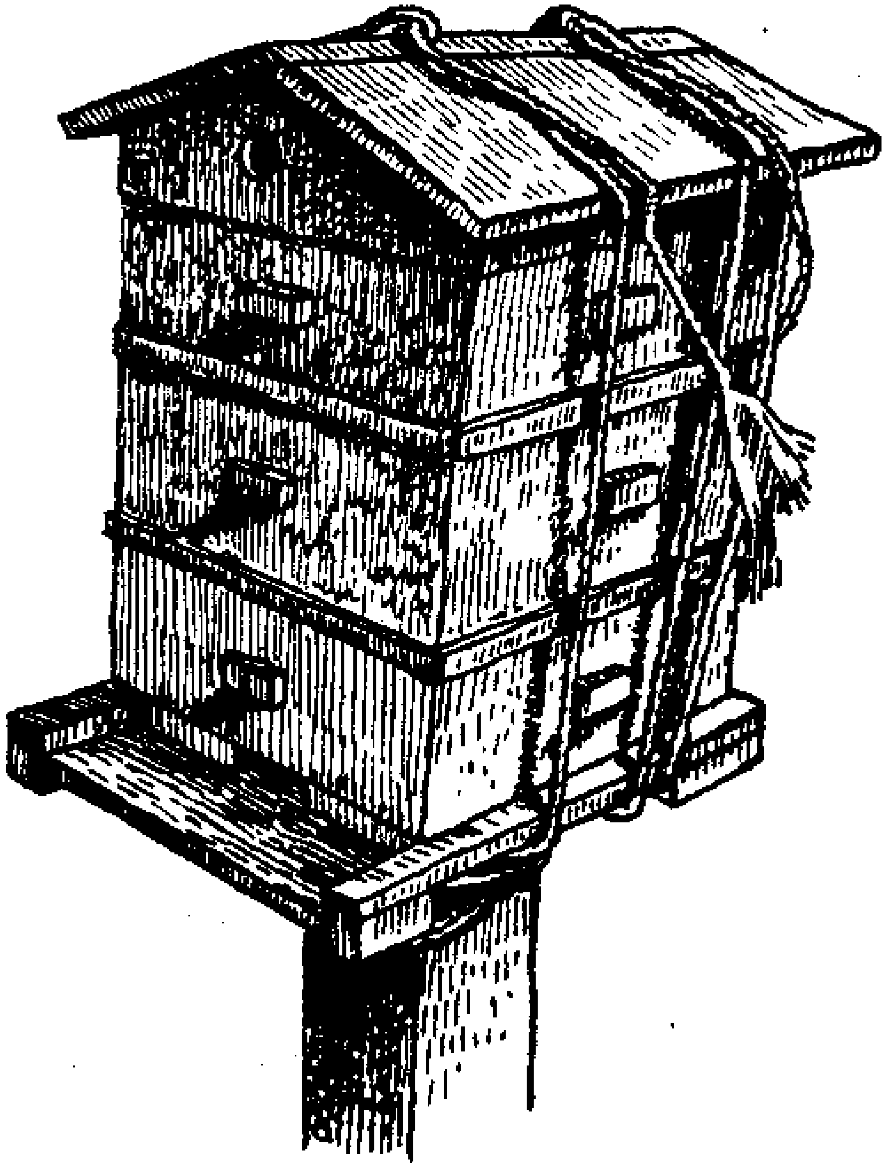
EXTRACTEUR DE MIEL

Figure 36



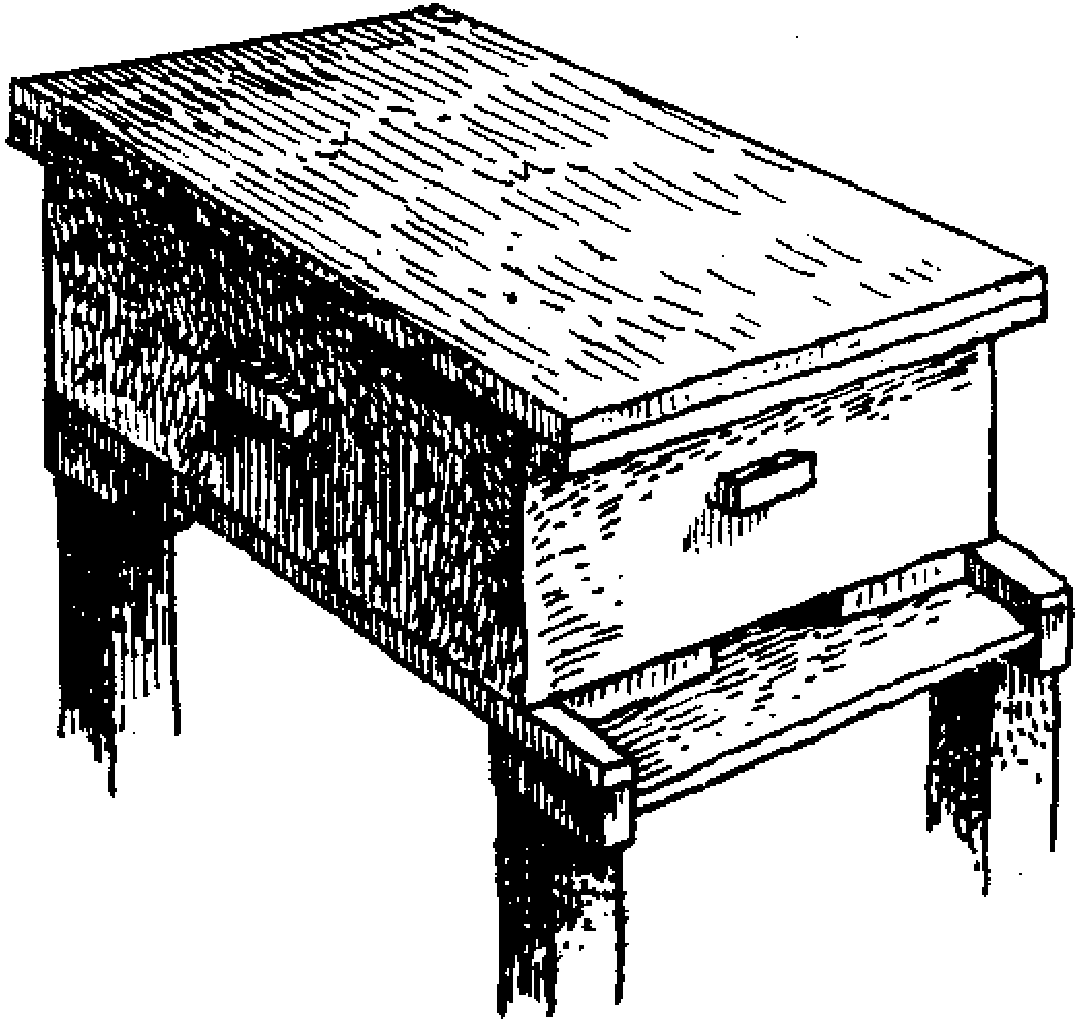
SEPARATION DU MIEL

Figure 37



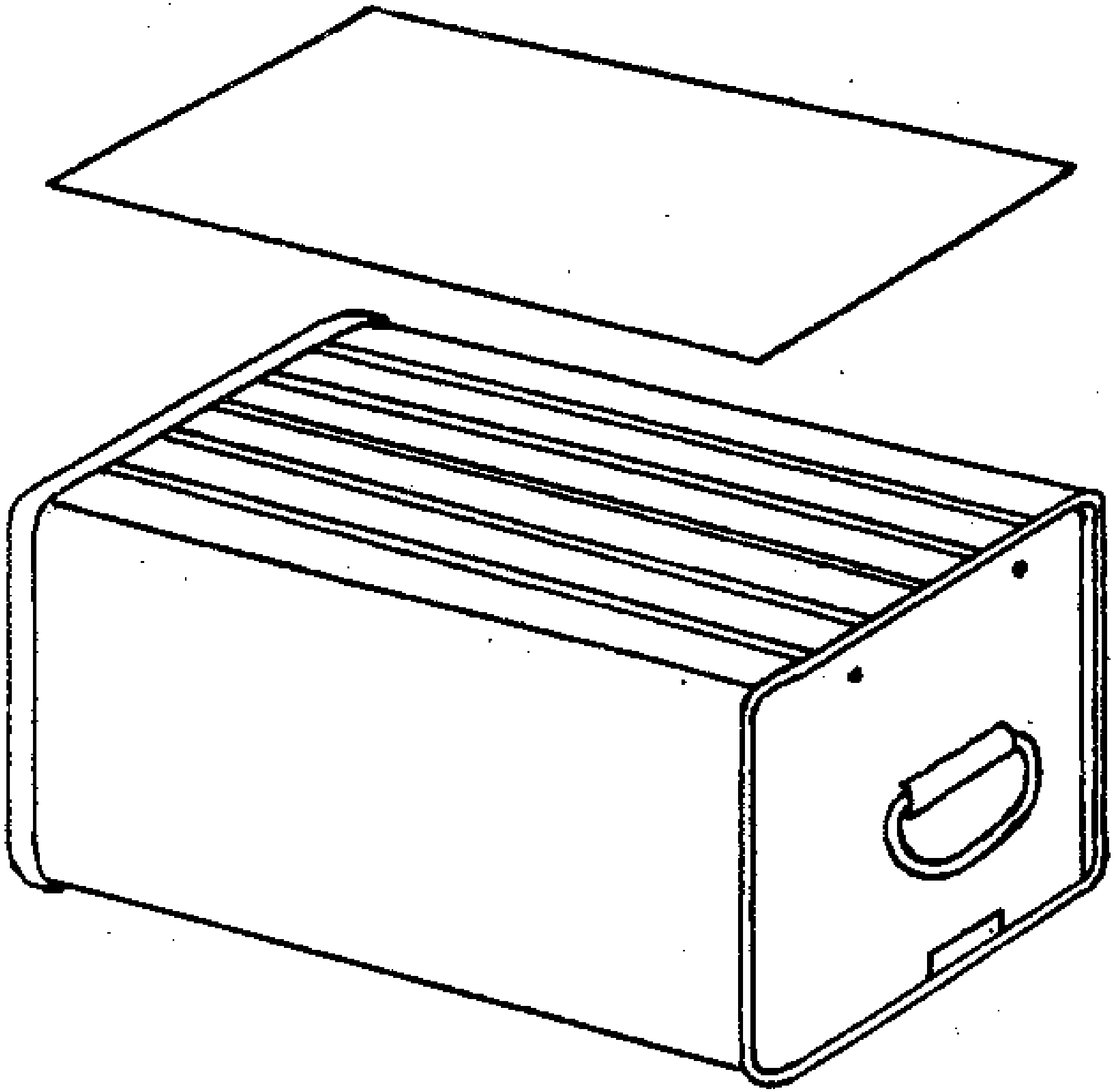
POTEAU SUPPORT

Figure 16



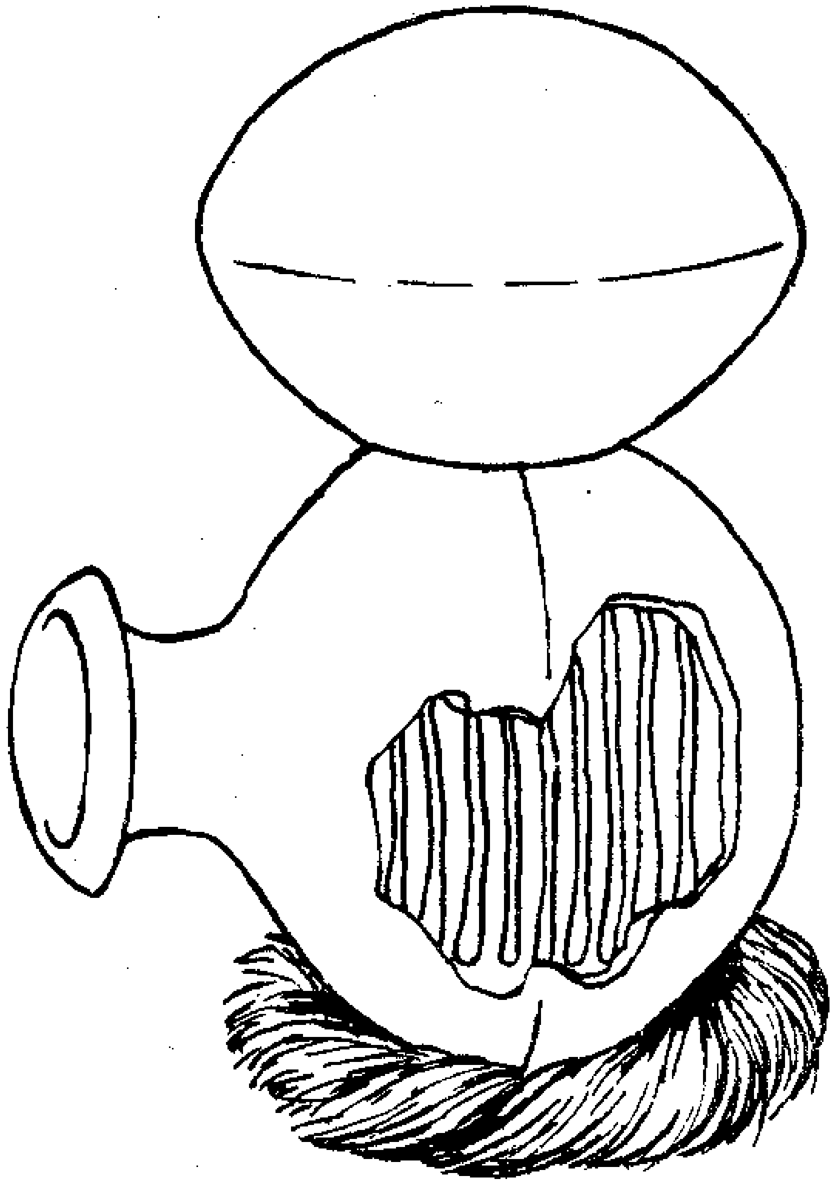
PIED SUPPORT

Figure 17



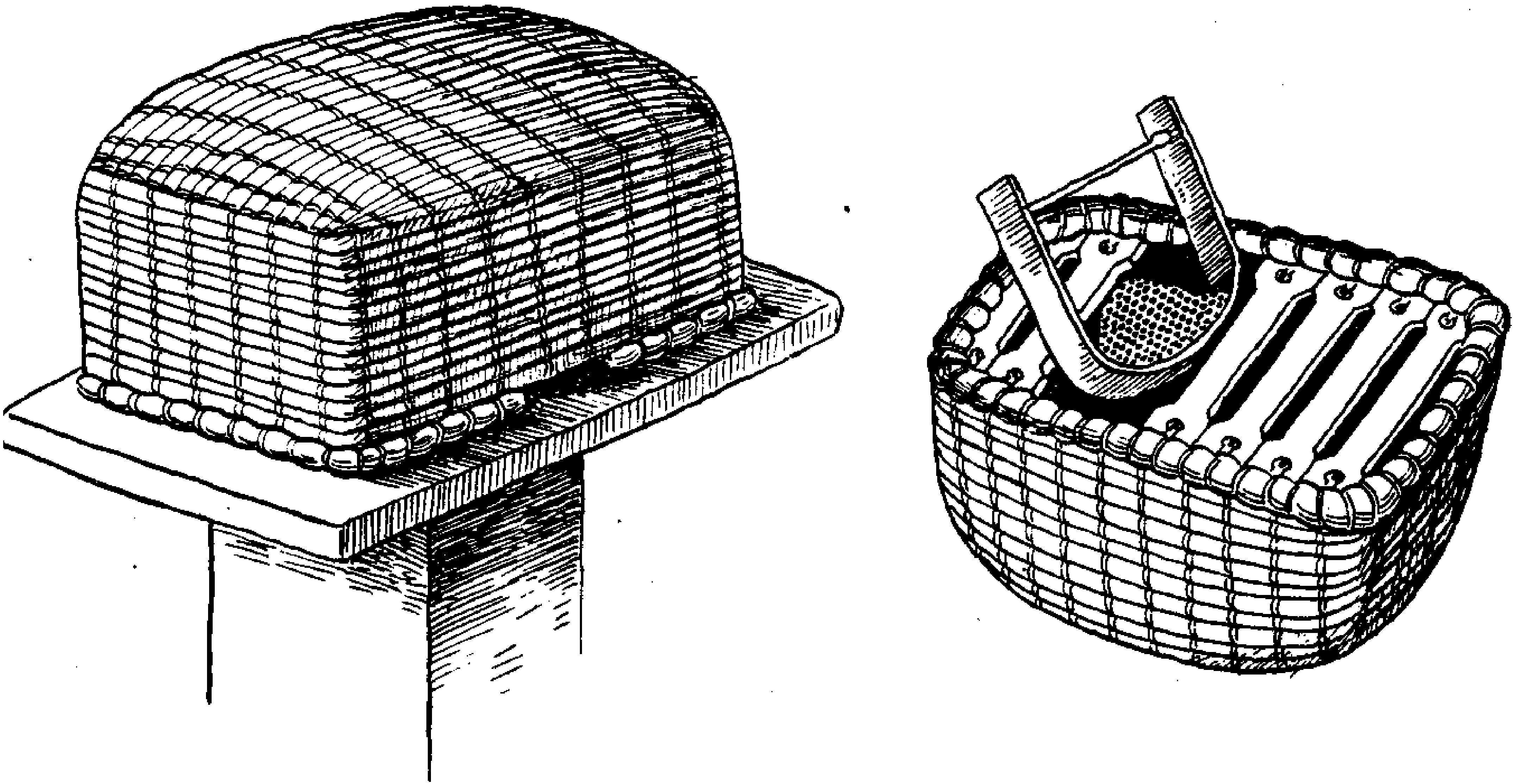
RUCHE EN FER BLANC

Figure 18



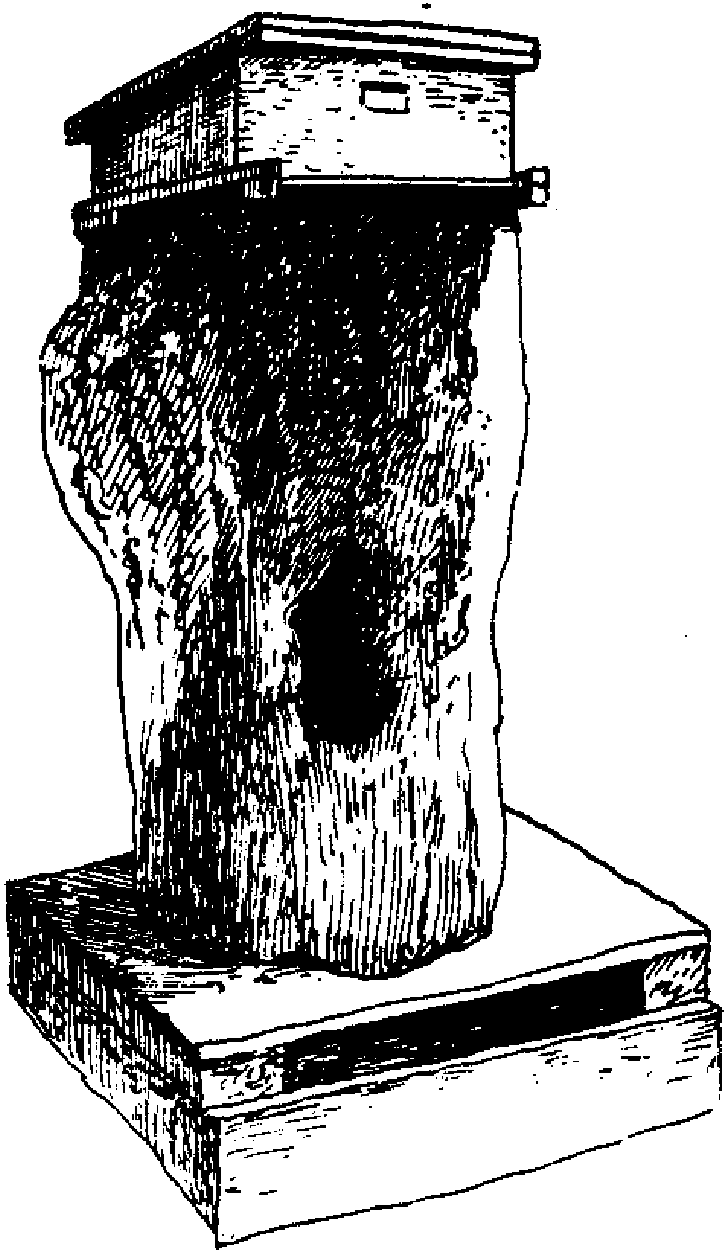
RUCHE EN POT

Figure 19



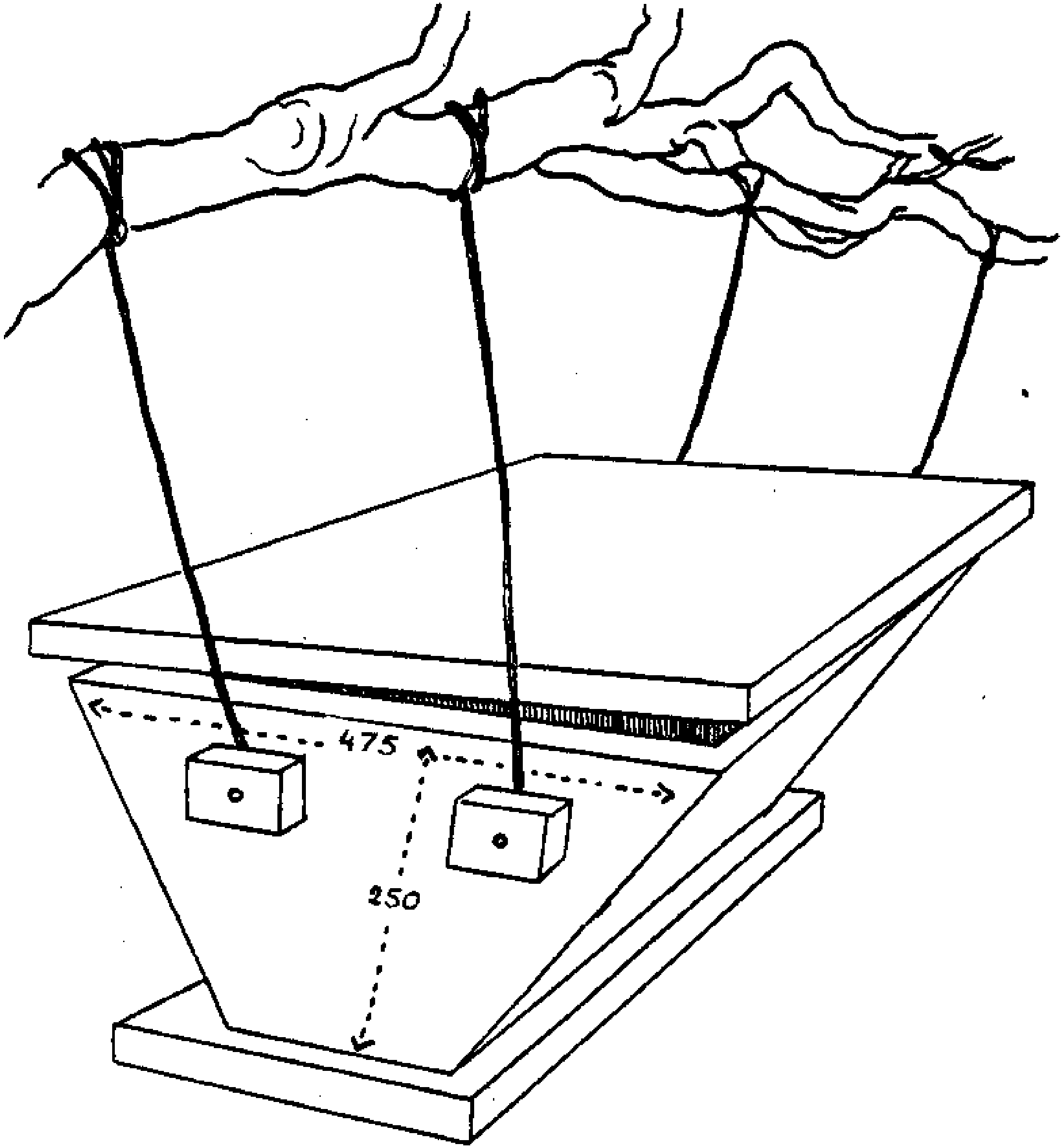
RUCHE EN PAILLE D'OSIER

Figure 20



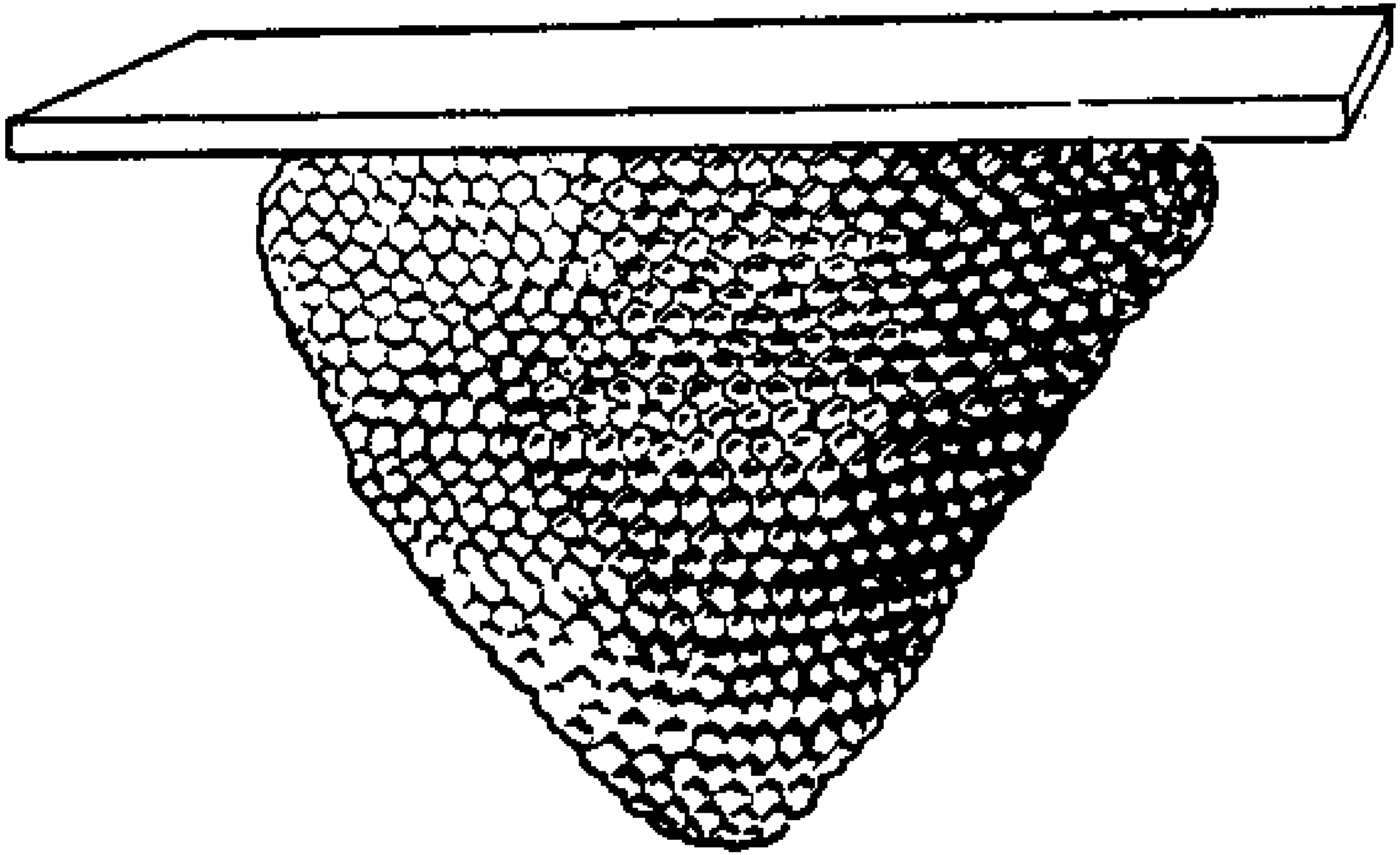
RUCHE DE TRONC

Figure 21



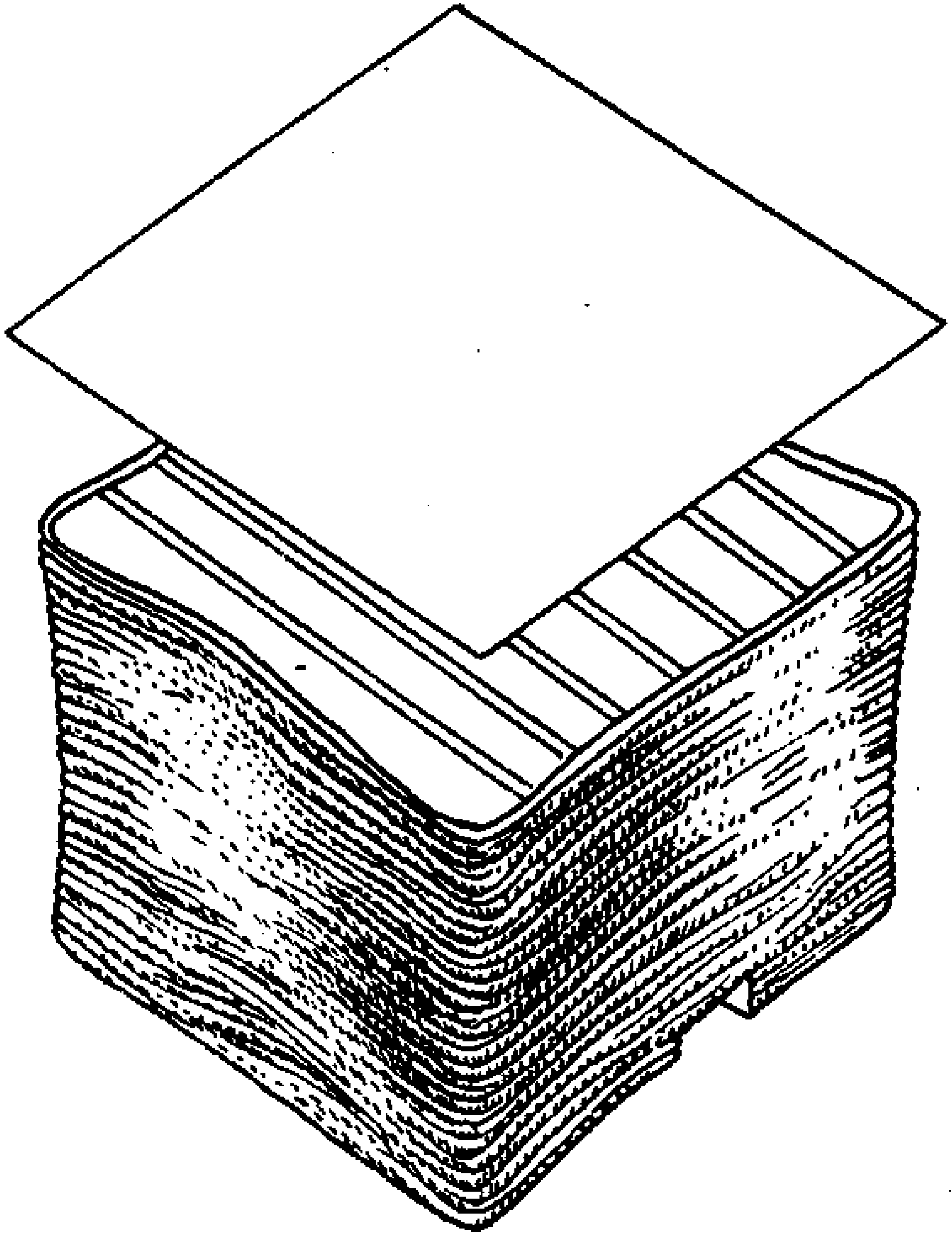
RUCHE DE TRANSITION EST-AFRICAINE

Figure 22



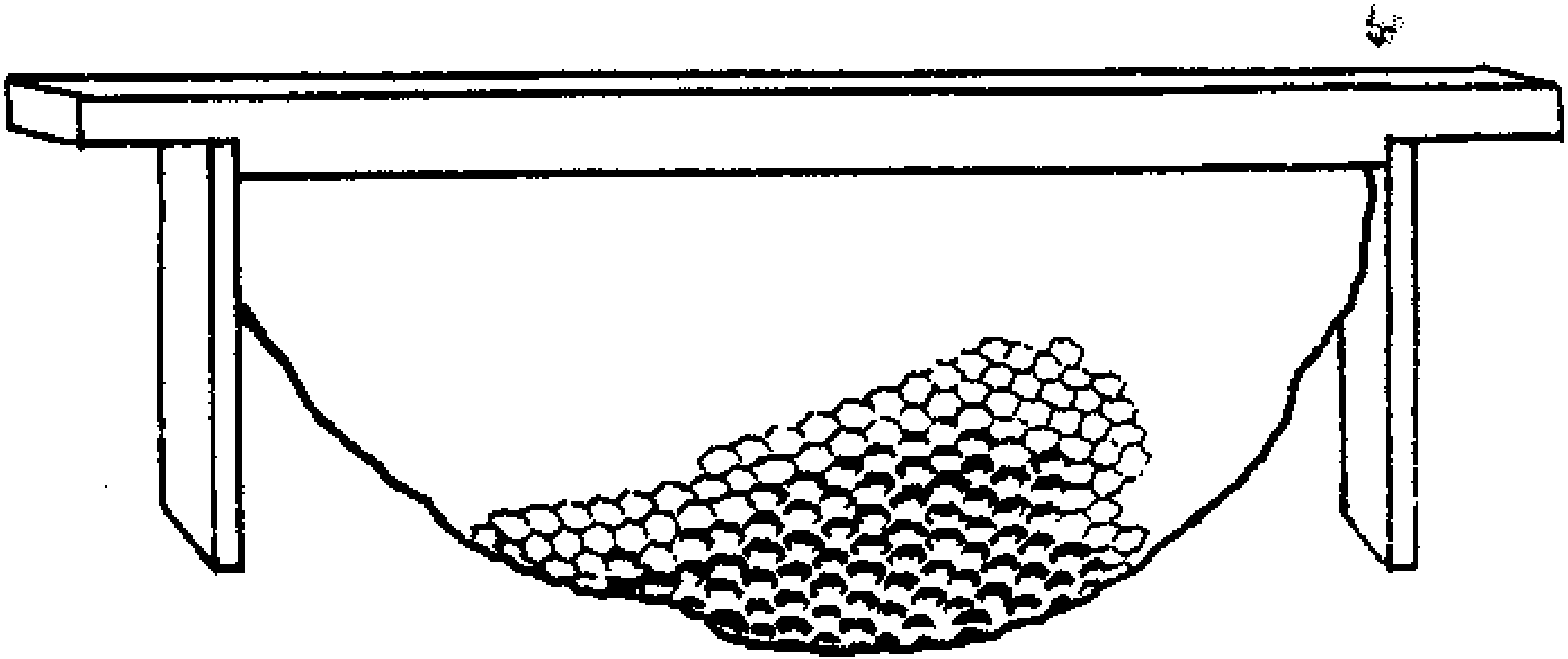
CADRE SIMPLE

Figure 23



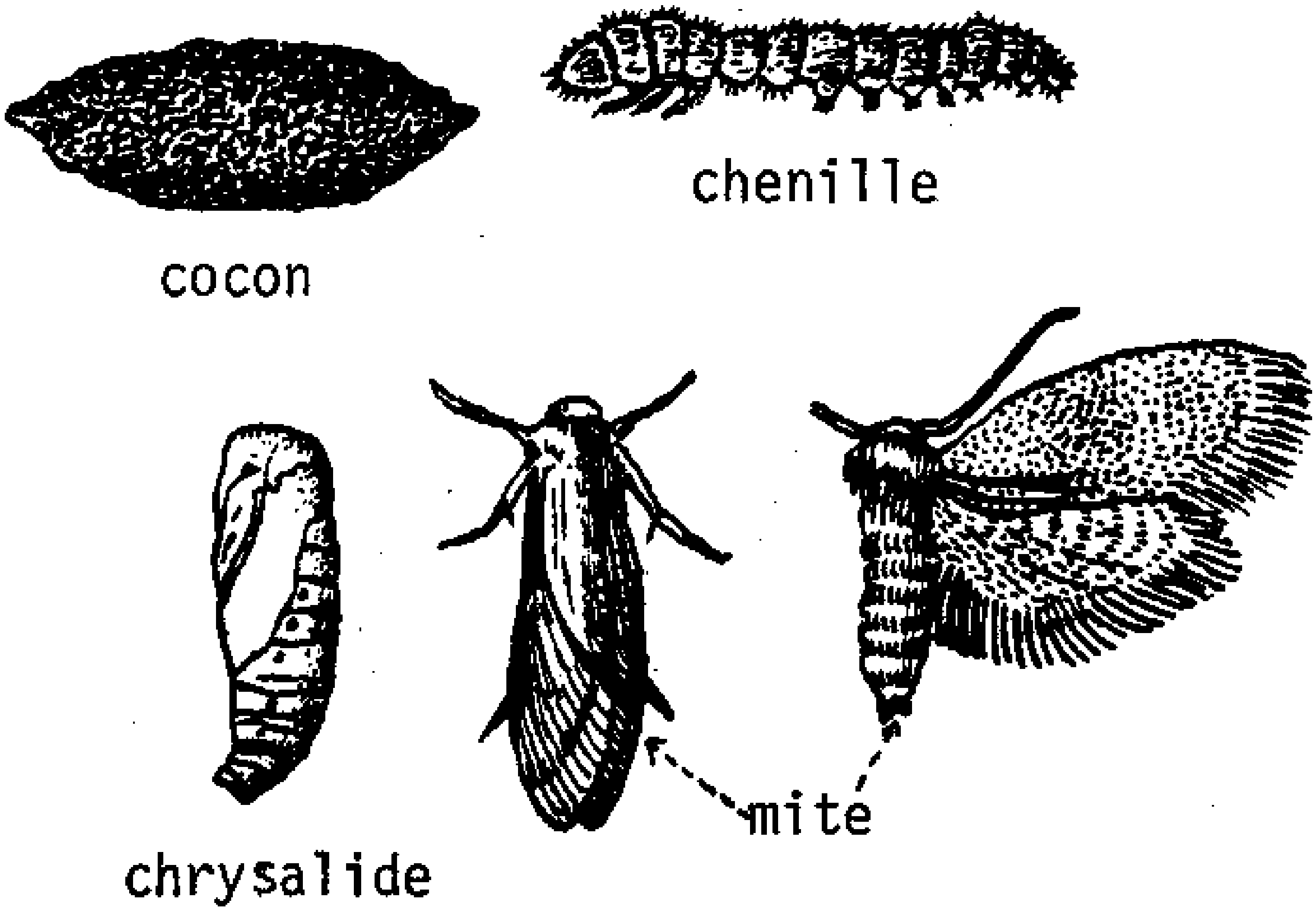
RUCHE TRANSVERSALE TRESSEE

Figure 24



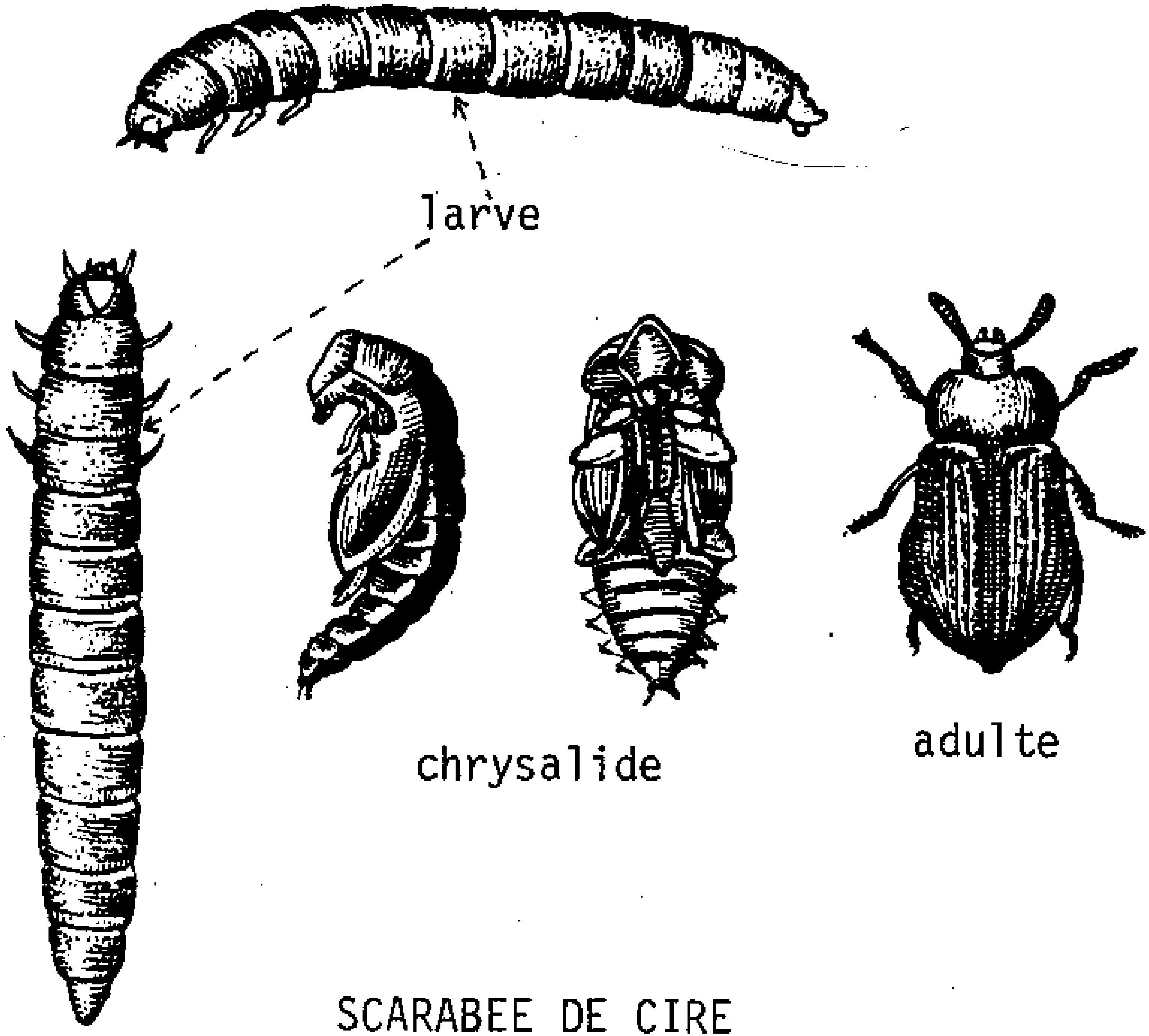
CADRE DE TRANSITION

Figure 25



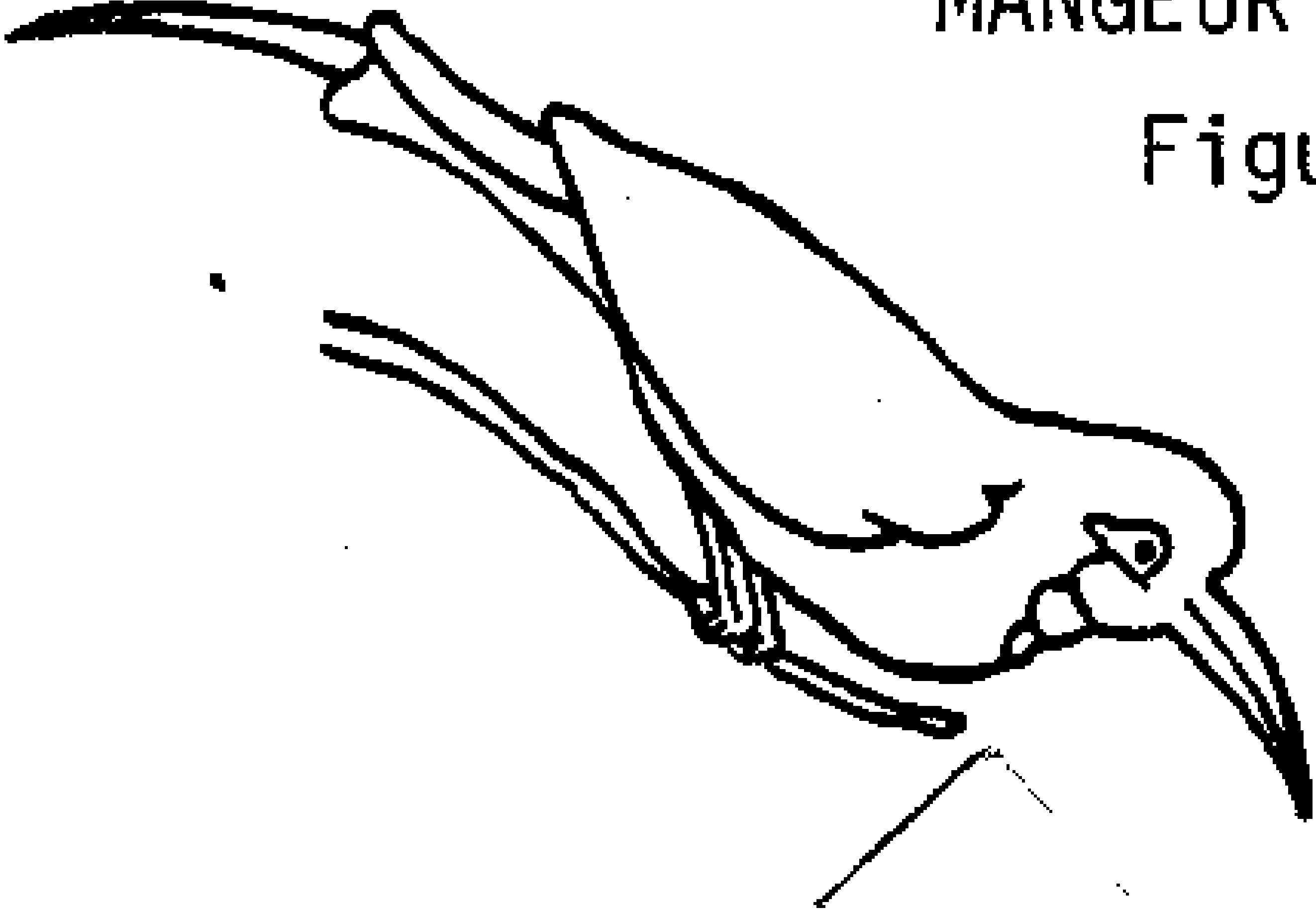
PLUS PETITE MITE DE CIRE

Figure 30



SCARABEE DE CIRE

Figure 31

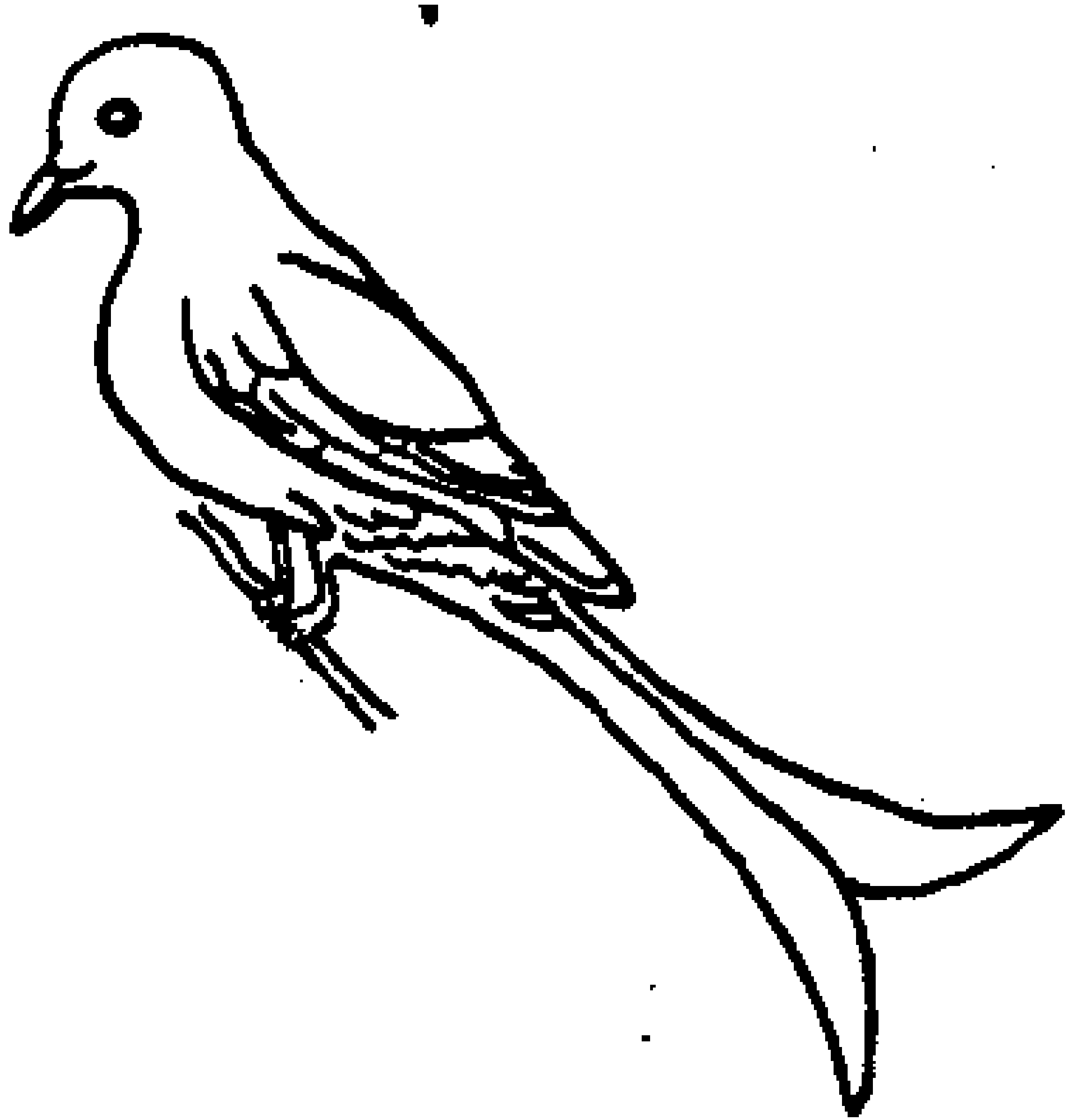


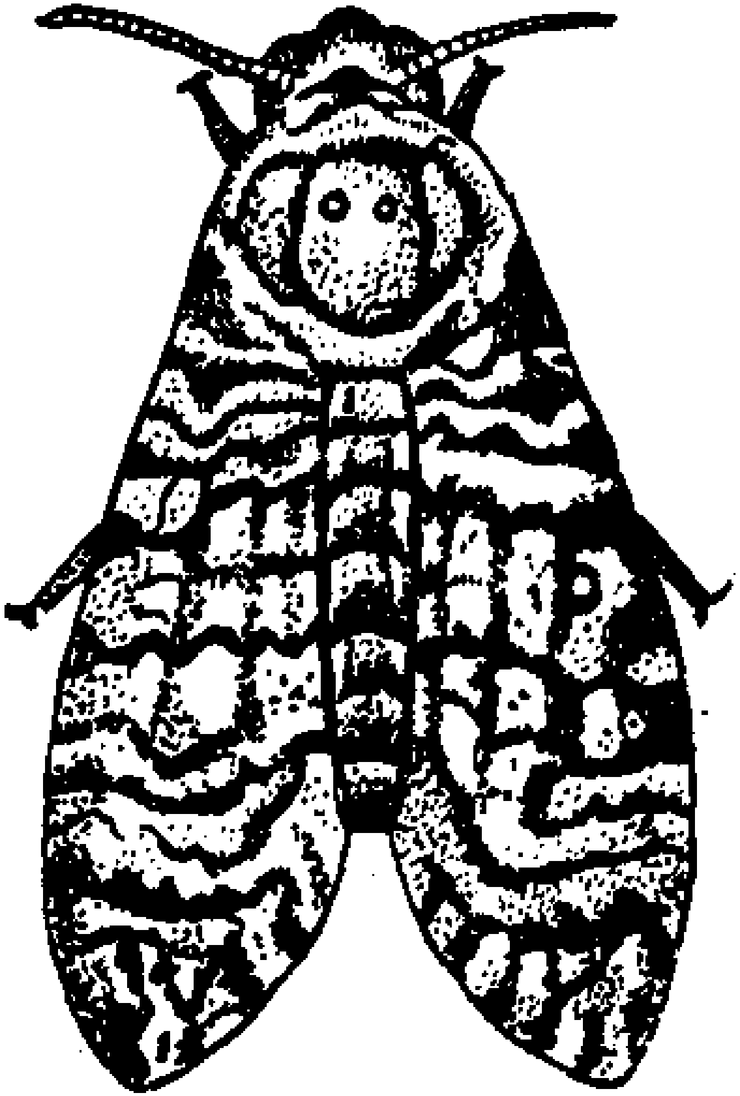
MANGEUR D'ABEILLE

Figure 32

CORNEILLE ROYALE

Figure 33





MITE "TETE DE MORT"

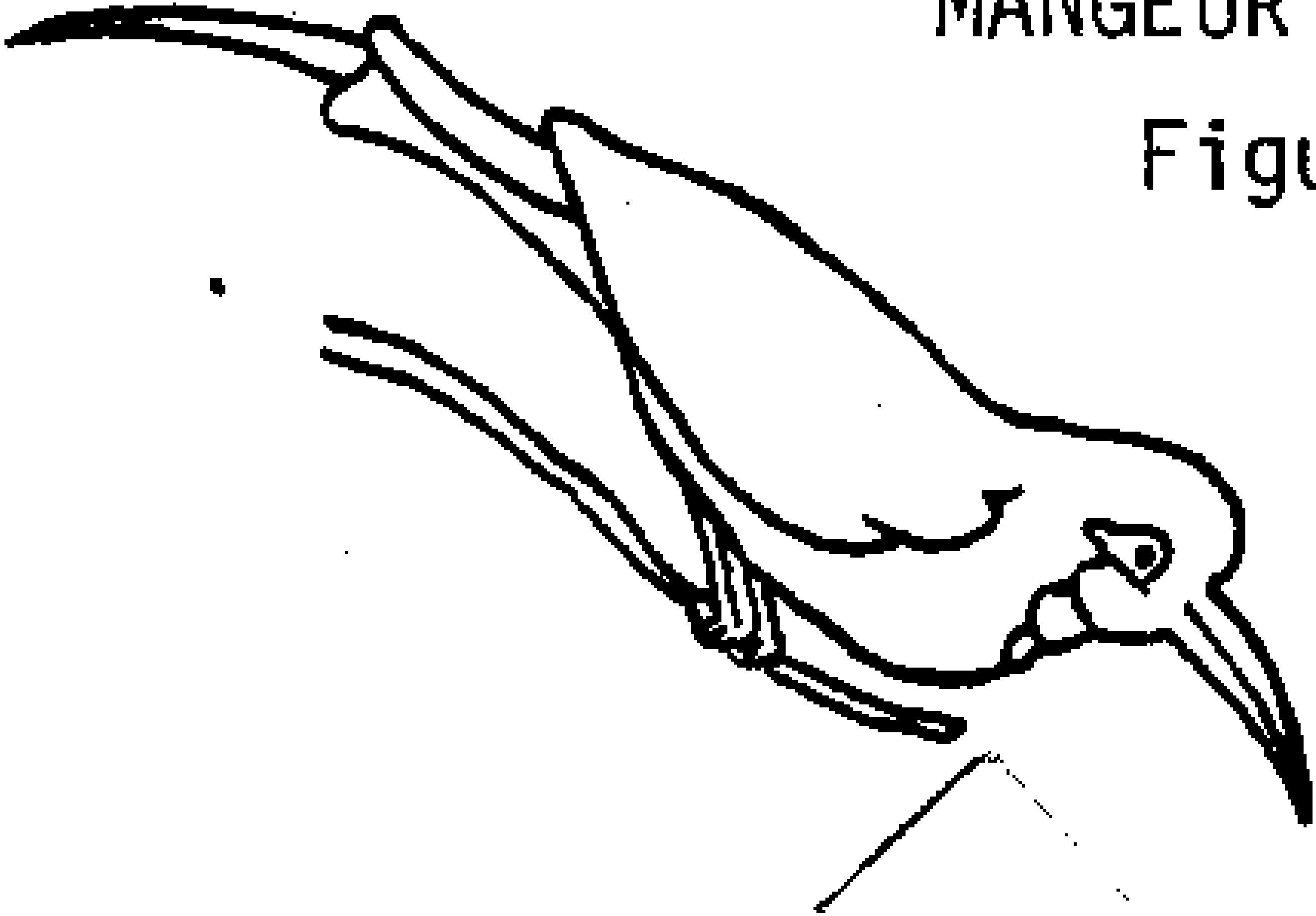
Figure 34

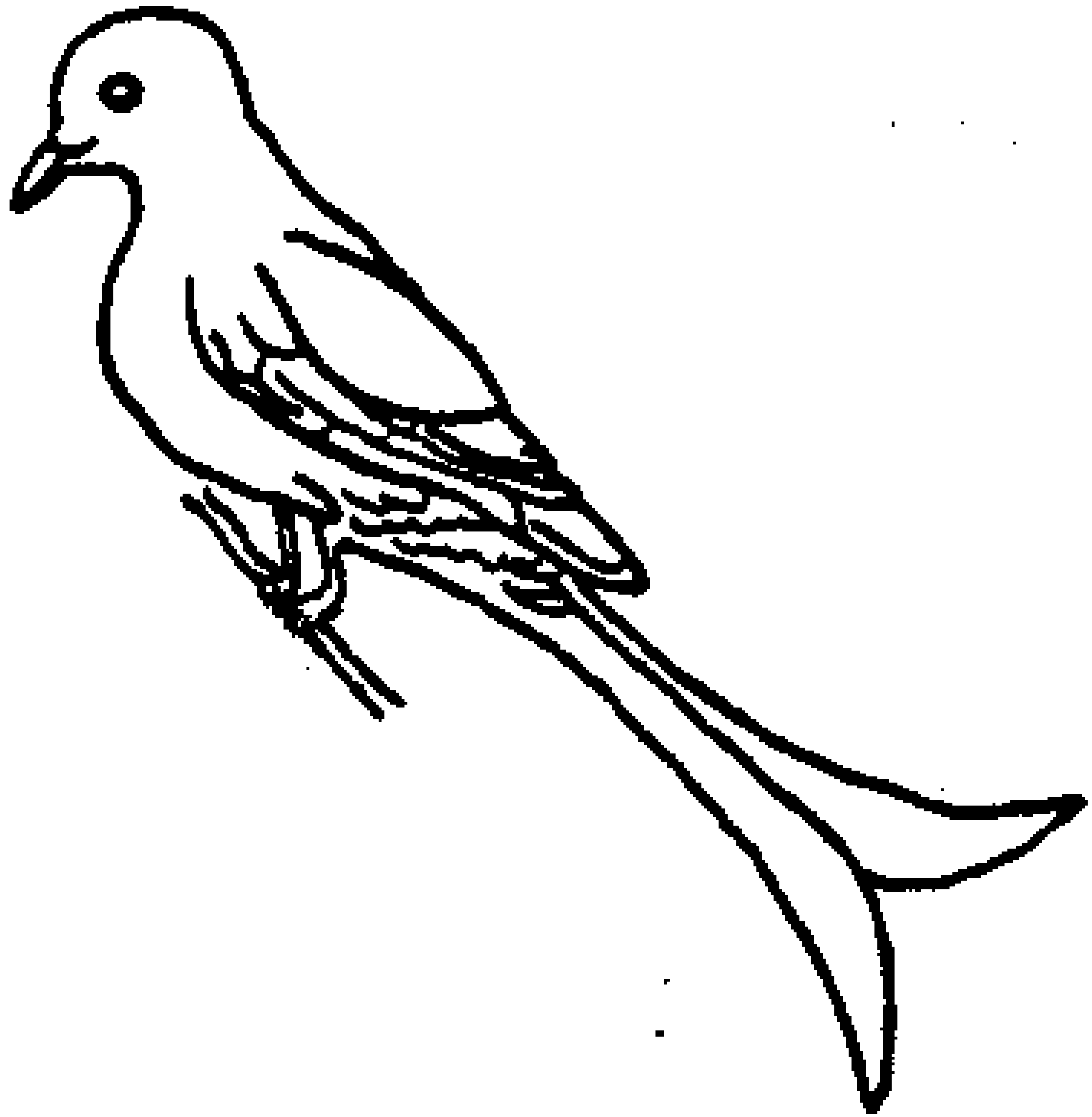
FOURMI

Figure 35

MANGEUR D'ABEILLE

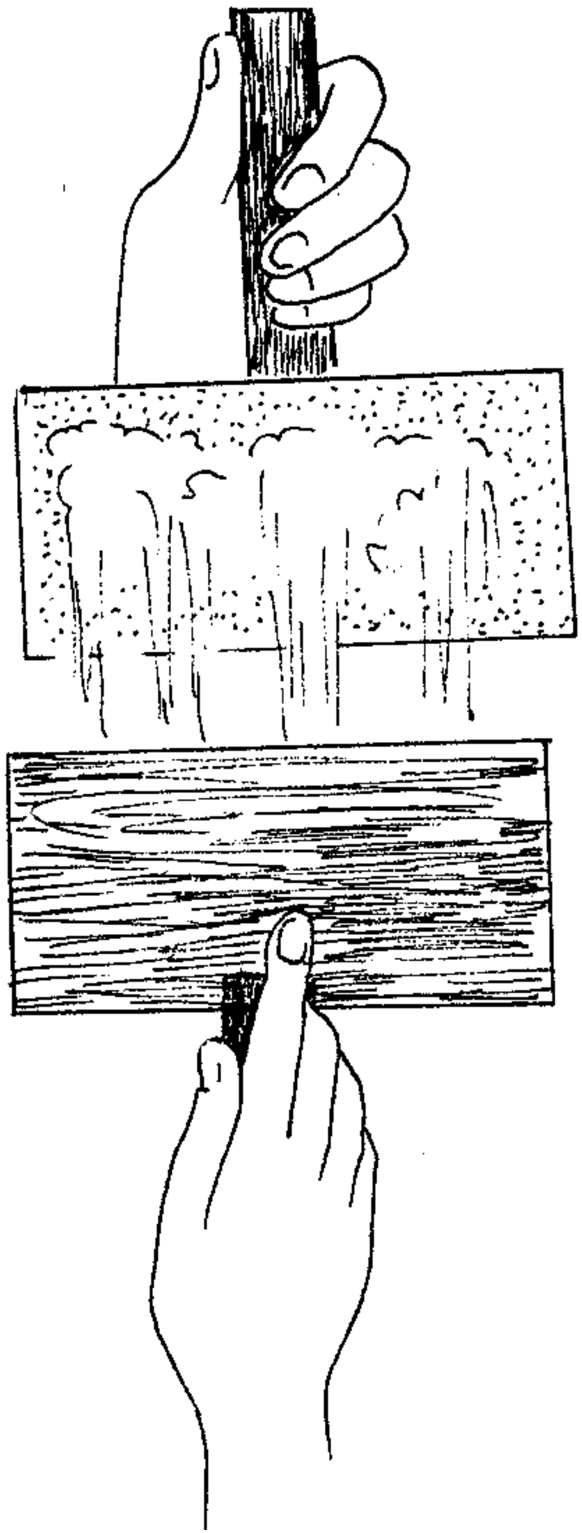
Figure 32

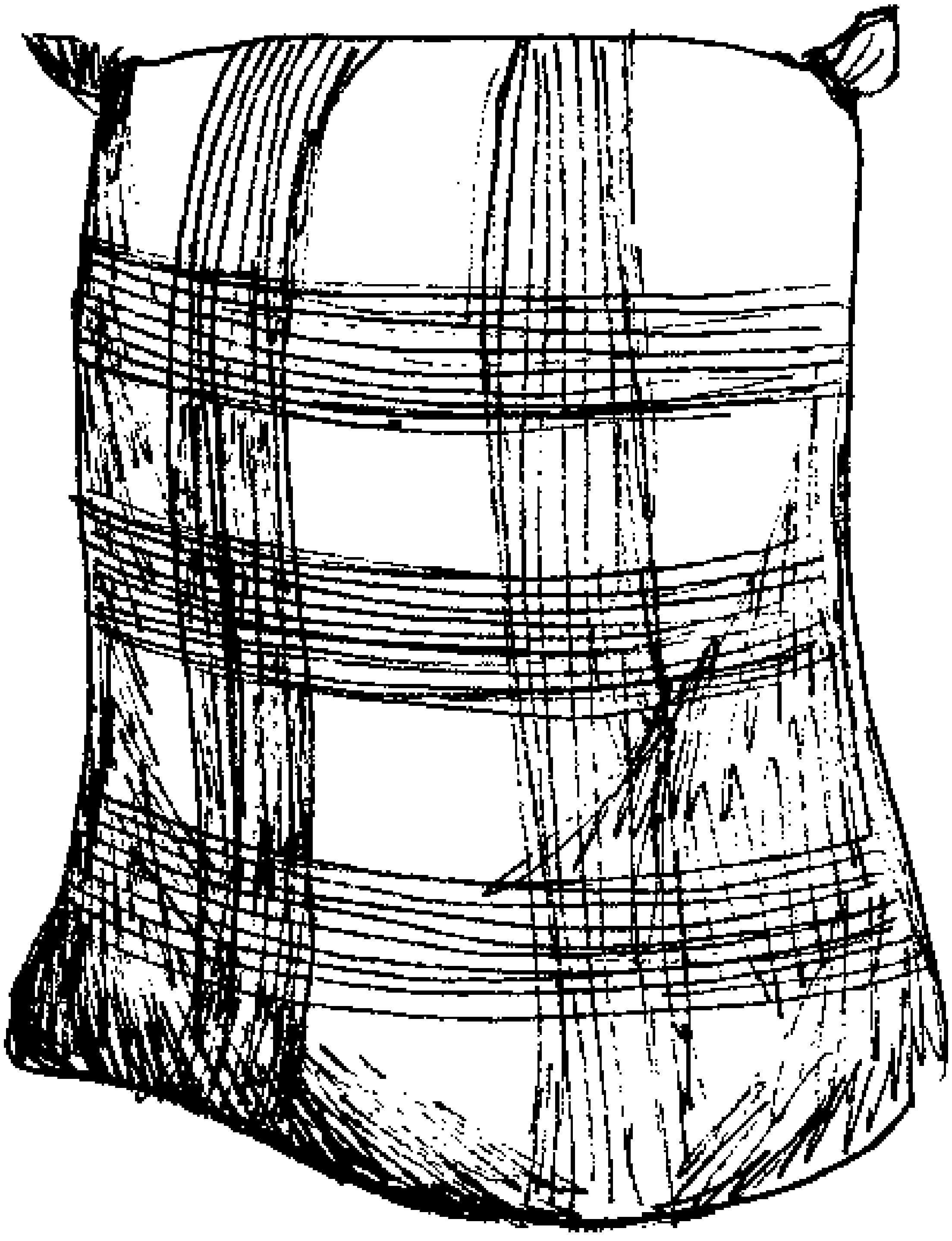


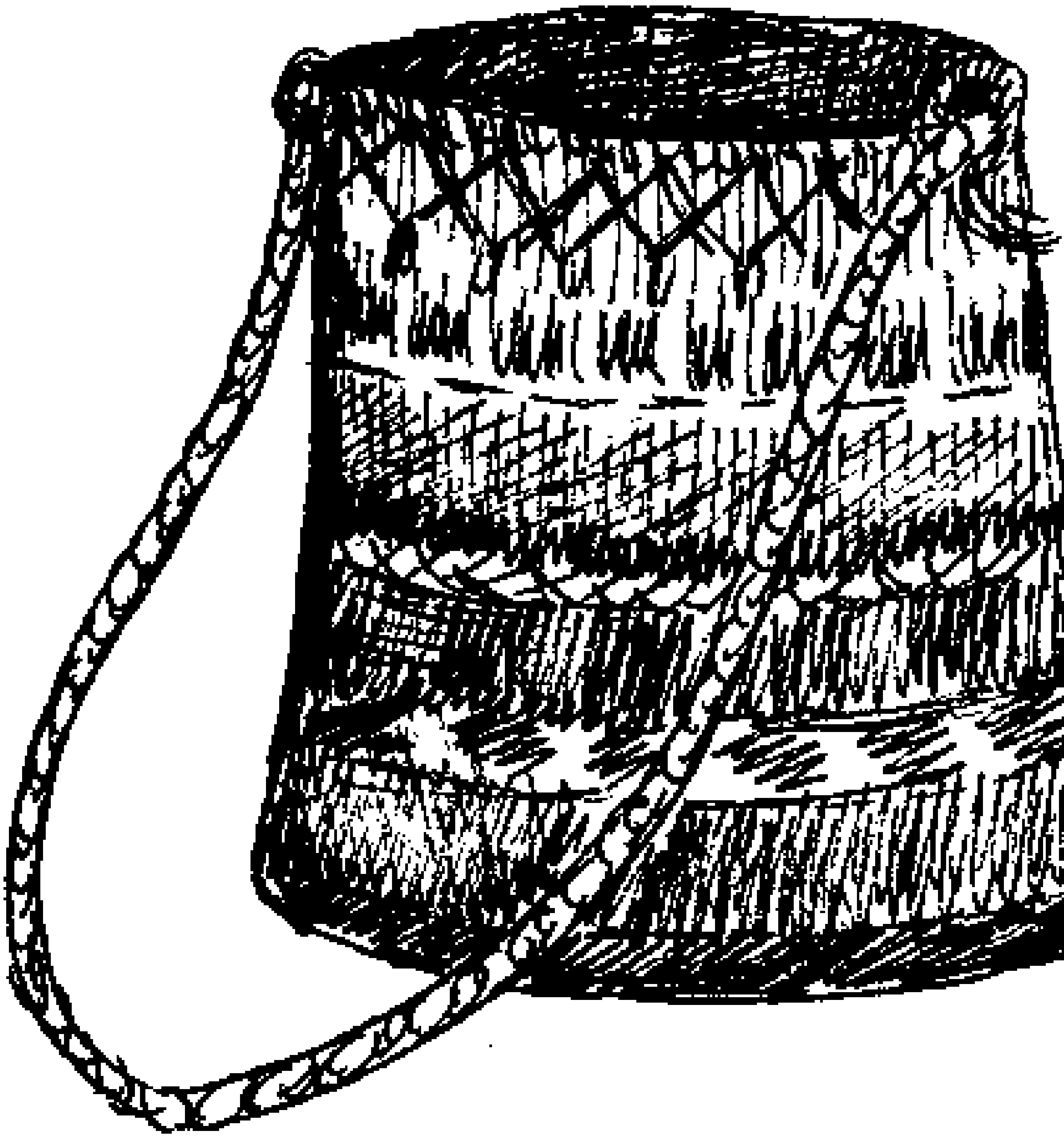


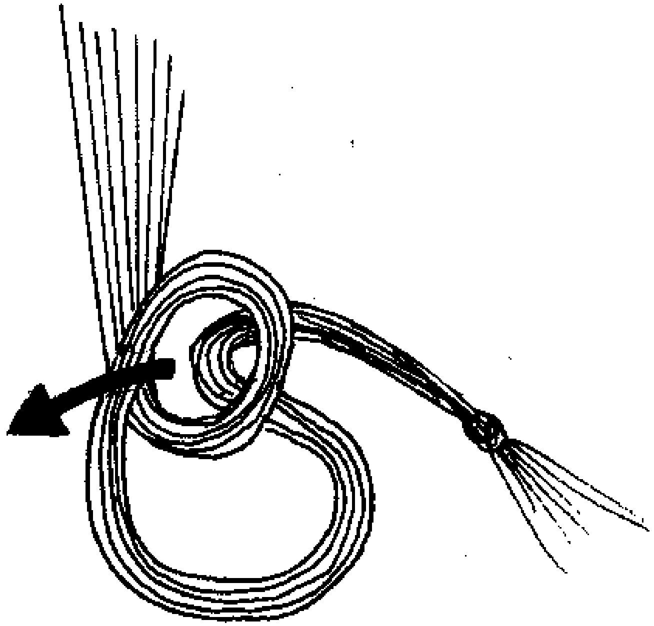
CORNEILLE ROYALE

Figure 33

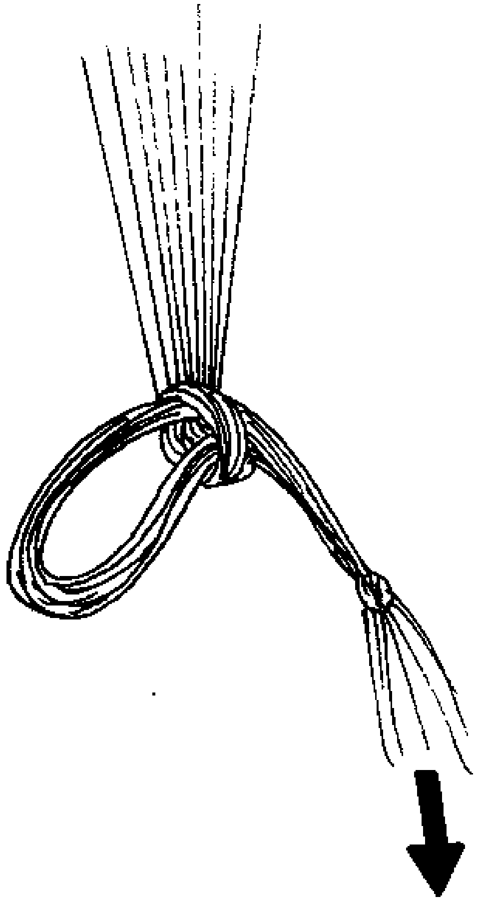




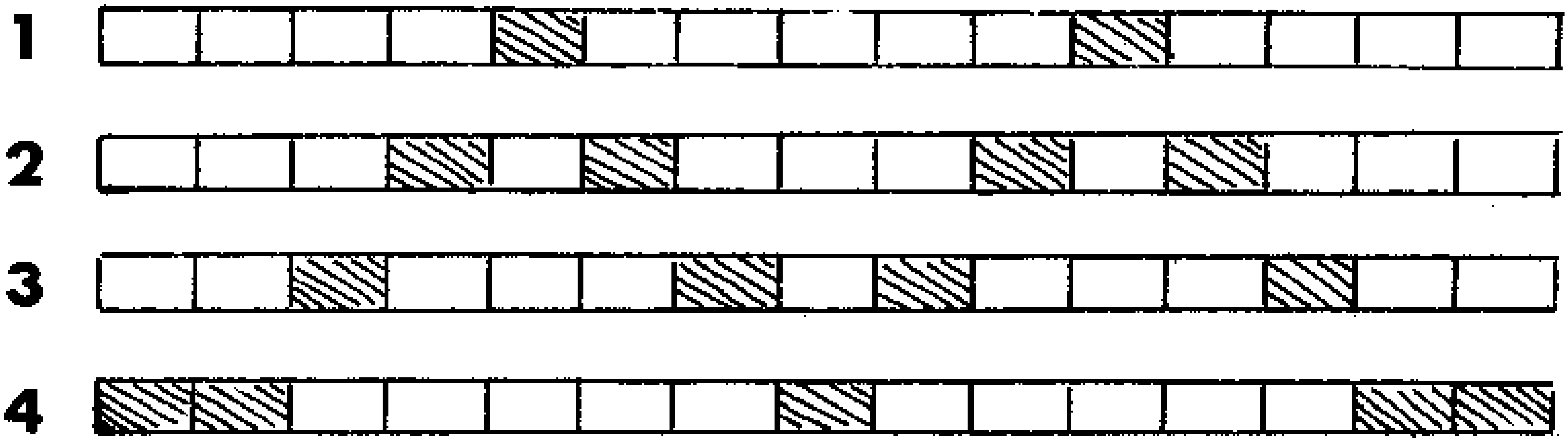


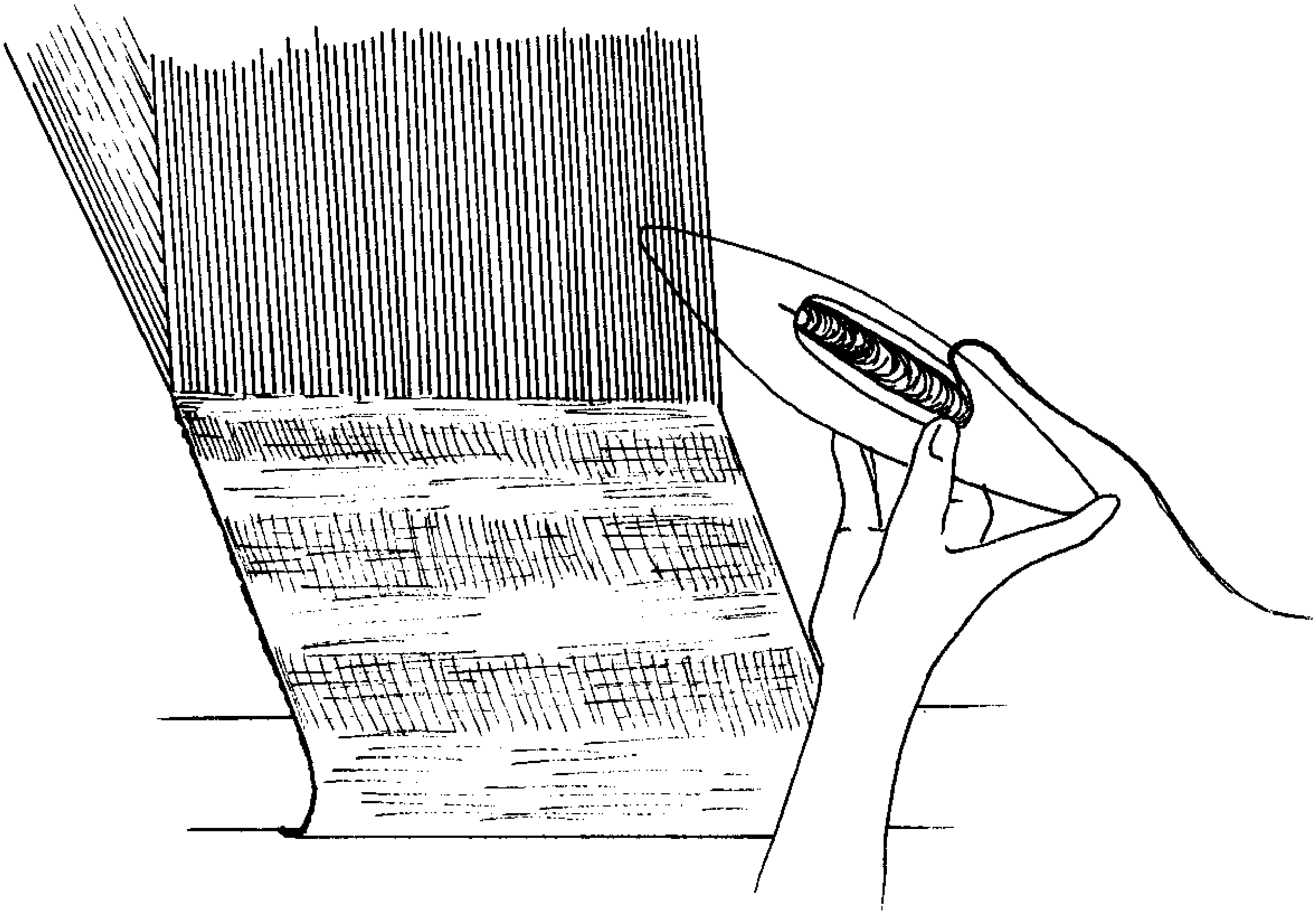


Knot used to tie warp to cord on beam.



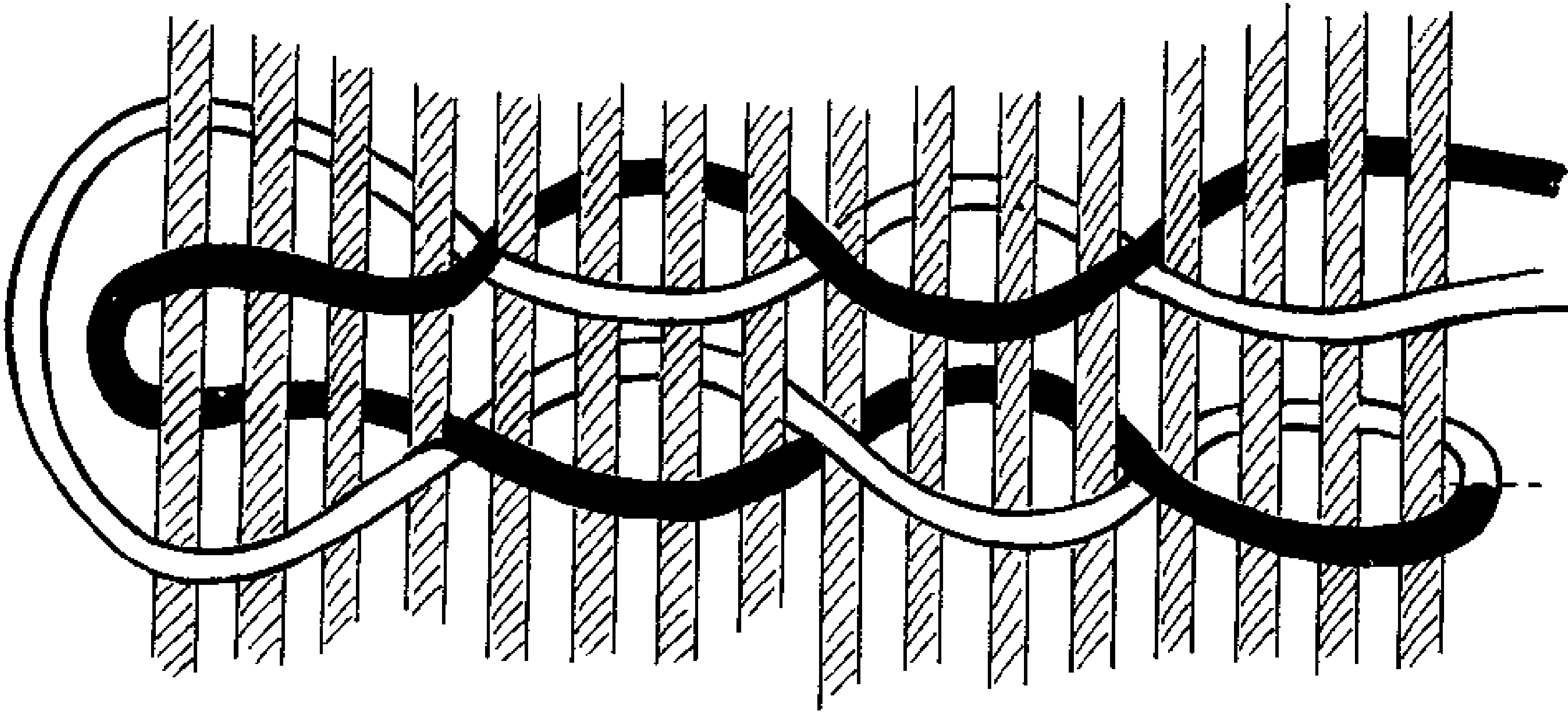
To release knot pull free end down.


1
2
3
4

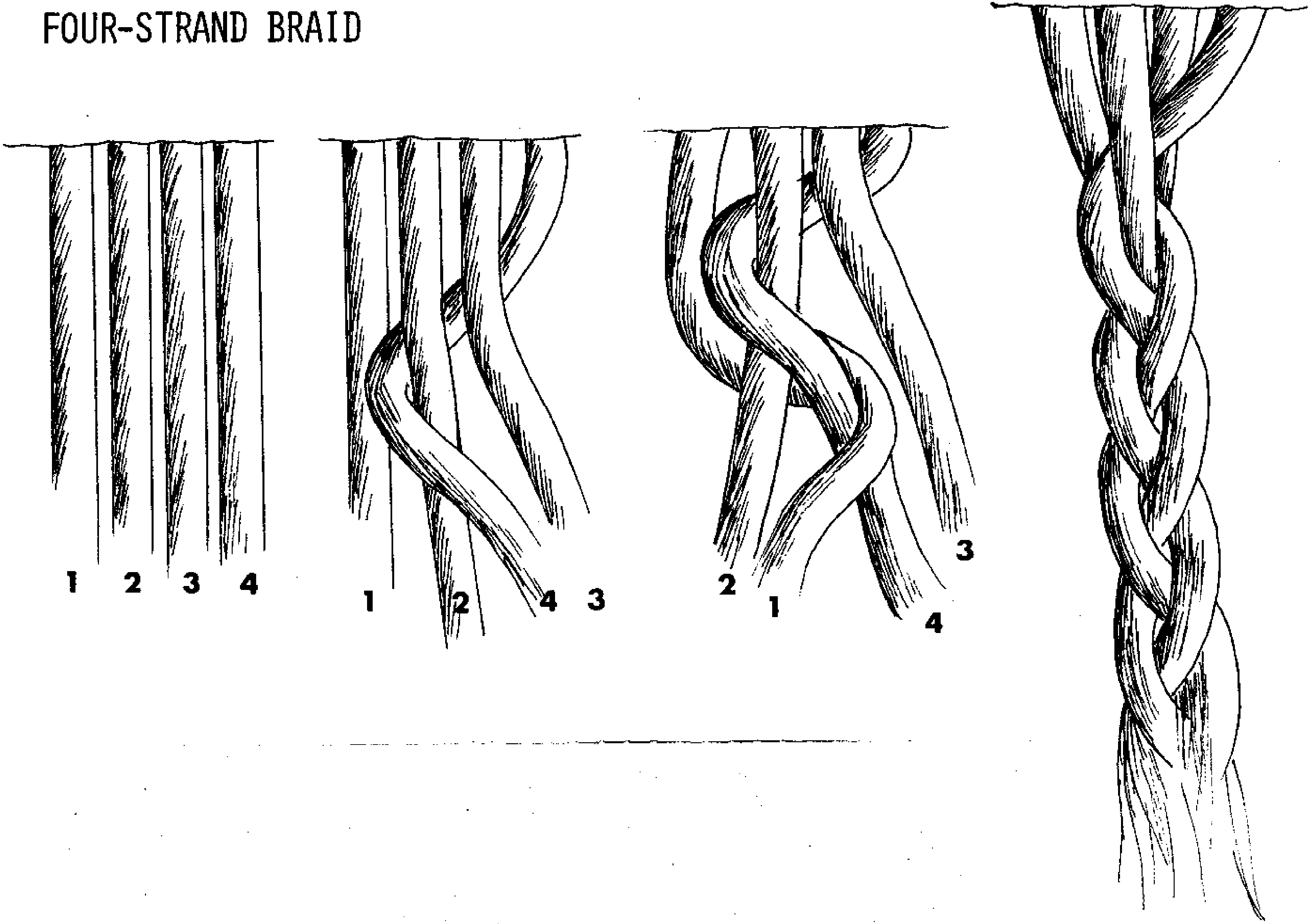


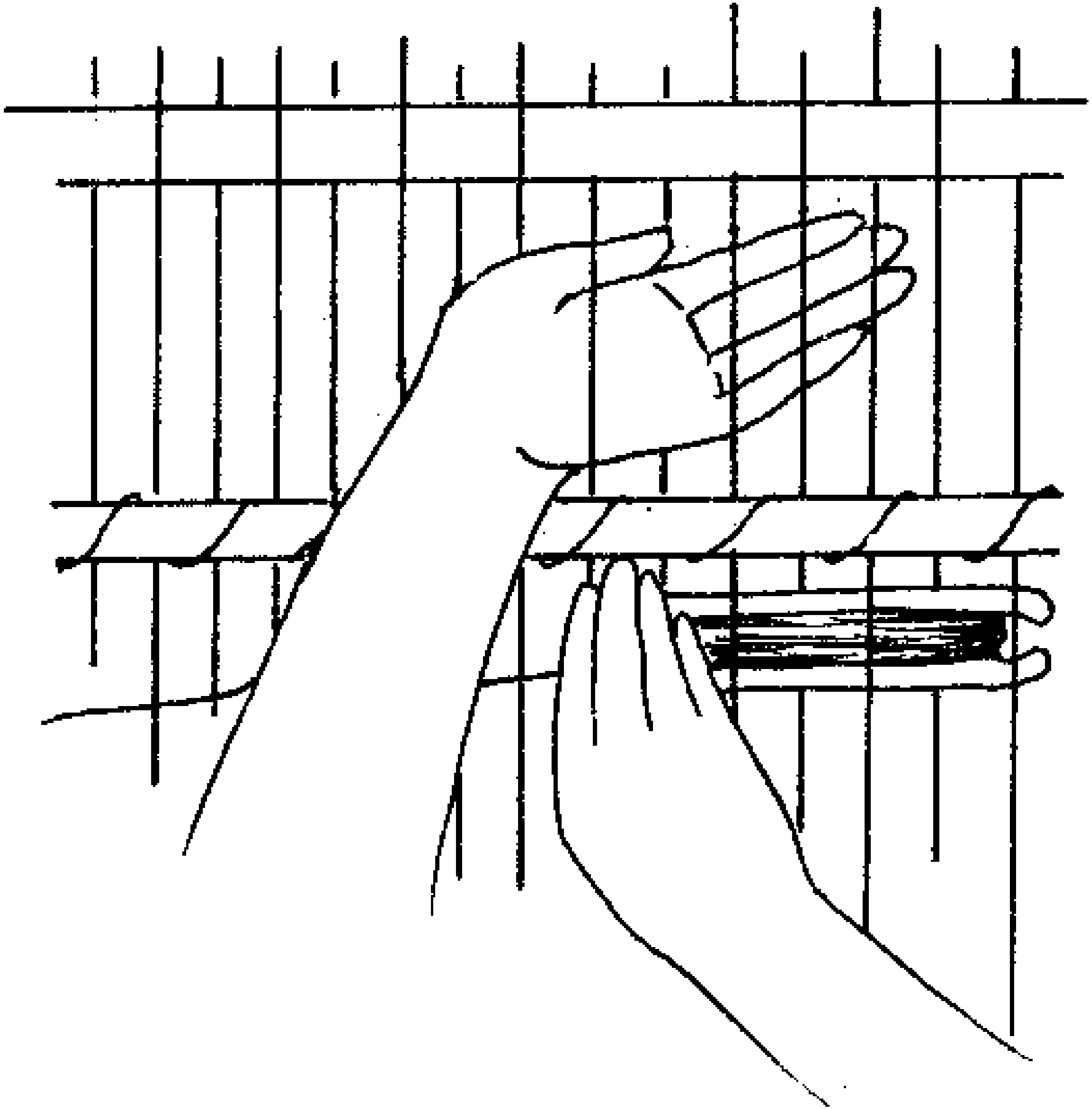
BOAT SHUTTLE IN USE

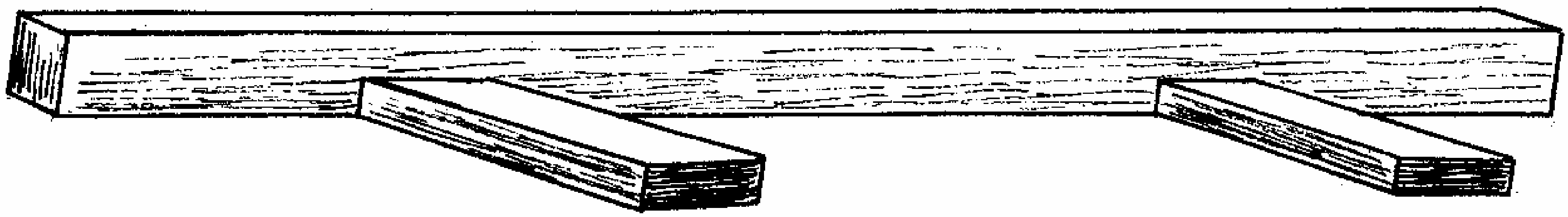
TWINING

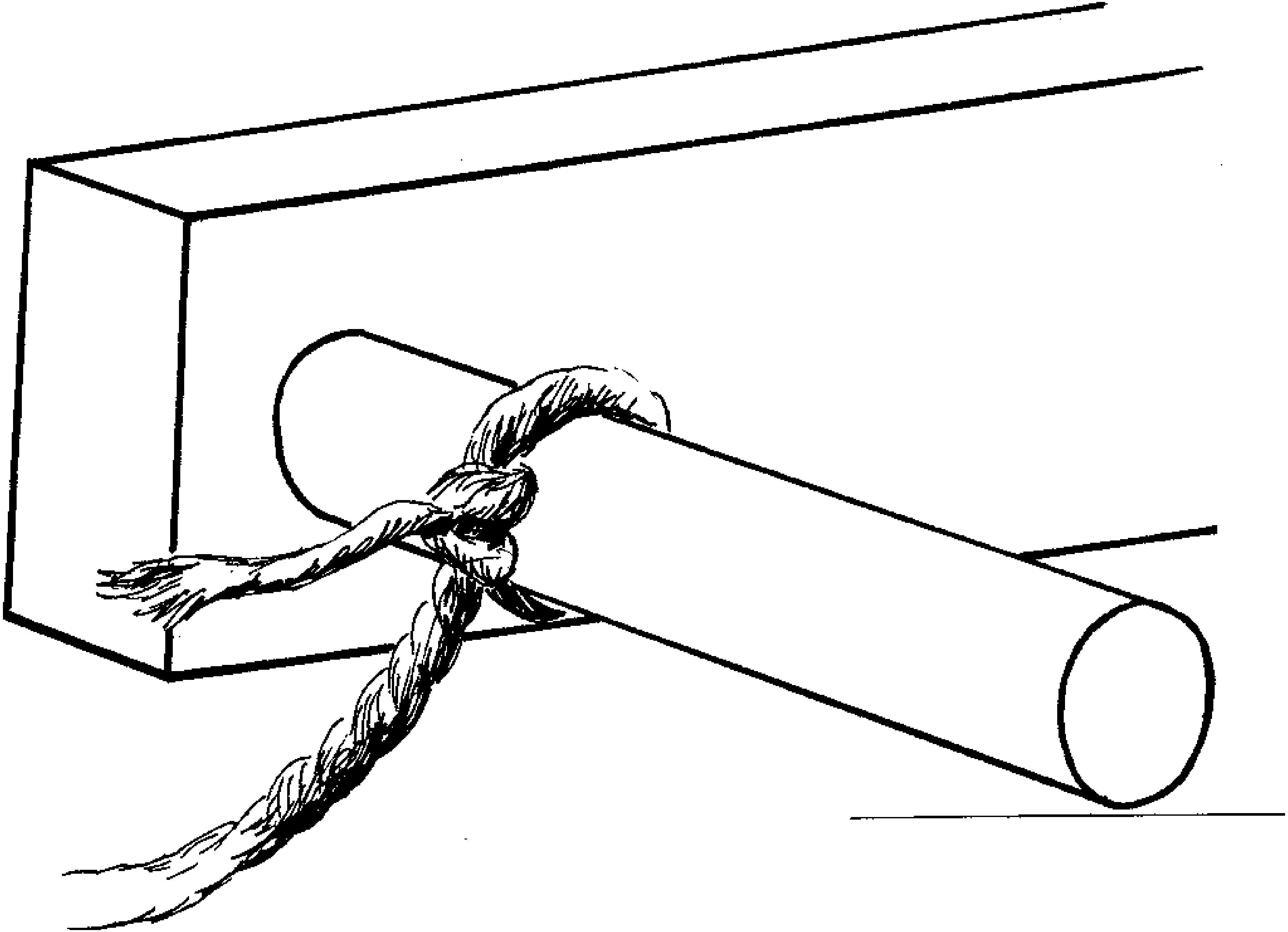


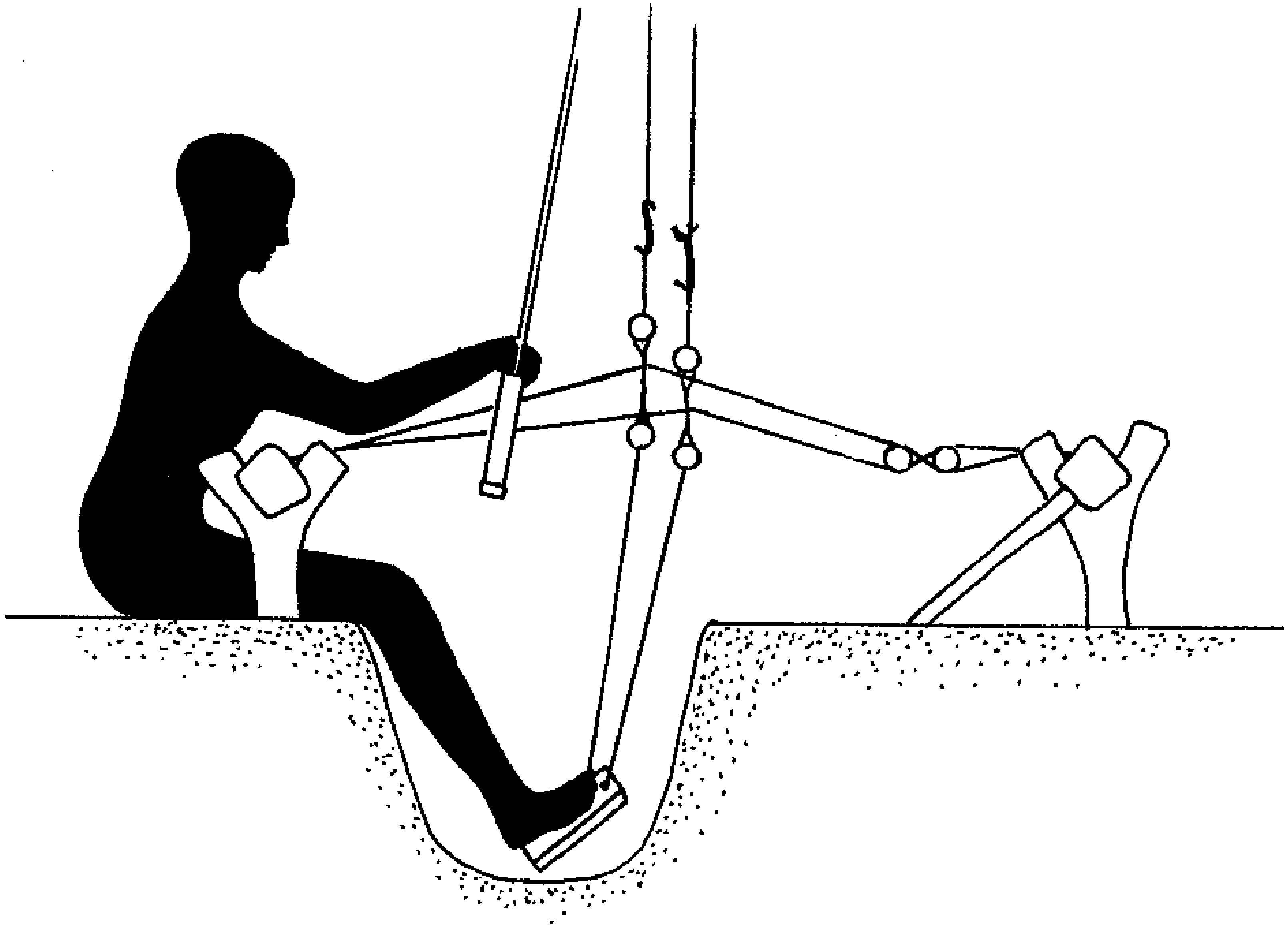
FOUR-STRAND BRAID



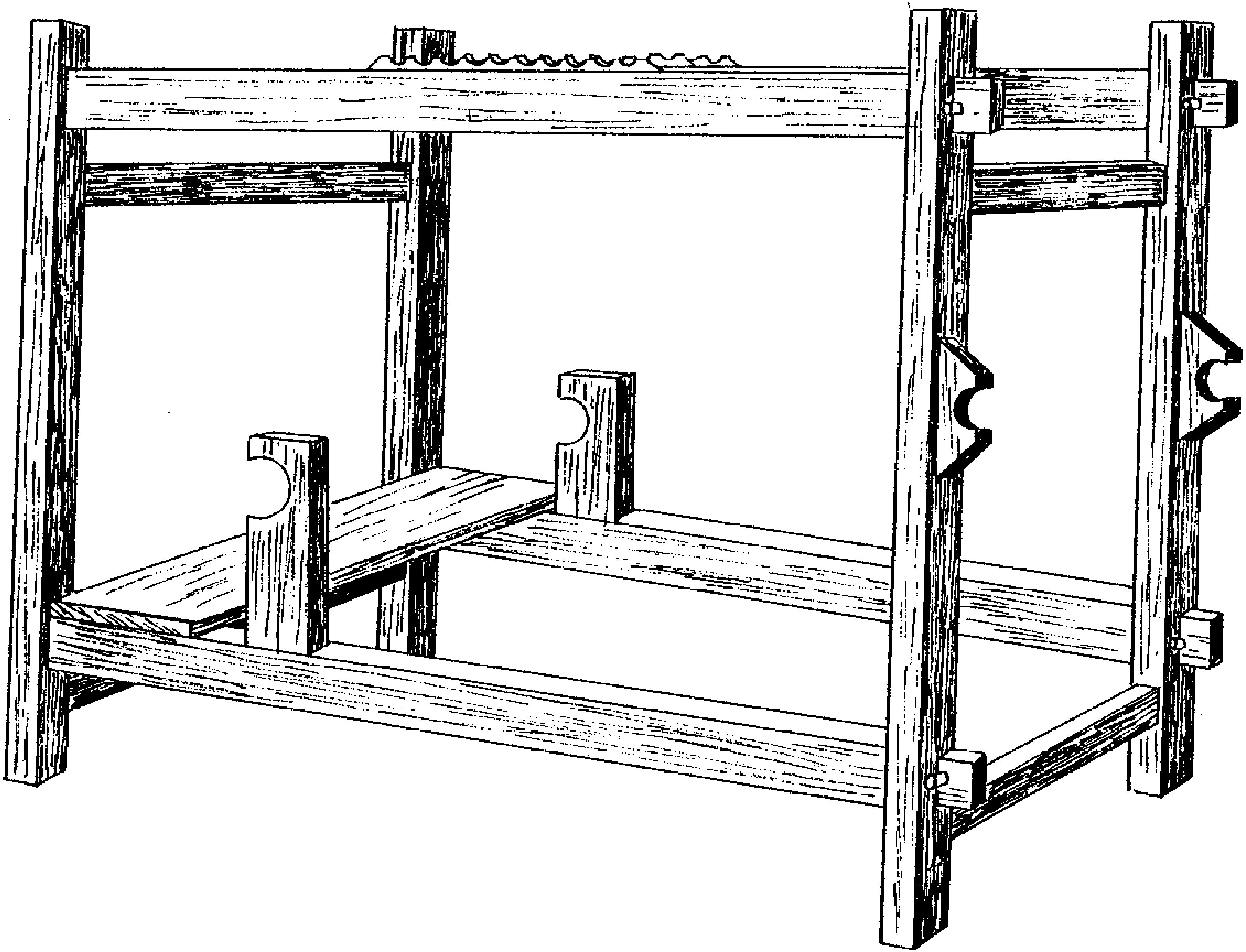






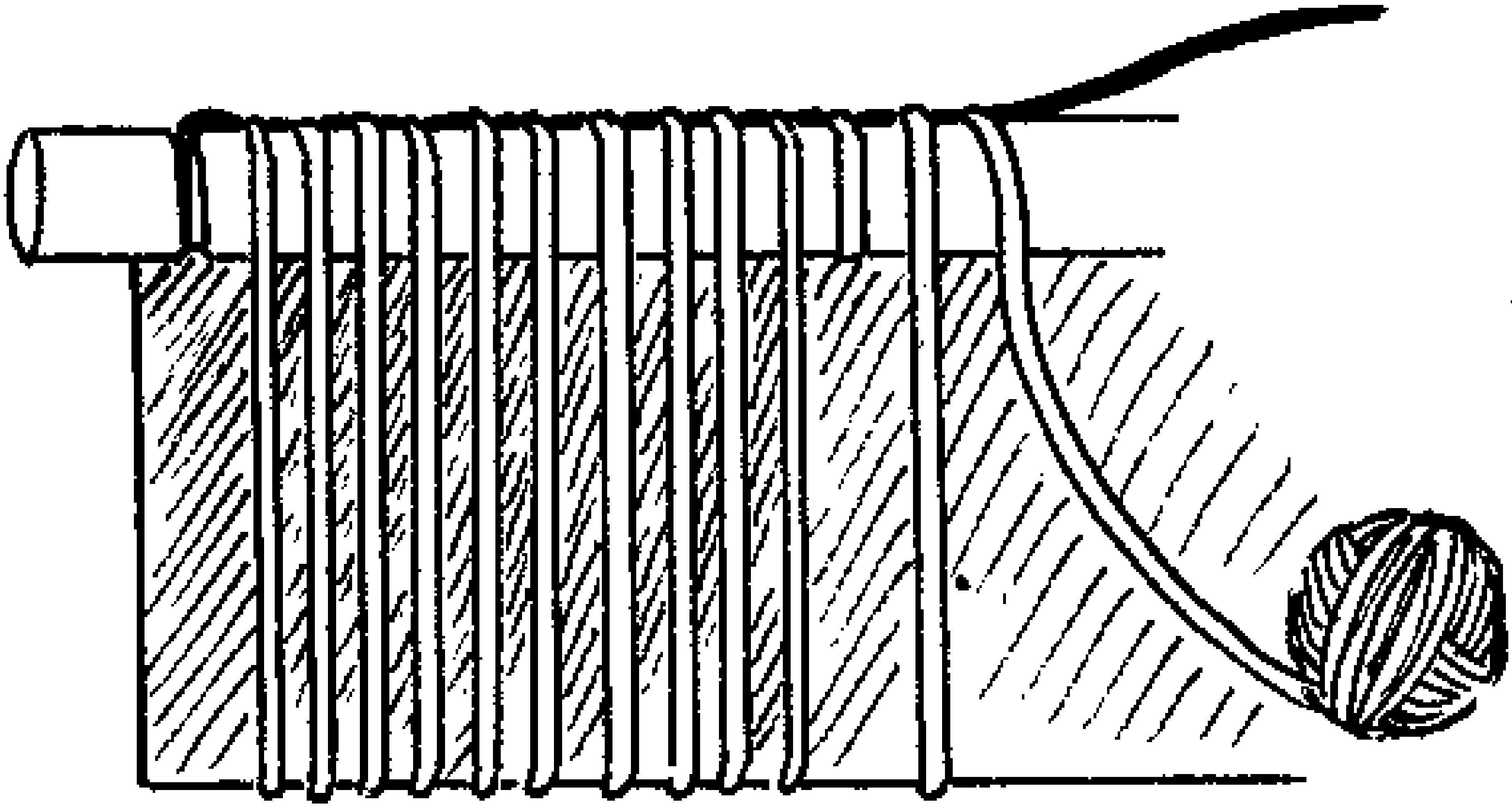


The Ceiling Supported Frame Is Now Complete

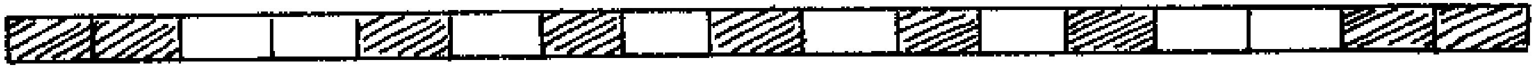


The Free-Standing Frame is Now Complete

THE MOVING PARTS FOR THIS LOOM AND THE WARPING AND WEAVING TECHNIQUES ARE DESCRIBED STARTING ON PAGE 84.



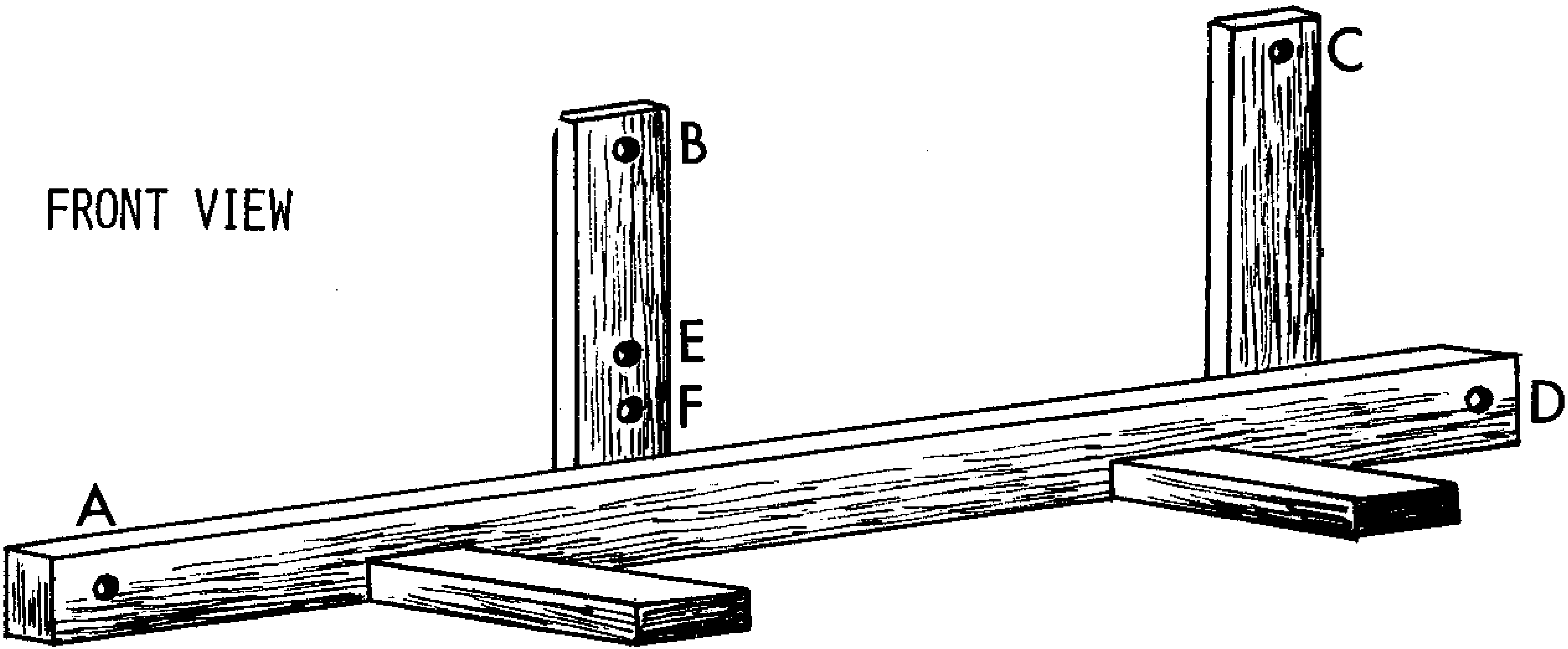
Frame, Inkle Looms:

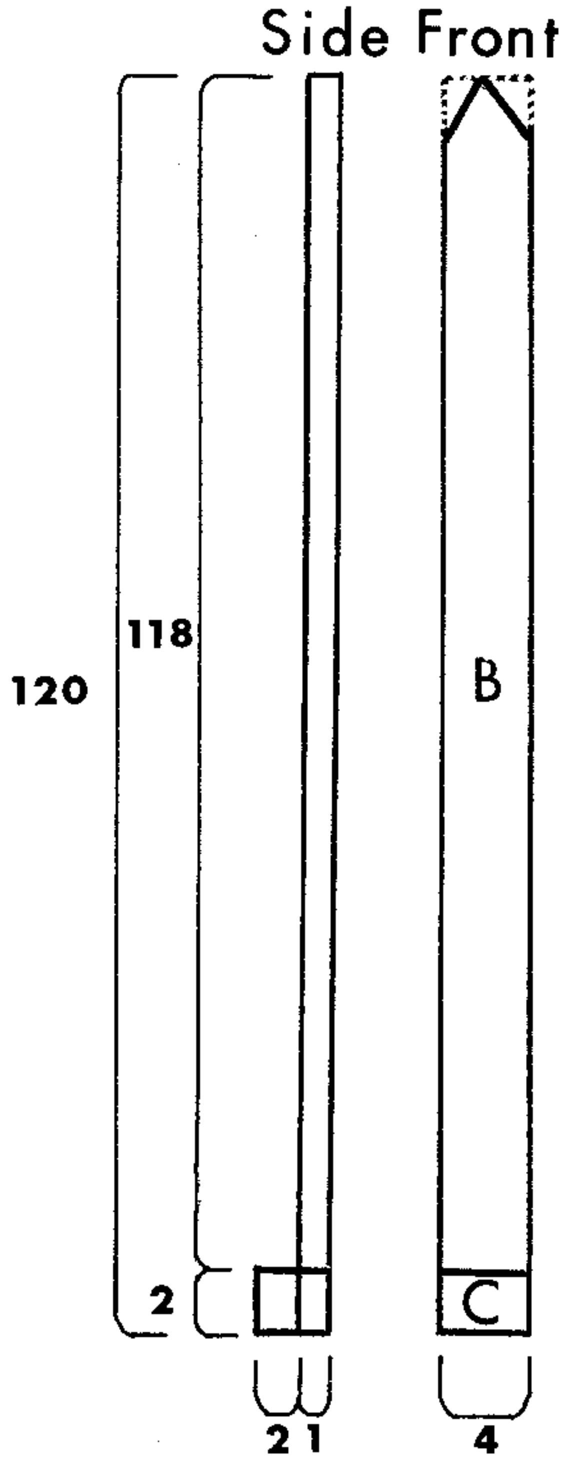


Foot-Powered Loom:

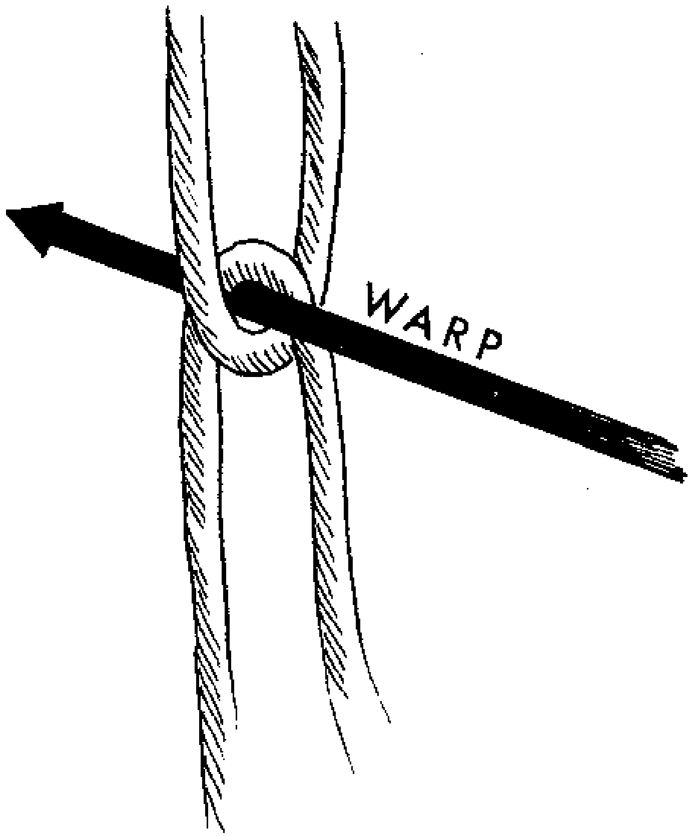
2

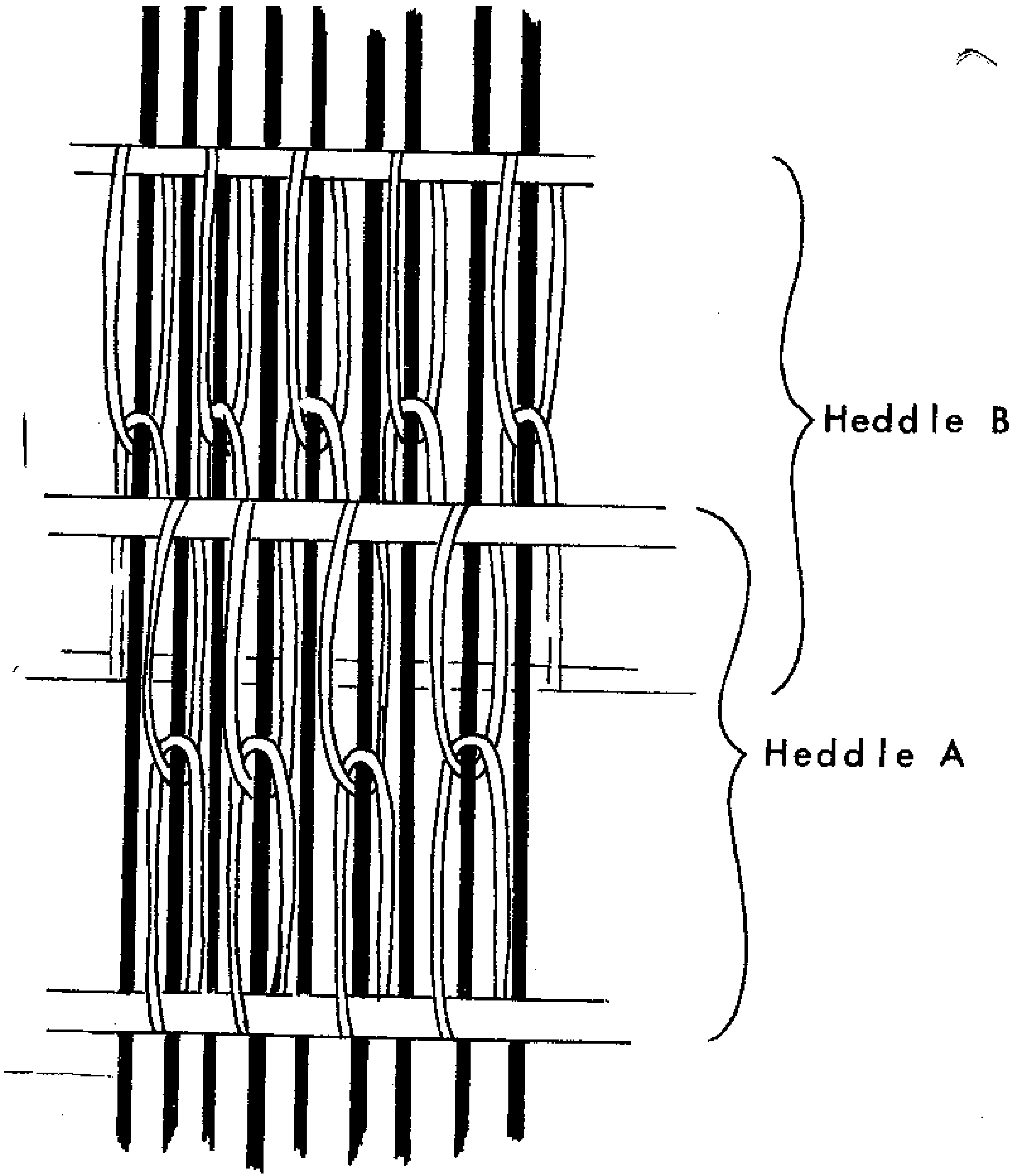
1

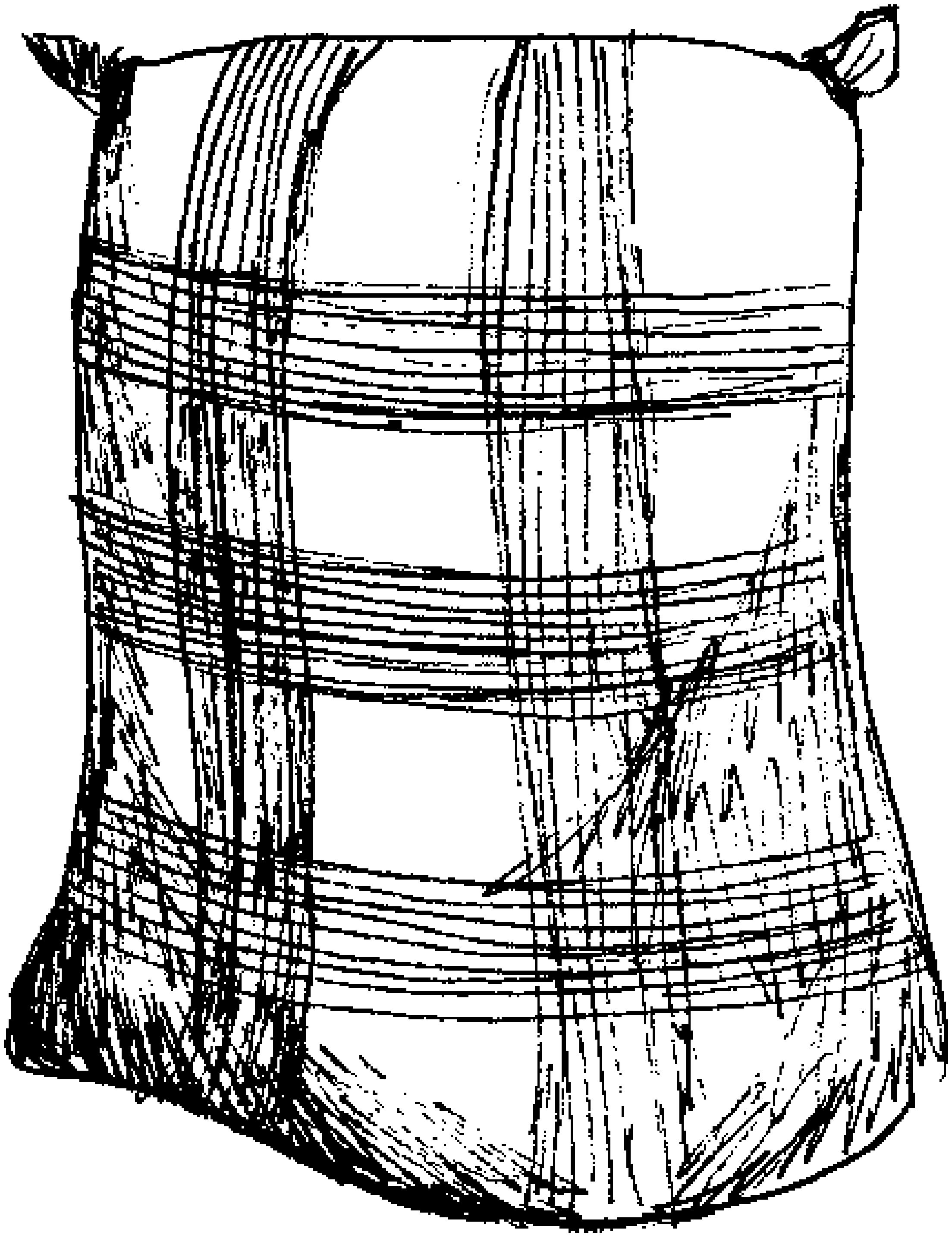

FRONT VIEW
A
B
C
D
E
F

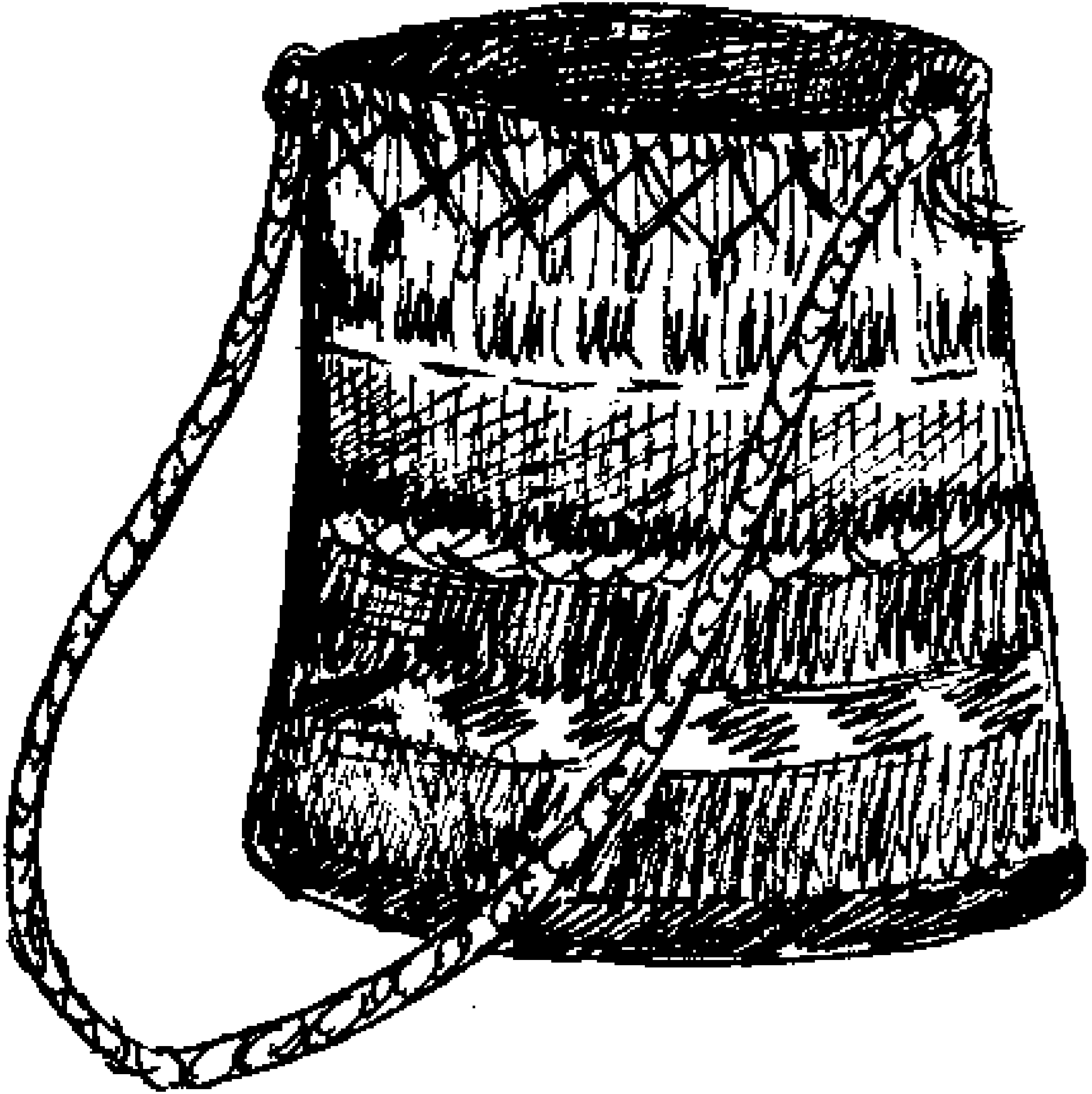

Side Front
118
120
2
B
C
2 1
4

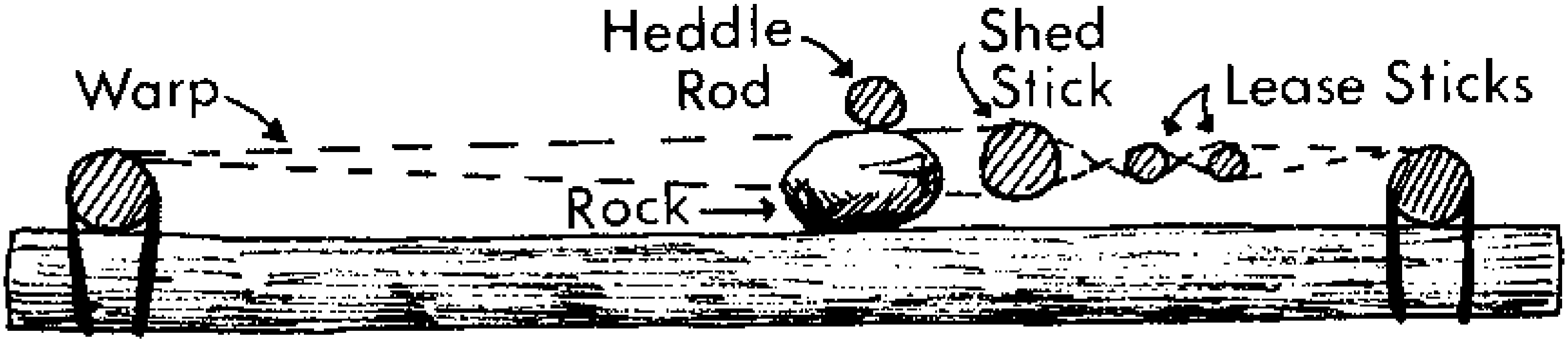
Step D: Pass warp thread through loop.



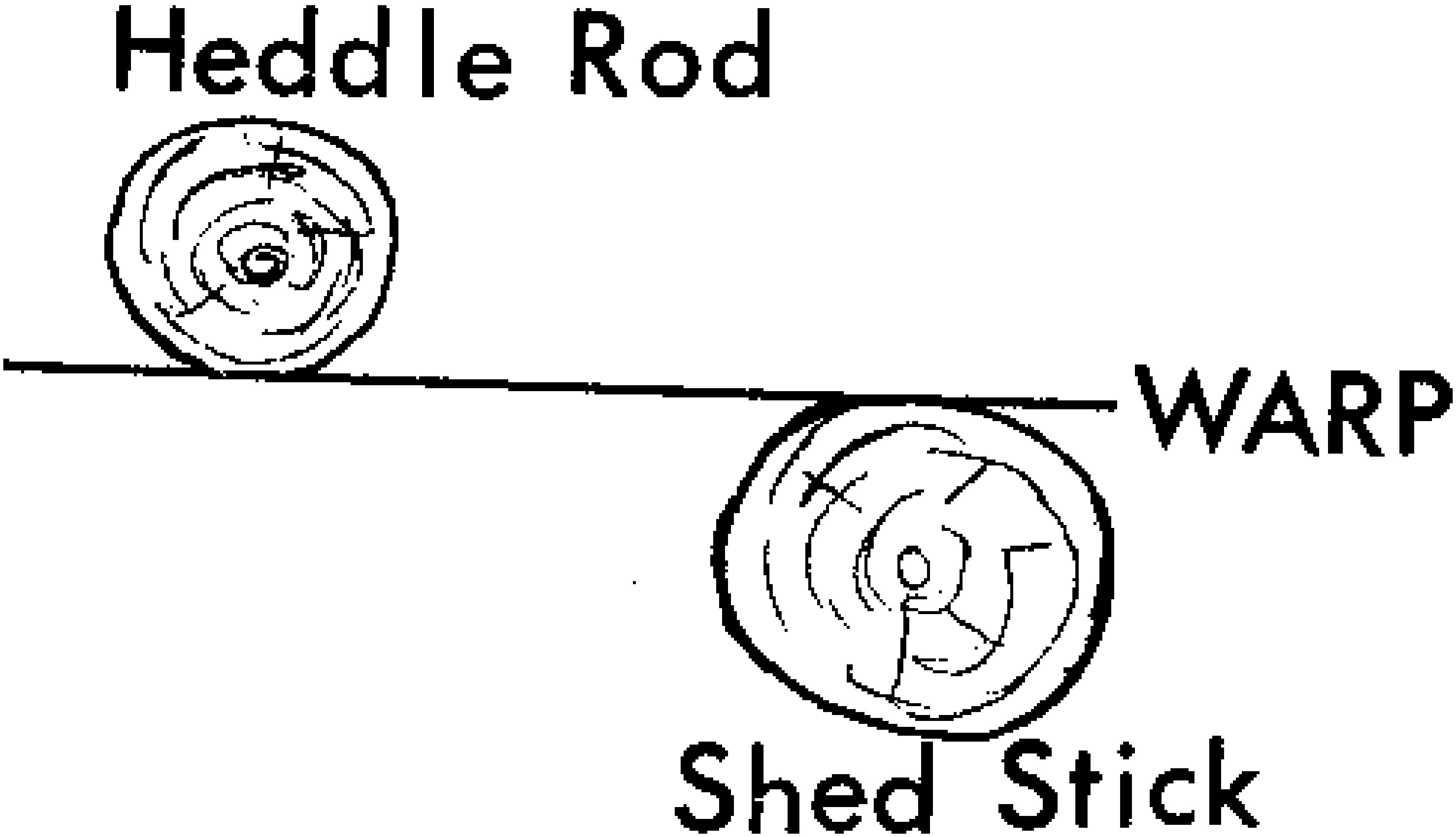






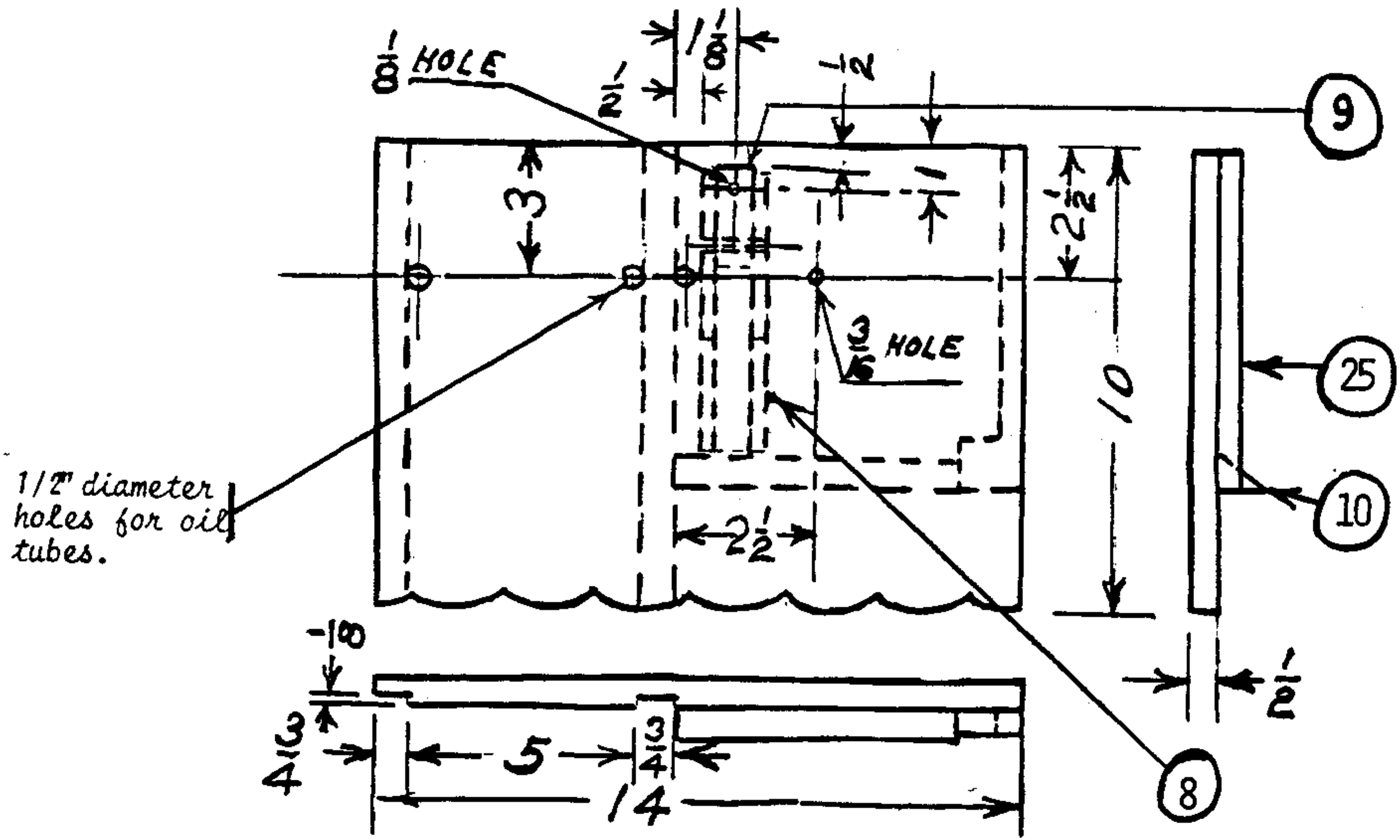


Side View

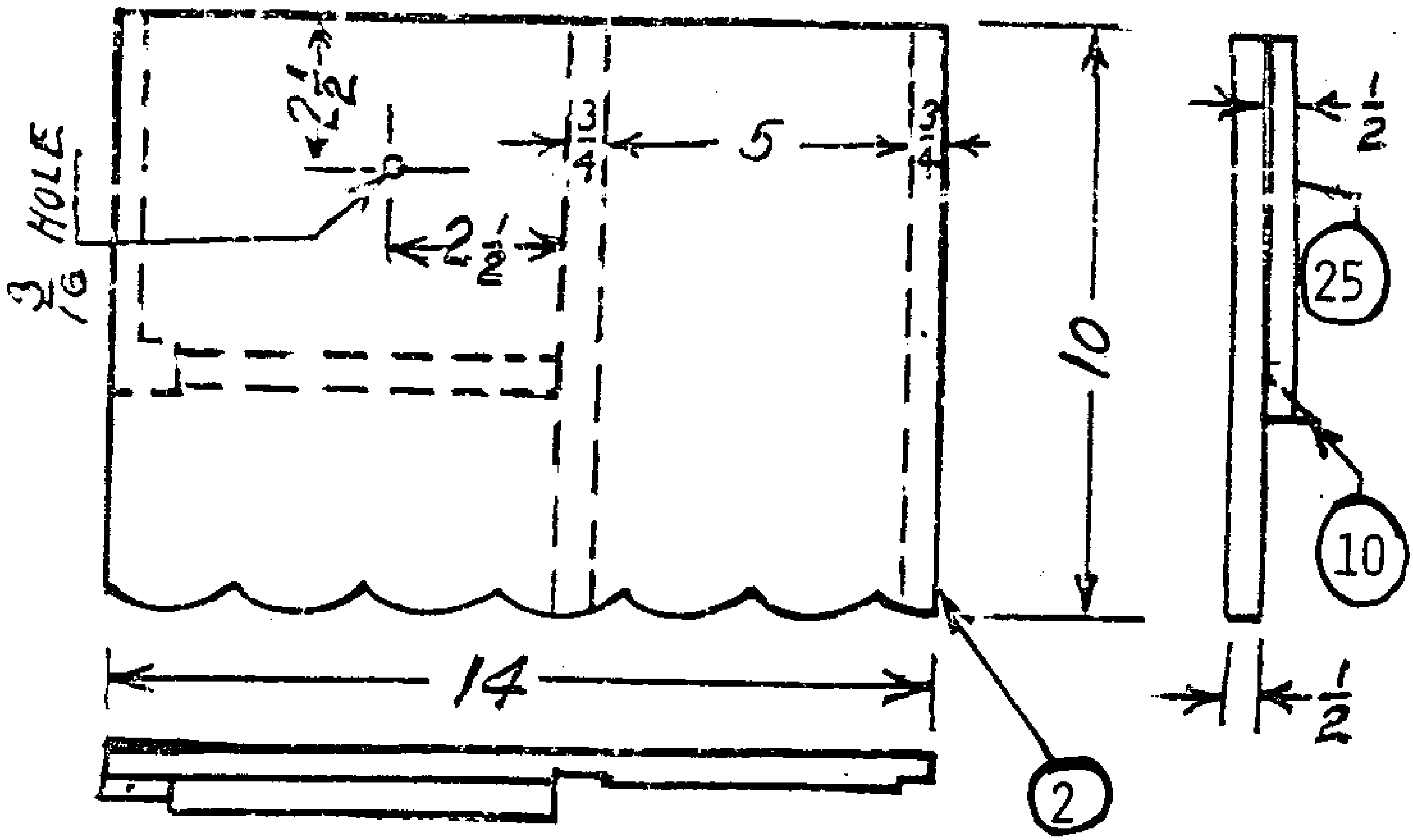


Close up.

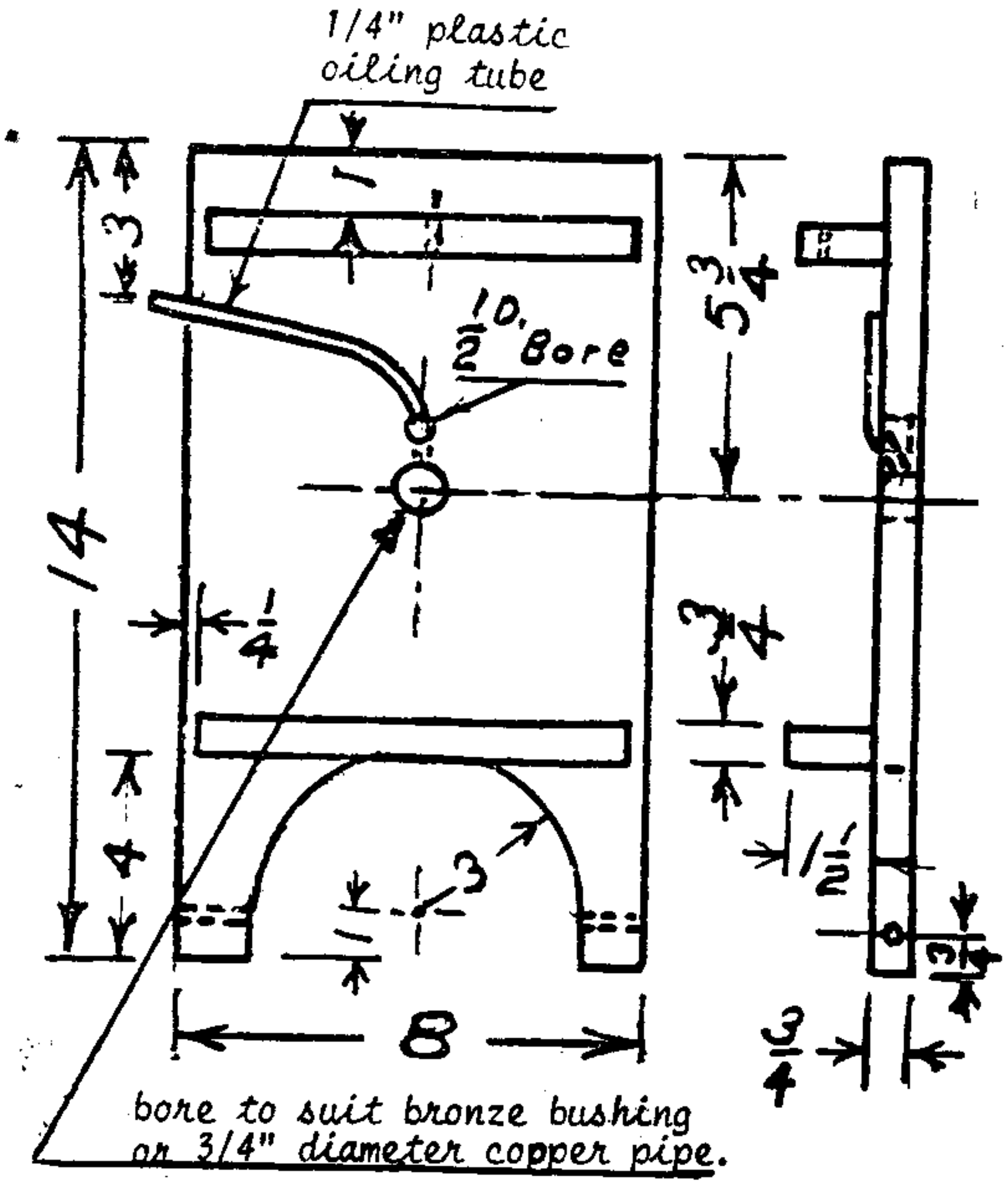

2
1



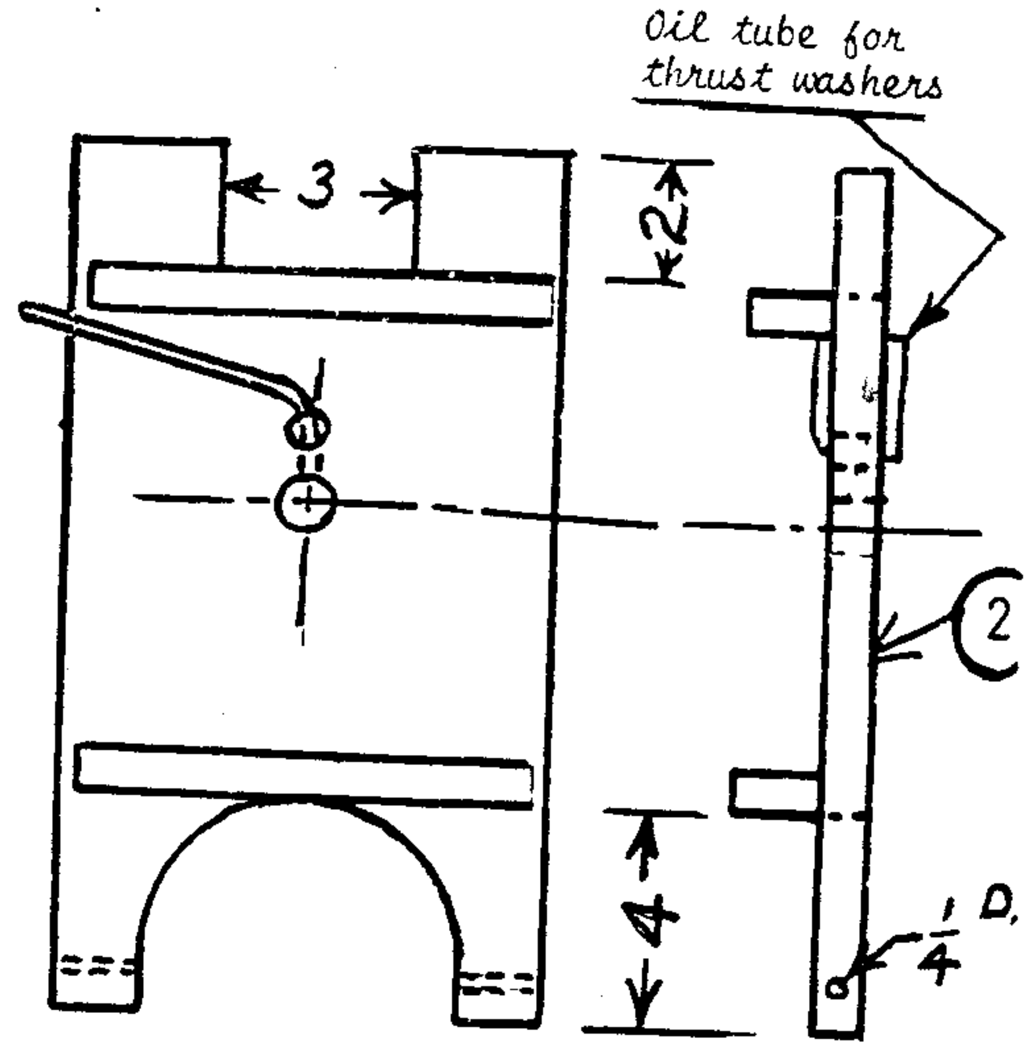
1 Subassembly, Left Side.



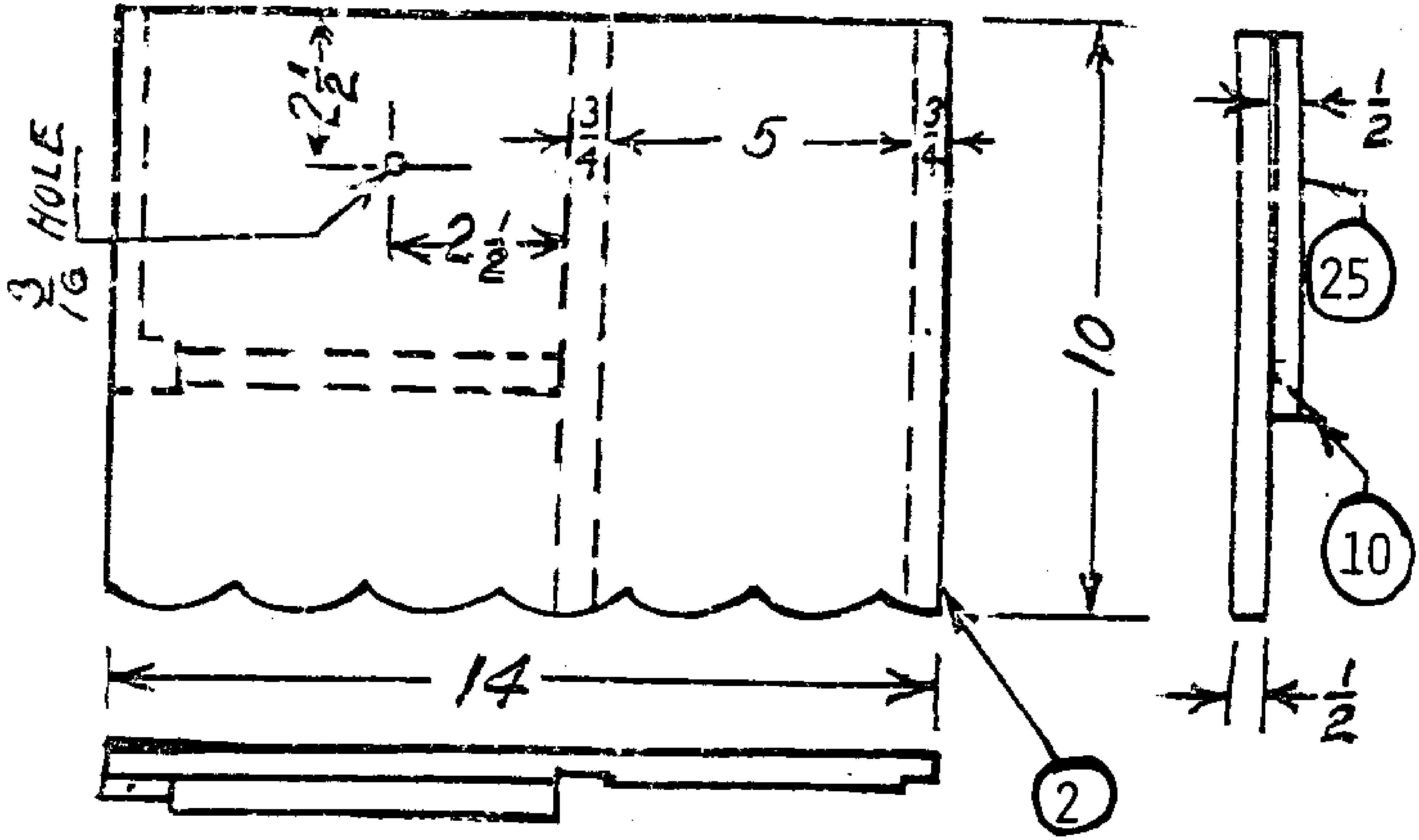
(2) Subassembly, Right Side.
For other dimensions see (1).



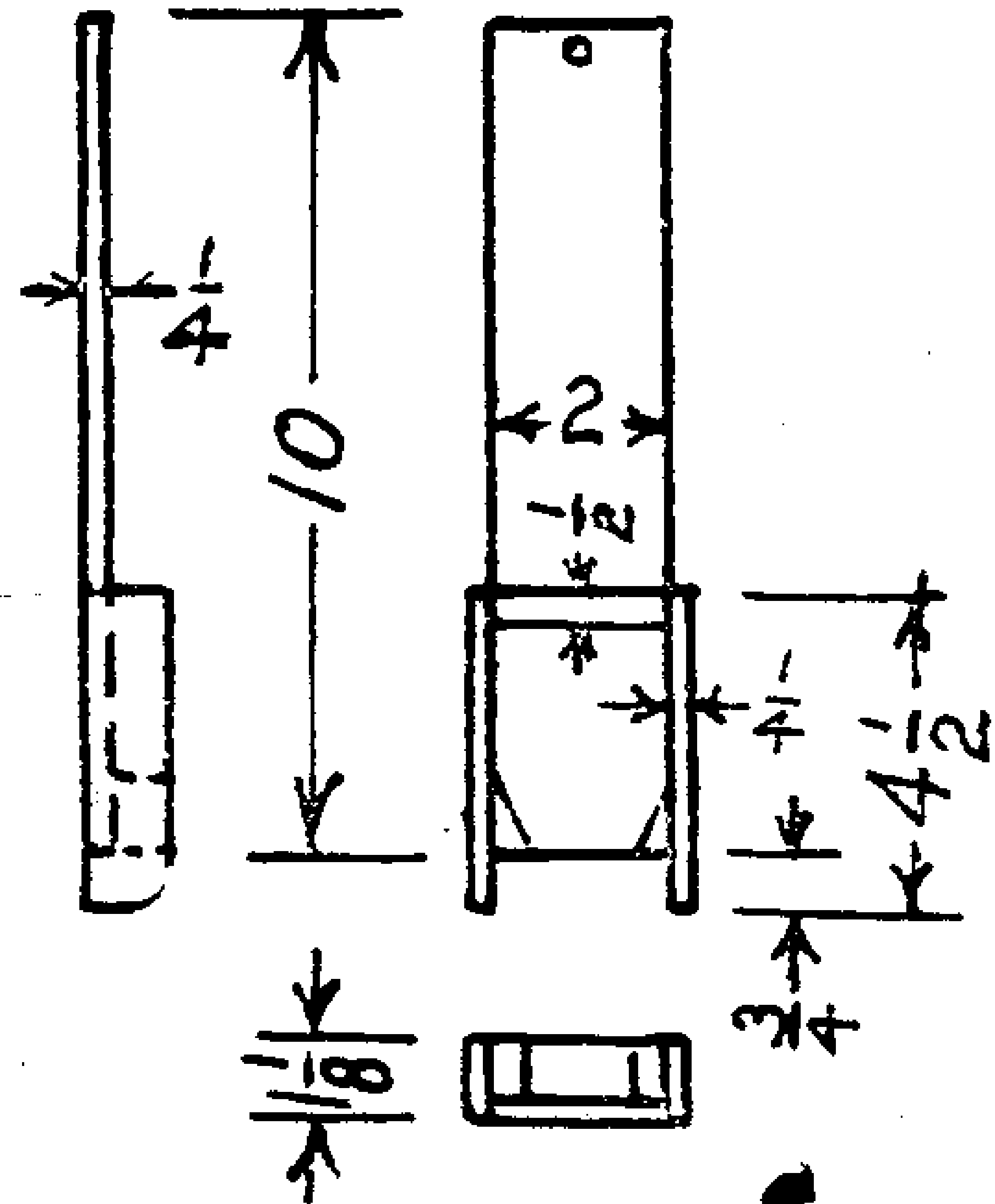
3 End Section.



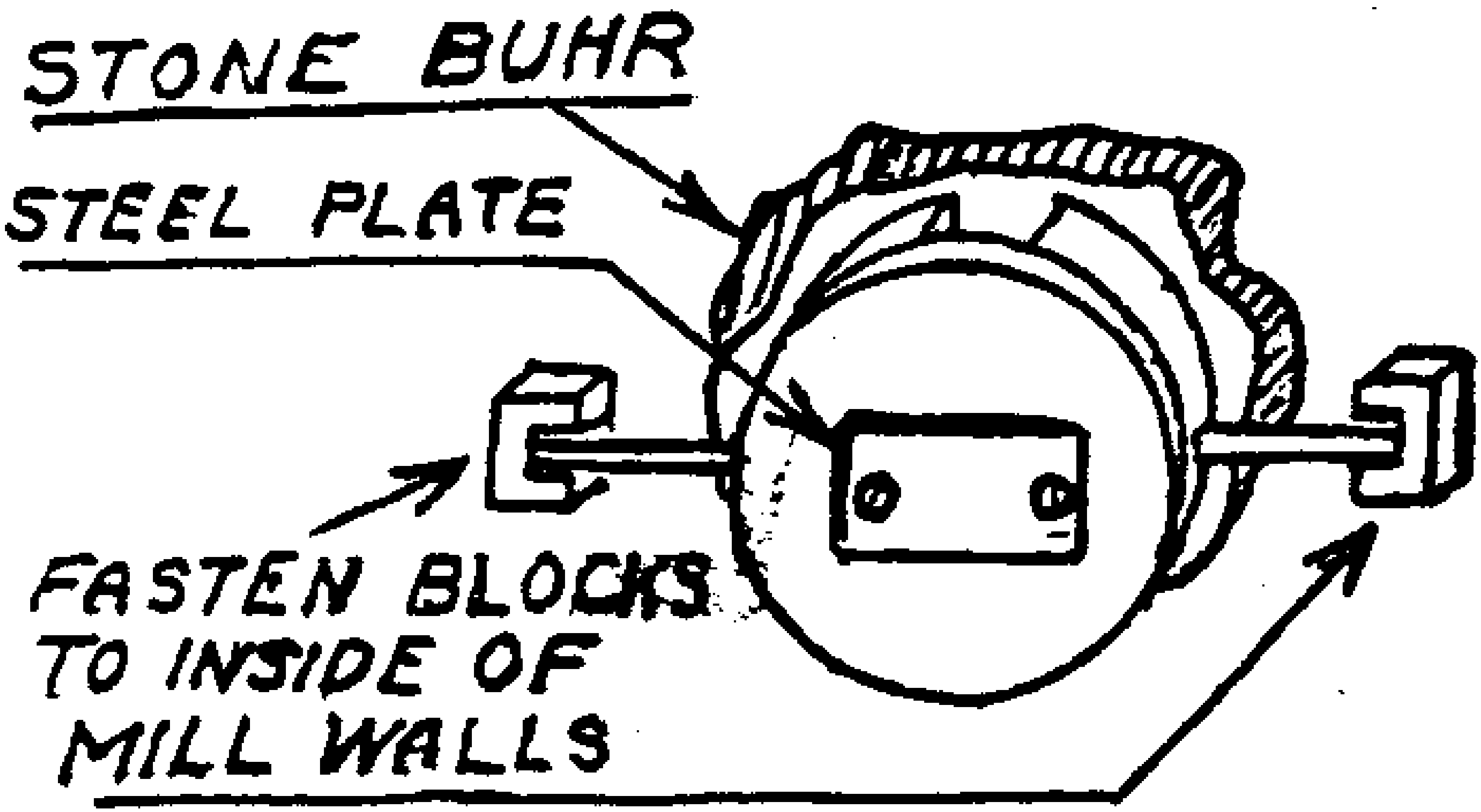
4 Center Bulkhead. Overall dimensions same as detail 3, note other variations.

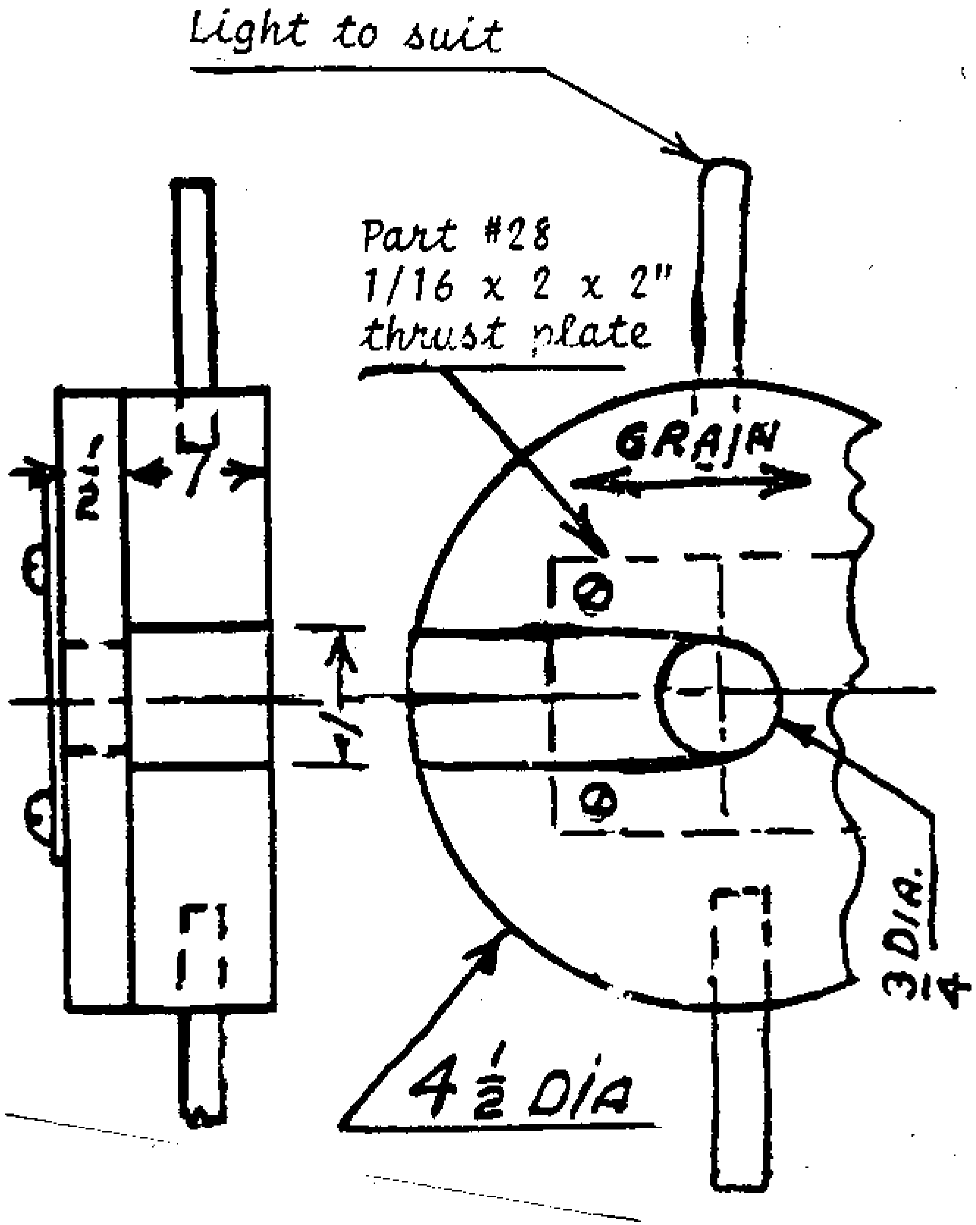


2 Subassembly, Right Side.
For other dimensions see 1.



1/4
10
2
1/2
1/4
4 1/2
3/4
1/8


STONE BUHR
STEEL PLATE
FASTEN BLOCKS
TO INSIDE OF
MILL WALLS



ne
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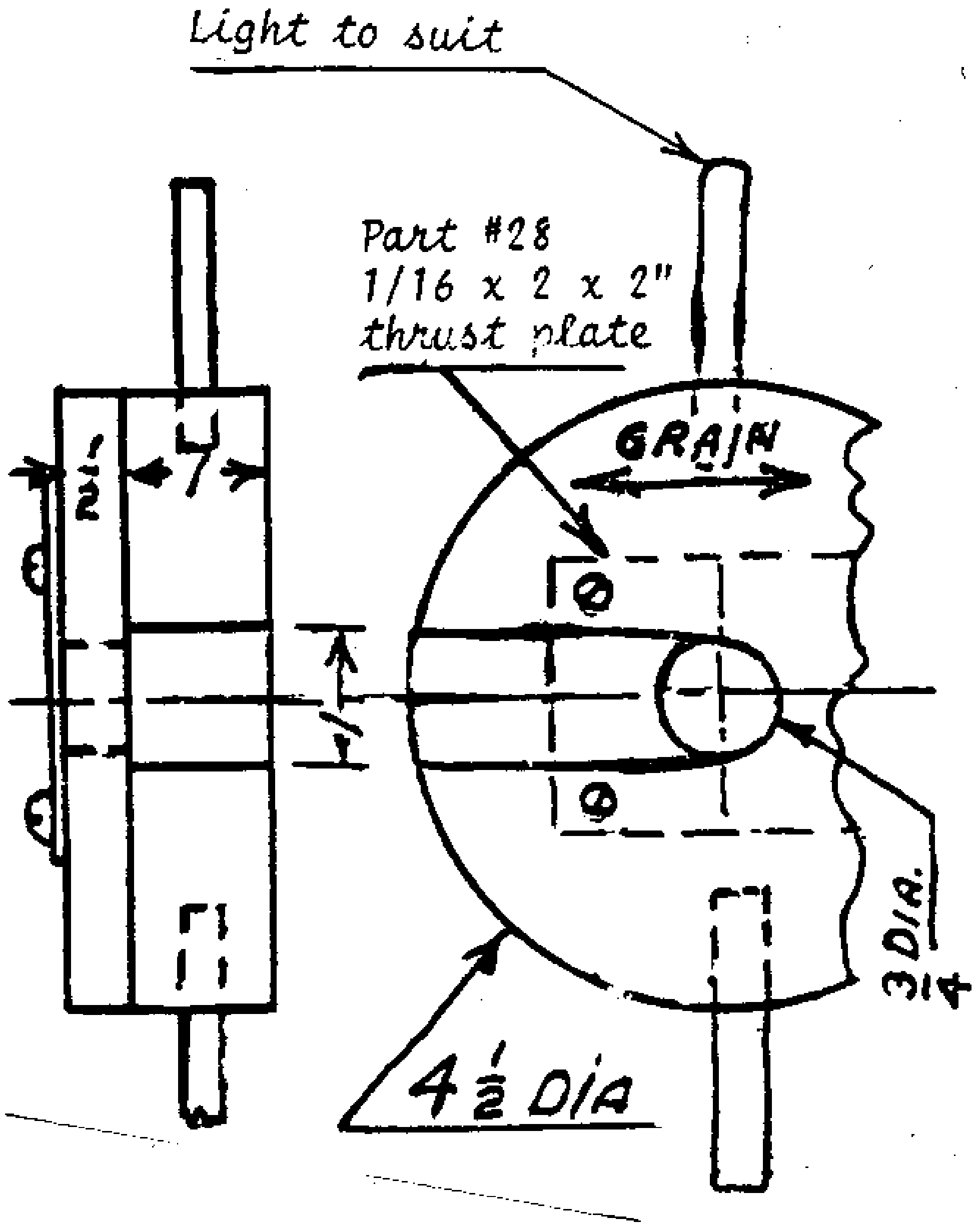
justment screw
the entire



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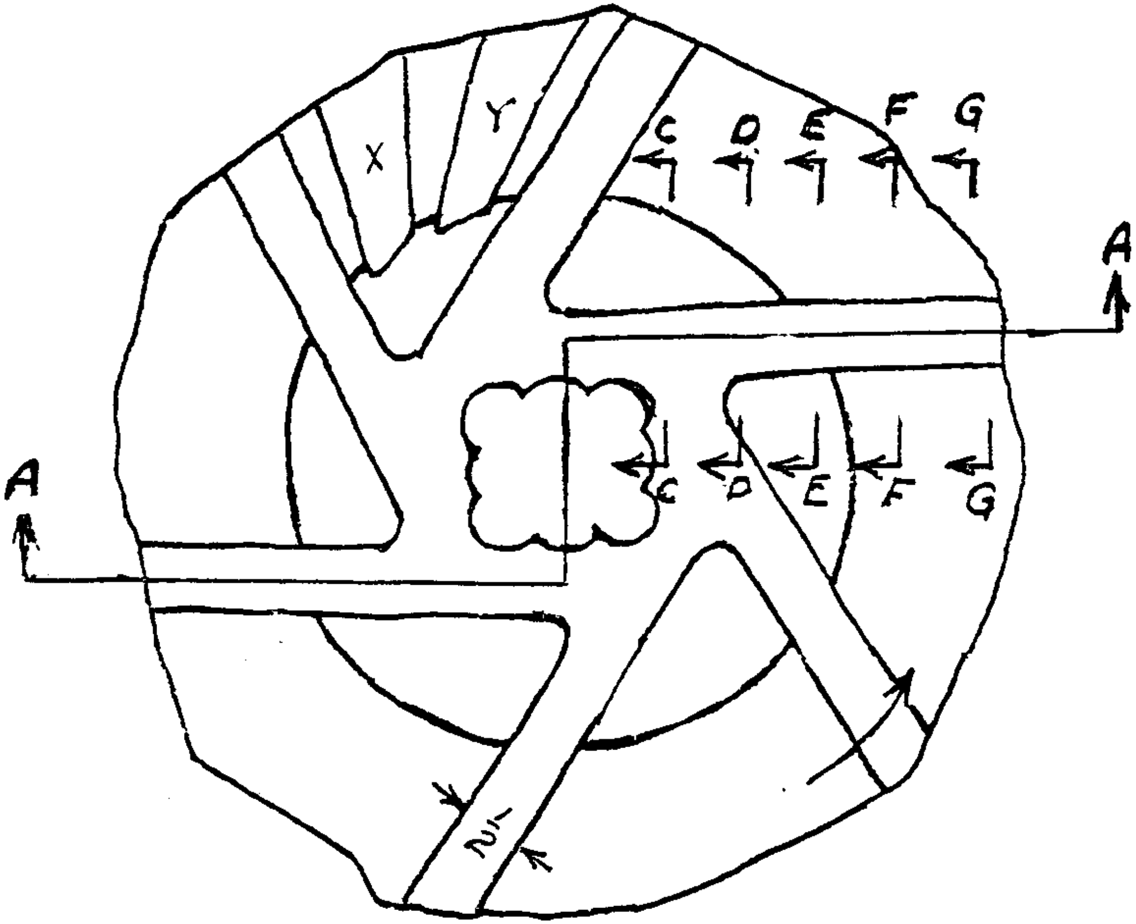
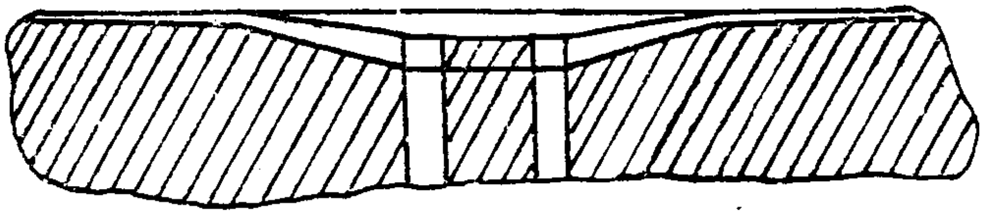
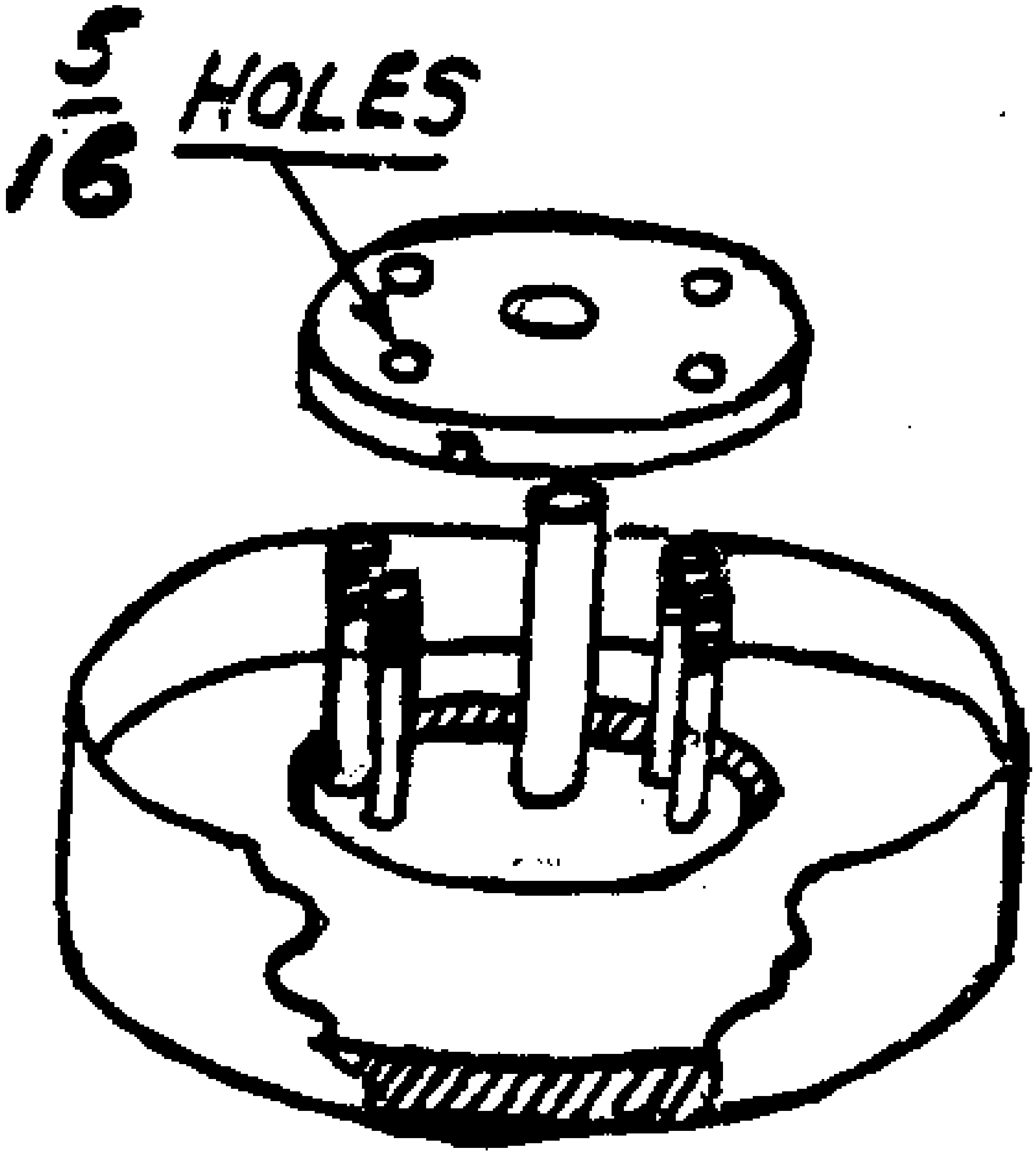
t it from
justment screw
the entire

STEP #2



Section AA


FULL SIZE



5/16 HOLES

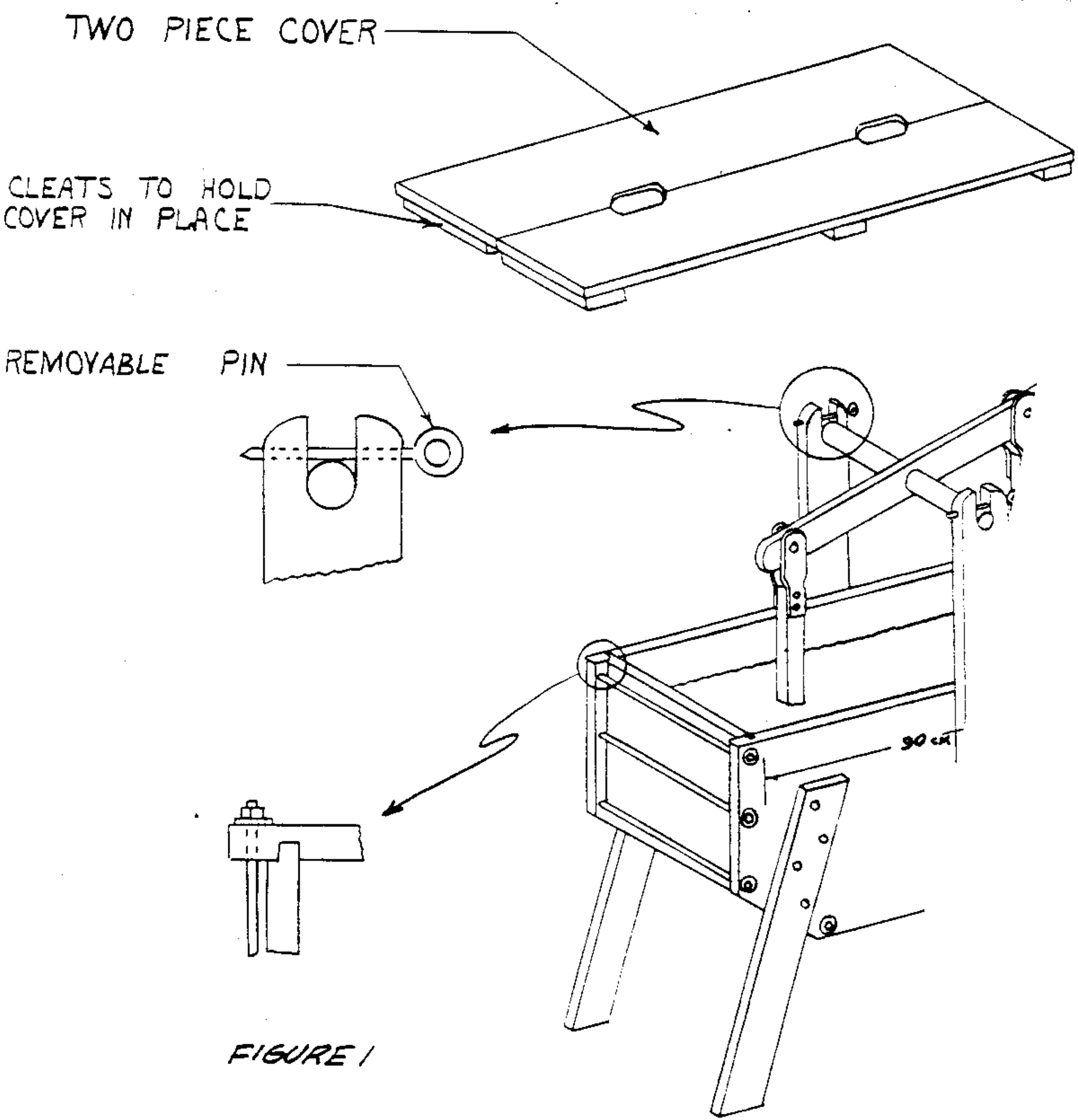

TWO PIECE COVER
CLEATS TO HOLD COVER IN PLACE
REMOVABLE PIN
90 cm

FIGURE 1

ANNEX IV

VILLAGES STUDIED, INTERVIEWERS, AND PARTICIPANTS--NORTHERN CENTER REGION/KAYA

Number of families observed: 16
Number of women who participated in group interviews: 664
Regional categorization: EPFD, Mr. Gabriel Ouedraogo

Village	Office in charge	Interviewer	Household observed	Number of participants in group interviews
1. Baadnoogo	EPFD (Kongoussi)	Alexine Ouedraogo	Tenga Gaesore	98
2. Baam	SEPFD	Agnes Zoungrana	Julien Bougma	46
3. Bayend-Fulgo	UNESCO project	Madeleine Ouedraogo	Saidou Sawadogo	30
4. Looga	UNESCO project	" "	Noaga Sawadogo	190
5. Mafoudou	SEPFD	Henriette Sawadogo	Albert Ouedraogo	27
6. Lawi	"	Djiba Tall	Pegdba Sawadogo	56
7. Selbouri	"	Francoise Ouedraogo	Salam Ouedraogo	25
8. Tampelga	"	Monique Sawadogo	Salam Nobila Ouedraogo	8
9. Wintini	"	Ramata Sigue	Saidou Sawadogo	47
10. Zura	UNESCO project	Georgette Bougma	Barthelemy Sawadogo	24

ANNEX IV (cont.)

11. Balonghin	Social Affairs-Kaya	Jacqueline Zabre	--	50
12. Gnongsin	" -Mane	Werbila Ouedraogo	Larba Kinda	--
13. Gonsin	" -Mane	Therese Ouedraogo	Nobila Ouedraogo	--
14. Ignongo	" -Mane	Werbila Ouedraogo	--	10
15. Ouemtenga	" -Kaya	Jacqueline Zabre	--	31
16. Titinga	" -Kaya	"	Souleymane Simpore	--
17. Wapassi	" -Mane	Therese Ouedraogo	--	12
18. Wintinga	" -Mane	Zenabo Ouedraogo	Gouringa Ouedraogo	10
19. Bangasse	ORD/Kaya	Suzanne Ouedraogo	Hamidou Ouedraogo	--
20. Noaka	"	Sophie Sawadogo	Sambo Ouedraogo	--

Size of family:

- 2 to 6 people
- 7 to 10 people
- 10 to 15 people
- 15 to 20 people

1. Who prepares the family's meals

   - Women of the house
   - Child or relative
   - Servant

Sex	Age

2. How many times a day do you cook?

	Dry season	Rainy season
once		
twice		
three times		

3. At what time is cooking done?[1] Beginning: fire laid
   End: cooking is over

Breakfast: from to

Lunch: from to

Dinner: from to

[1] Interviewer's observation.

4. What sort of dishes do you prepare for each meal?

Breakfast:

Lunch:

Dinner:

Other preparations between meals:

5. How many pots do you use to prepare each meal (dimensions, sizes)?

Breakfast:

Lunch:

Dinner:

Pots used for other purposes. Which ones?:

6. The different meals, are they prepared:

- one after the other?
- at the same time?

7. Where do you cook?[2]

	During the dry season	During the rainy season
in the hall		
in the courtyard outside		
in the courtyard under a roof		
in a kitchen hut		
in a living hut		

[2]Ask them why the same women use several different places to cook.

8. What apparatus and which cooking utensils do you use?

Stoves	Number of answers	Utensils	Dimensions
Three stones		Canari	
Constructed in banco		Pot	
Metal stove		Saucepan	
Other		Other	

9. Who set up the stove on which you are cooking?

10. Did you participate in the installation?

11. How long have you used it?

12. What kind of maintenance and repairs does this stove need?

13. Are there any preparations or customs involved before the stove is installed? Who has to make them, and what has to be done?

14. Did you participate in the construction of your

- house?
- kitchen?
- granary?
- karite stove?

If yes, explain what you did.

15. What new things does the family have, which are run by women?

	Run by men	Run by women	Run by young men	Run by young women
Radio receiver				
Bicycle/moped				
Cart				
Parafin lamp				
watch/alarm clock				
other				

16. Which fuel do you use to prepare meals?[3]

	Number of meals	Dry season	Rainy Season
• wood			
• cow manure			
• millet straw			
• gasoline			
• gas			
• other fuel			
• coal			

17. What price do you pay per week for your fuel supply?

a) Number of hours and kilometers covered by those who go and look for wood by themselves. How many times a week?

---

[3]Specify which women use one fuel exclusively. For those who use several different fuels, specify for what purpose, and during how many months.

b) Sum spent by those who buy the wood:

18. Among the fuels that you use, which one is:

	Number of answers
. least expensive	
. the one that permits fast and least tiring cooking	
. the one you prefer	

19. Classify in decreasing order of importance what tires you most when you are cooking.

- heat
- smoke
- watching the fire and the pot
- various

20. What do you think of a housewife who is afraid of smoke? Why?

21. Do you use the smoke (emitted during cooking)? If yes, how?

22. Are certain attitudes and positions recommended or forbidden while cooking? Which ones and why?

23. You are presently cooking under certain conditions. List in order of priority five things you would like to change about these conditions.

24. What method do you use to reduce your consumption of fuel?

25. Do you heat water every day?

How many times a day?

For what use?

26. How and when do you heat the water?

- During meal preparation?
- After the preparation of the meal? Do you use more wood?

27. Do you wish to reduce the time you spend cooking your meals?

28. How much are you ready to spend for the construction of a stove that would allow you to save time and fuel?

Price	Number of responses
1,500 CFA	
3,000 CFA	
5,000 CFA	
9,000 CFA	

Who will spend the money?

- Yourself
- Your husband
- Who else?

29. What ideas did the interview suggest to you?

30. What advice would you like to give those who want to build improved stoves to help housewives and families?

    - Construction materials (banco, improved banco, cement, metal)
    - Stove that permits the cook to work seated
    - Stove that permits the cook to work standing
    - Number of pots that you want to use at the same time on the fire
    - Permanent stove
    - Transportable stove
    - Stove which uses big and long pieces of wood
    - Stove which uses small and short pieces of wood
    - Stove without chimney
    - Stove with chimney

B. Housewife interview and observation

IDENTIFICATION

Village/District:

Interview conducted from: to:

Interviewer:

Office/Organization:

Name and first name of the head of the family:

Ethnic group: incomes: Low
Medium
High

Number of spouses:

Total number of children:

Number of children ranging from 0 to 3 years:

Number of persons eating in the family:

Income-generating activities undertaken by wife/wives:

- Own piece of land: Products cultivated: Annual income:
- Market gardens: Products cultivated: Monthly income:
- Sale and Preparation of dolo: How many times a week: profit
- Small trade: Products sold: Monthly profit:
- Wicker work: Monthly income:
- Pottery: Monthly income:
- Cotton spinning: Annual income:
- Hair-cutting:
- Other:

1. Who prepares the family's meals?
   - Woman of the house
   - Child
   - Parent
   - Servant

   Sex: Age:

2. When there is more than one spouse, how do they divide the preparation of the meals between them?

3. Where do you cook?

	During the dry season	During the rainy season	Why
In the hall			
Outside in the courtyard			
Under a roof in the court-yard			
In the kitchen hut			
In the living hut			

4. Do the wives use a common stove?

   Yes: No:

5. If no, specify the number and uses of the different stoves:

6. Which cooking instrument(s) do you use?

   - Three stones:
   - Traditional improved stove: give local name:
   - Modern improved stove: specify which type:
   - Other (specify):

7. Who set up the stove on which you cook?

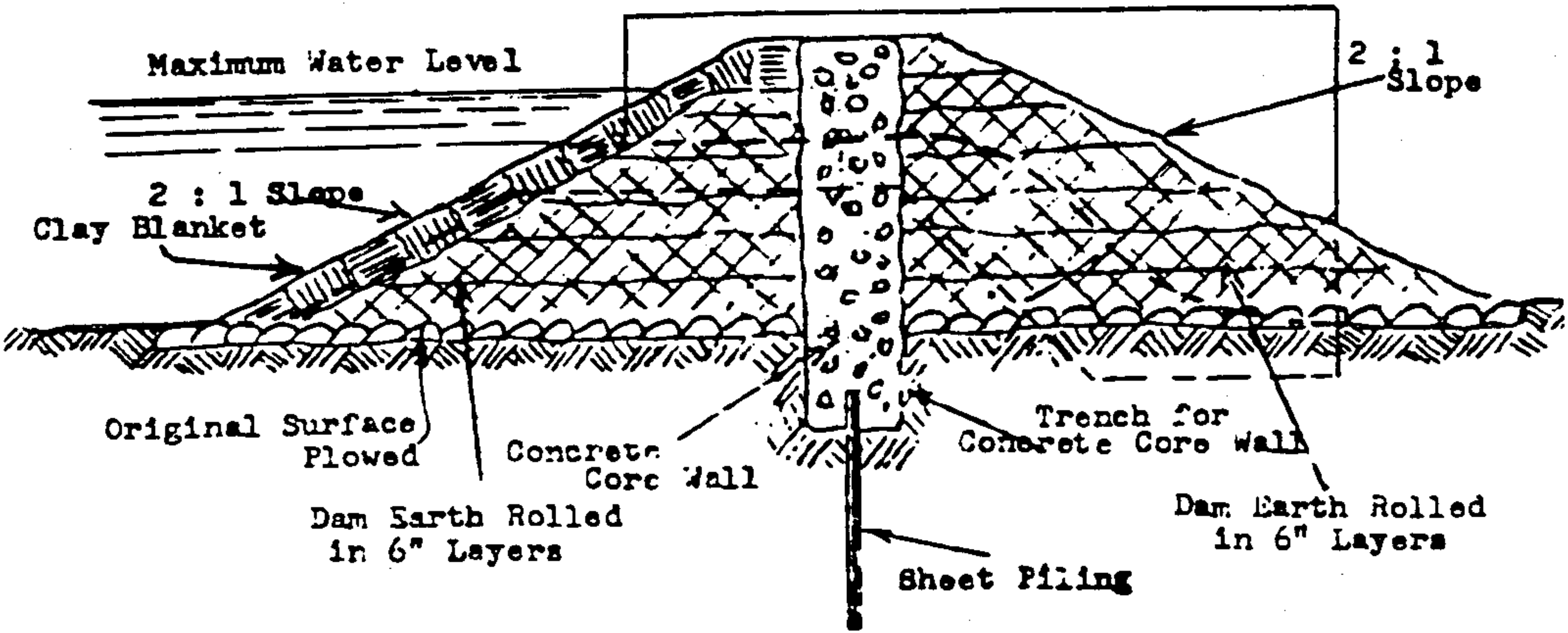


Figure 16. Earth-fill dam

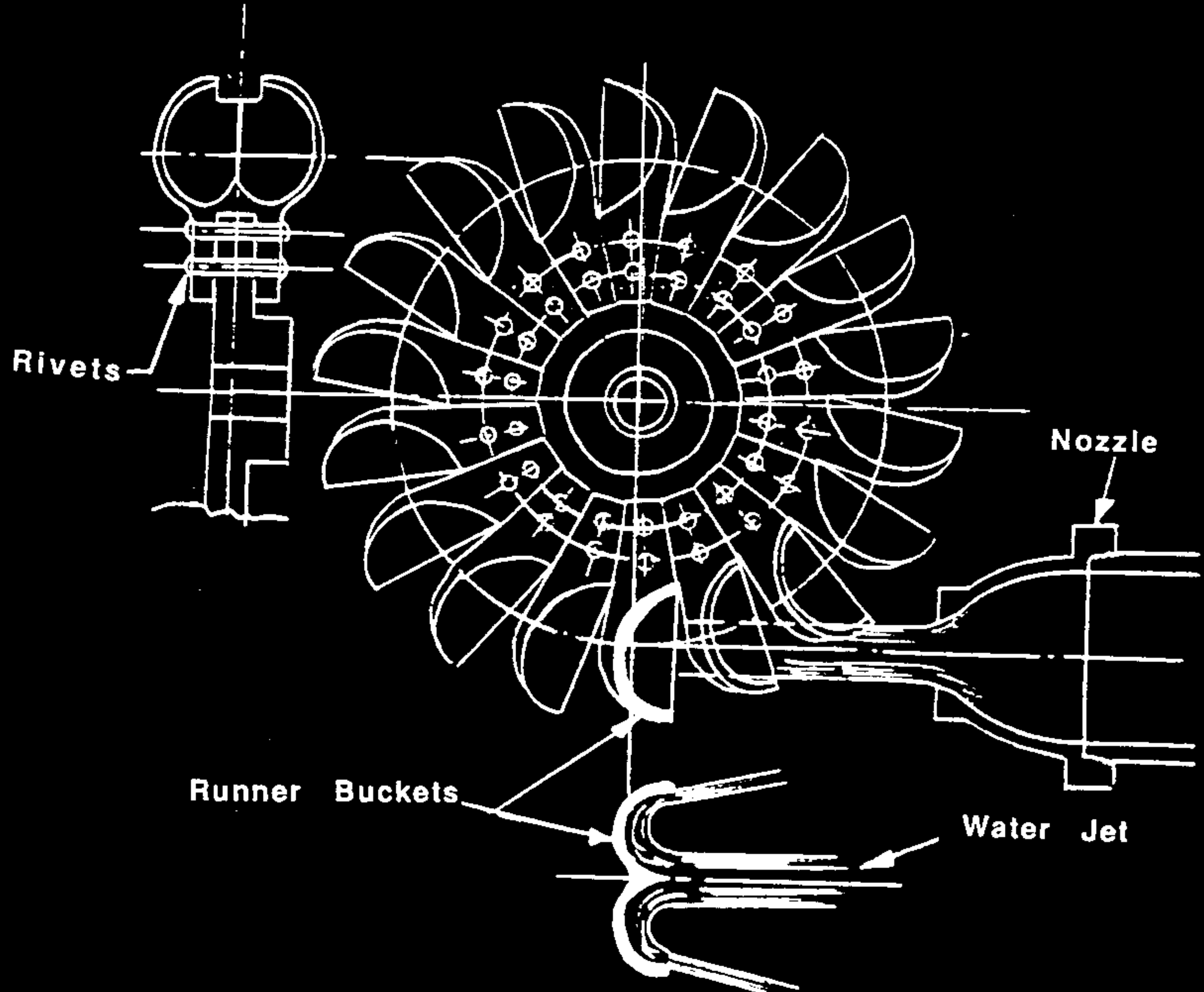


Figure 24. Small Impulse-Turbine Runner

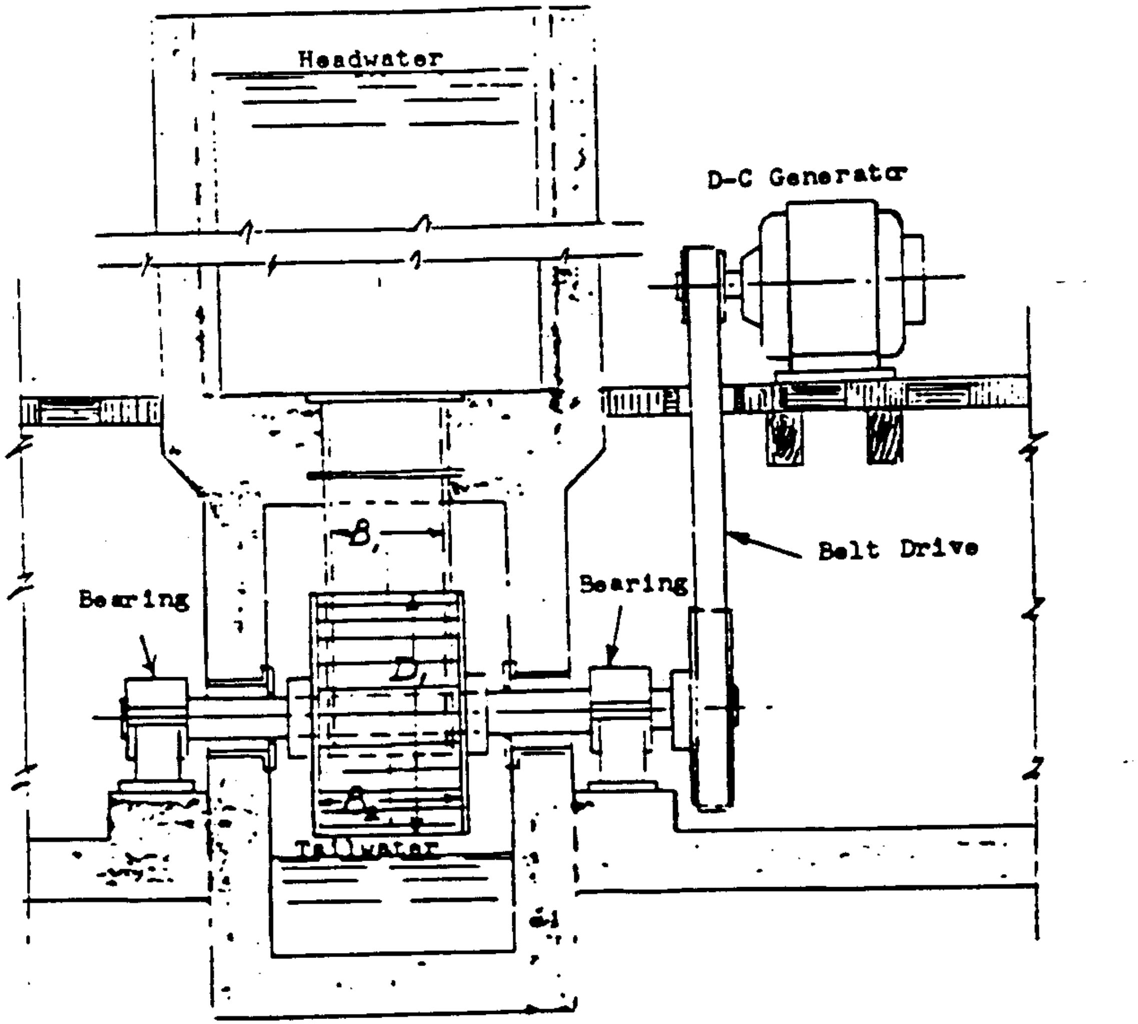


Figure 26. Arrangement of a Micnell (Banki) turbine for low-head use without control (B)

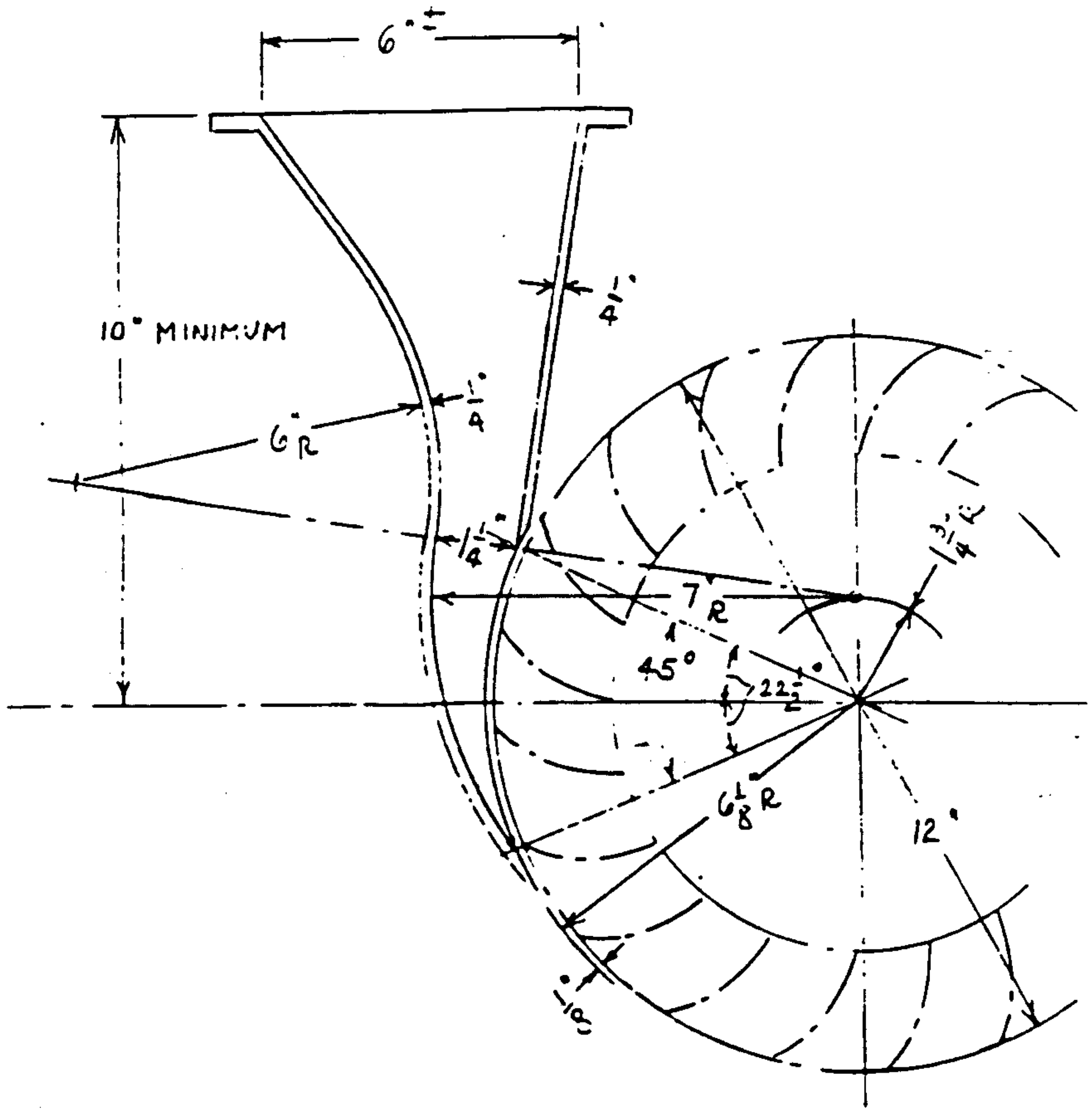


Figure 28. Detail of nozzle for 12-inch Michell runner

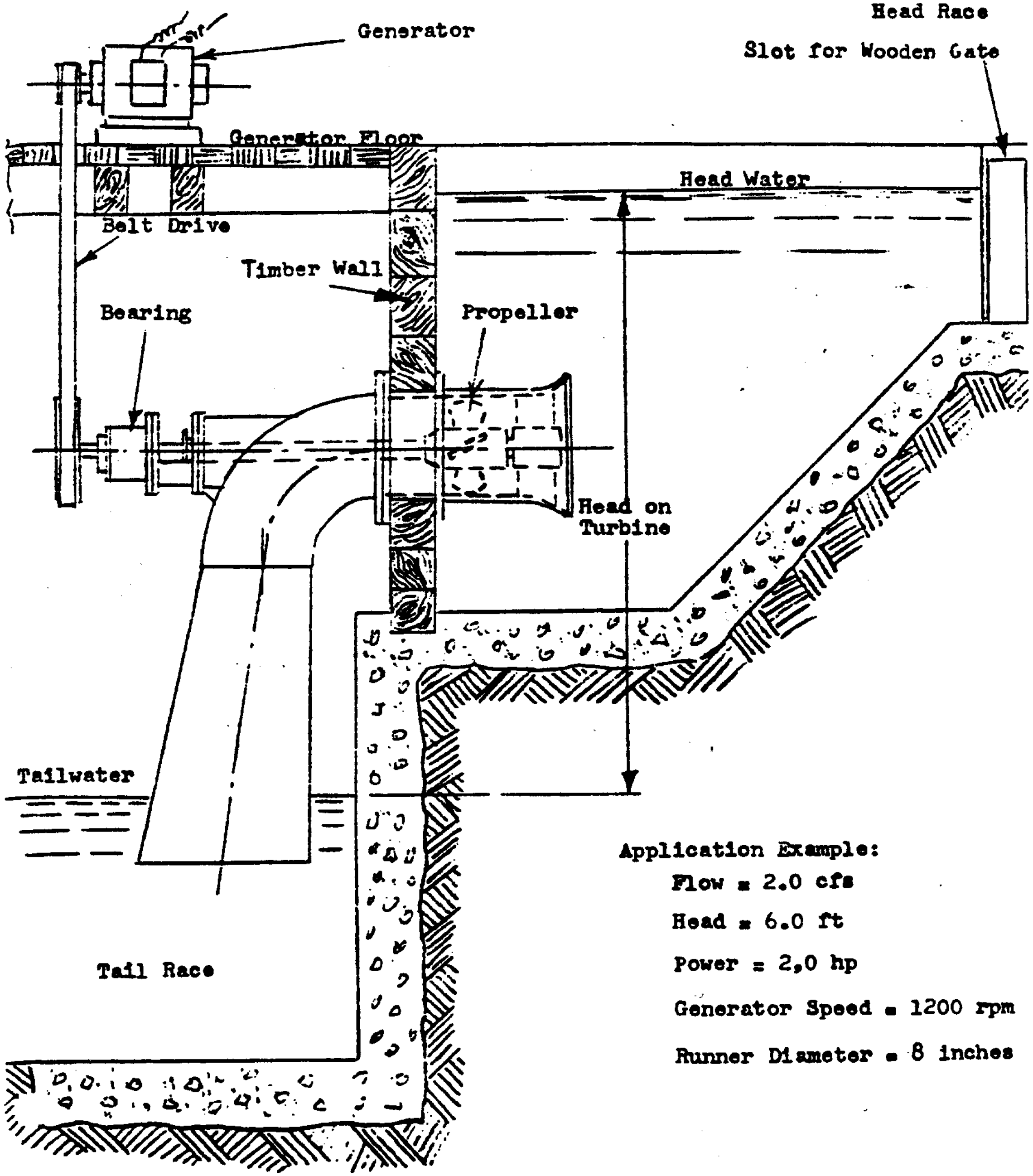


Figure 30. Simple Propeller Pump which, with reversed rotation, can function as Propeller Turbine

Materials Account

	Item	Cost Per Item	# Item	Total Costs
1				
2				
3				
4				
5				
			Total Costs	

Materials Account

Item	Cost Per Item	# Items	Total Costs
1			
2			
3			
4			
5			
		Total Costs	

Materials Account

Item	Cost	Reason Replaced	Date	Comments
1				
2				
3				
4				
5				
Totals (by week or month)				

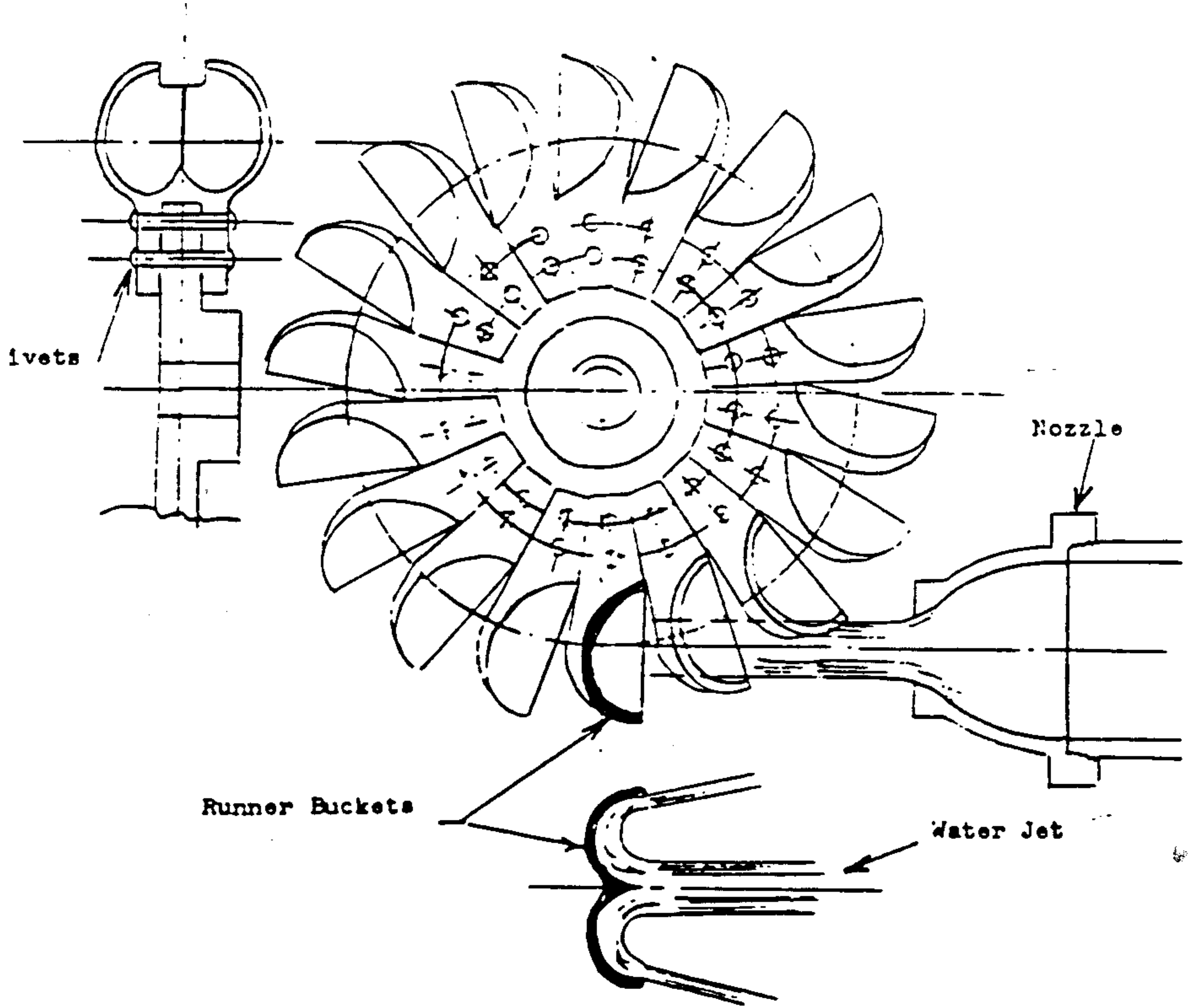


Figure 24. Small impulse-turbine runner

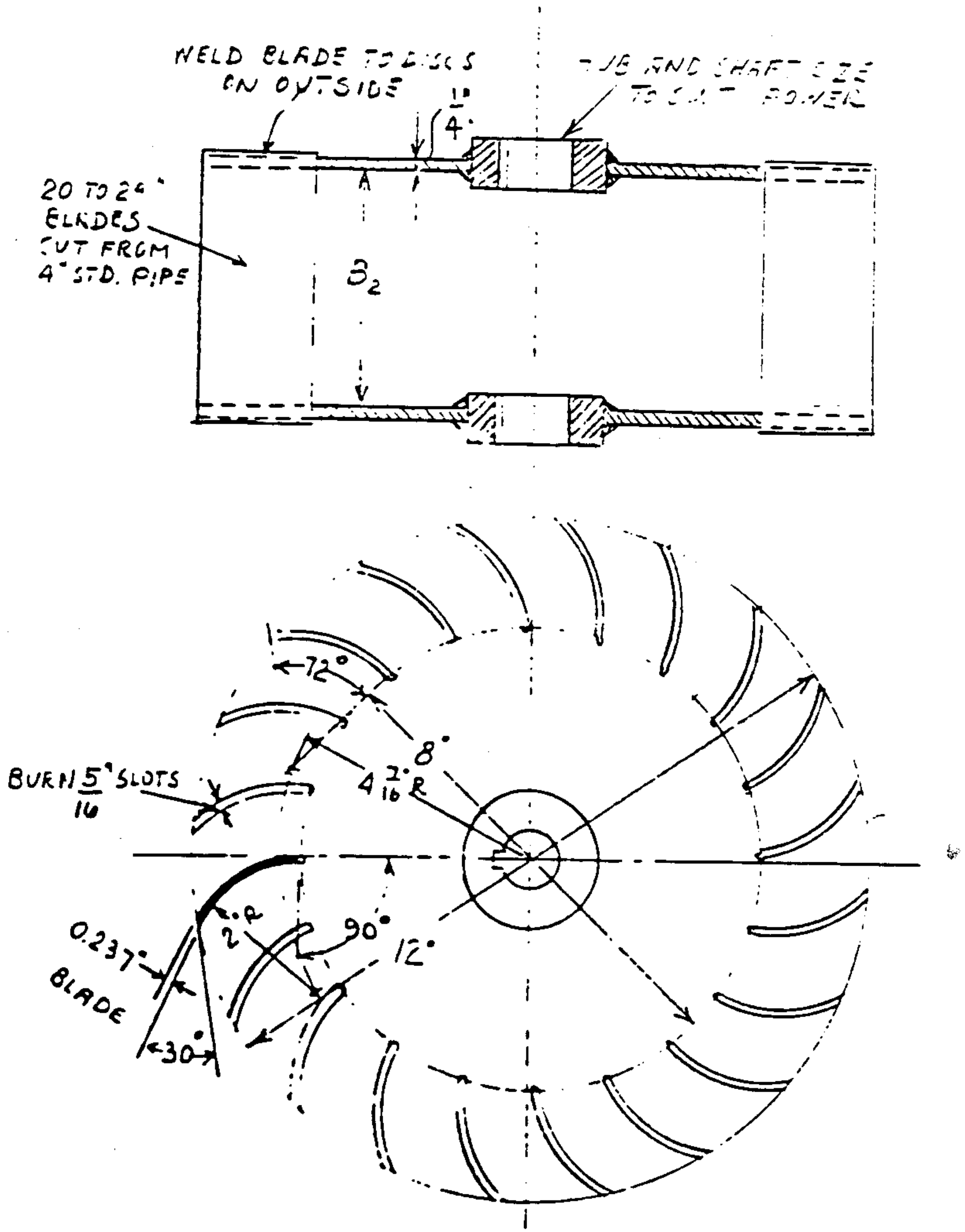


Figure 27. Detail of Michell runner, 12-inch size

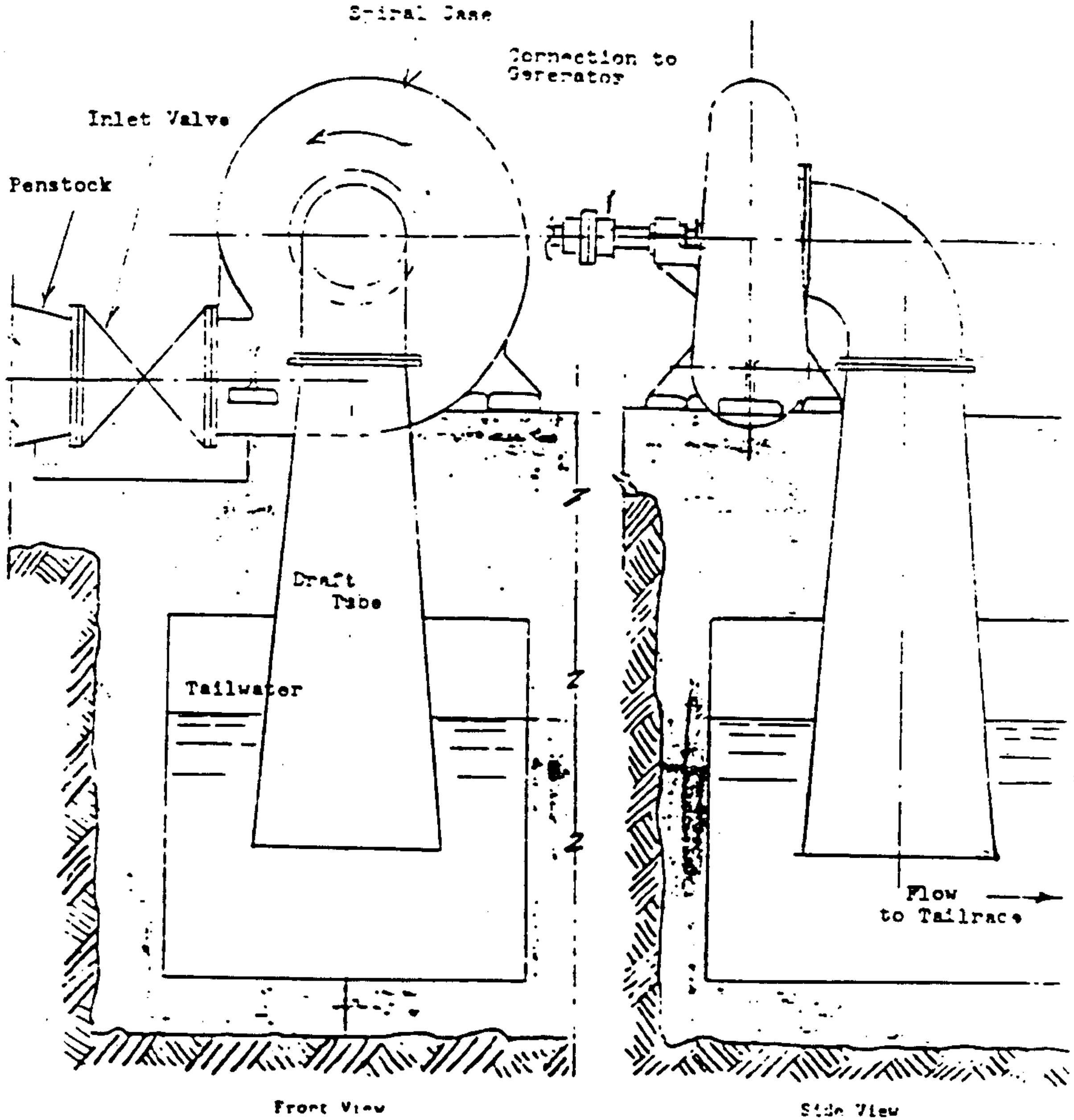


Figure 29. Centrifugal Pump which, with reversed rotation, can function as a Water Turbine

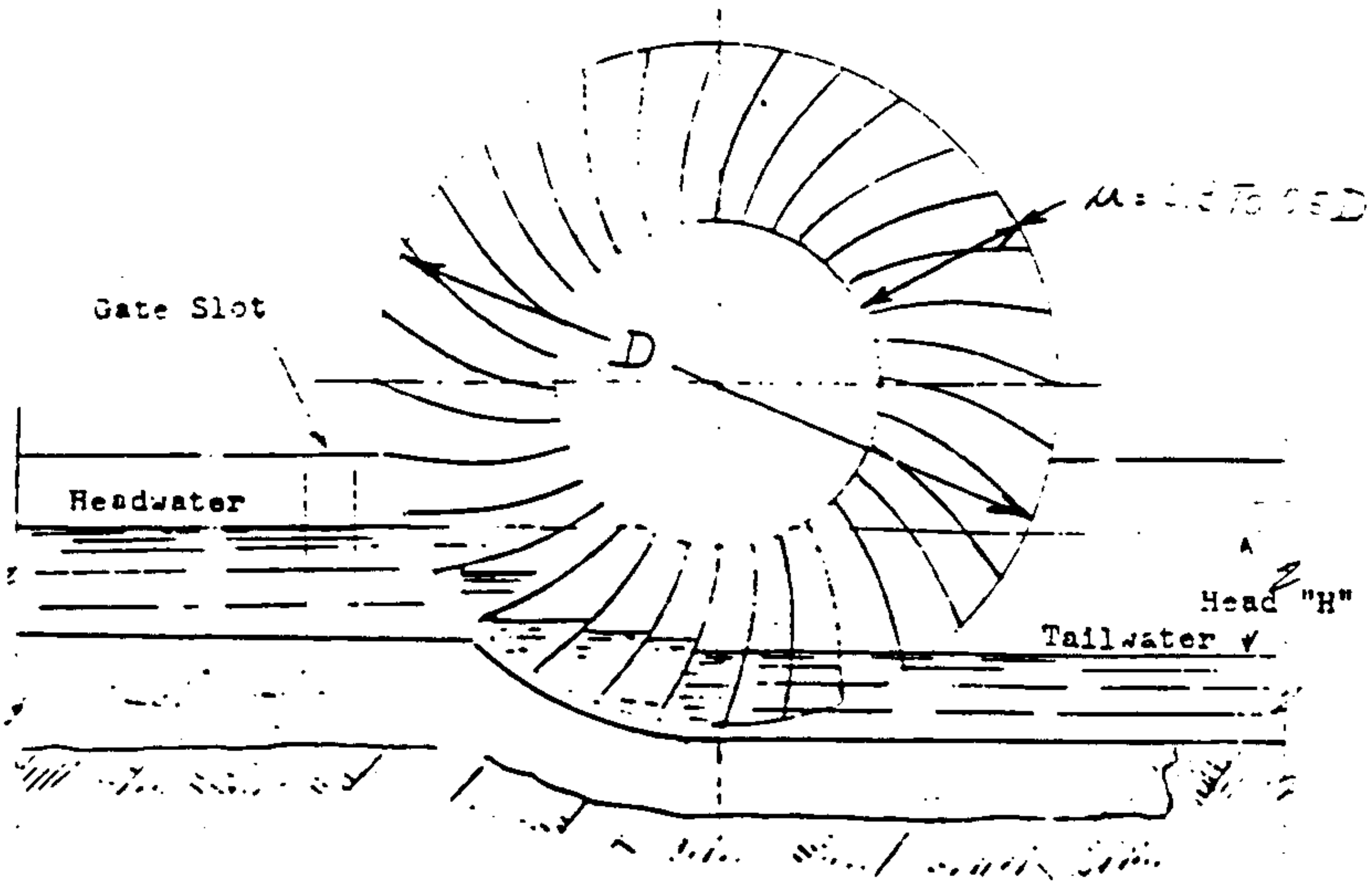
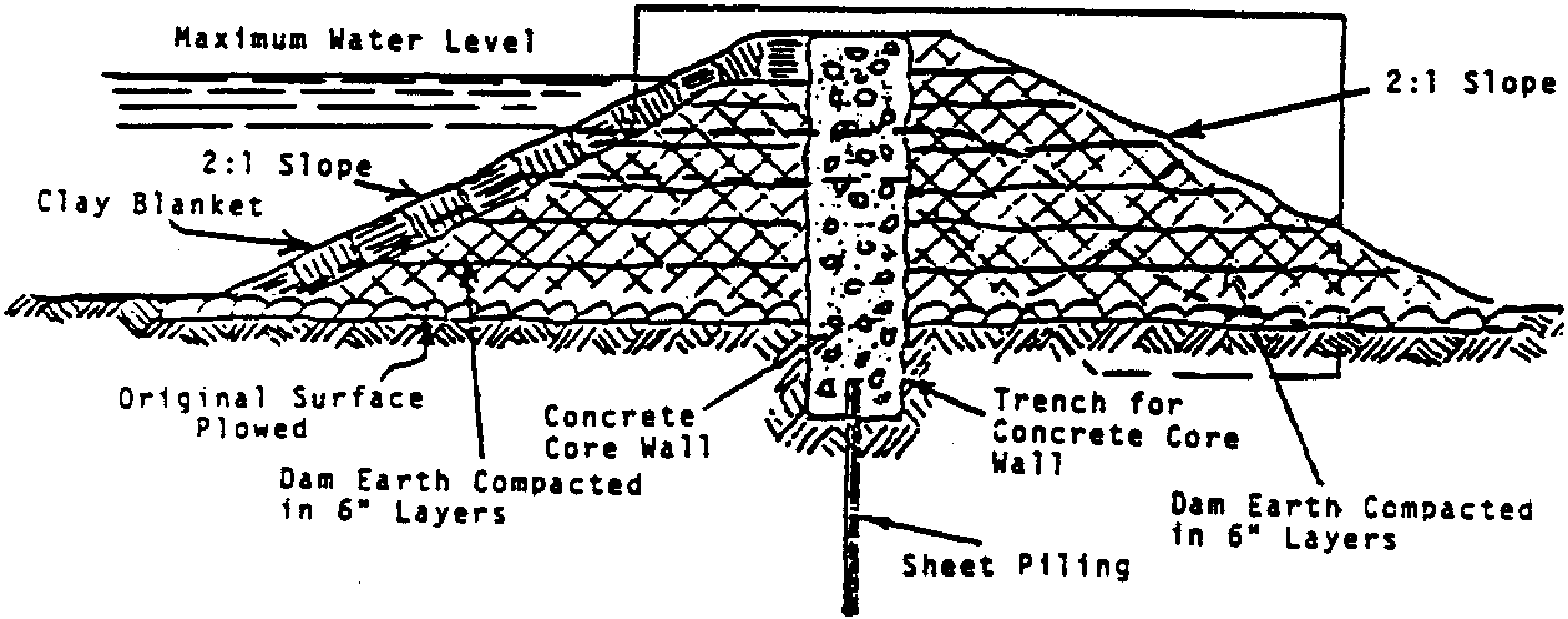
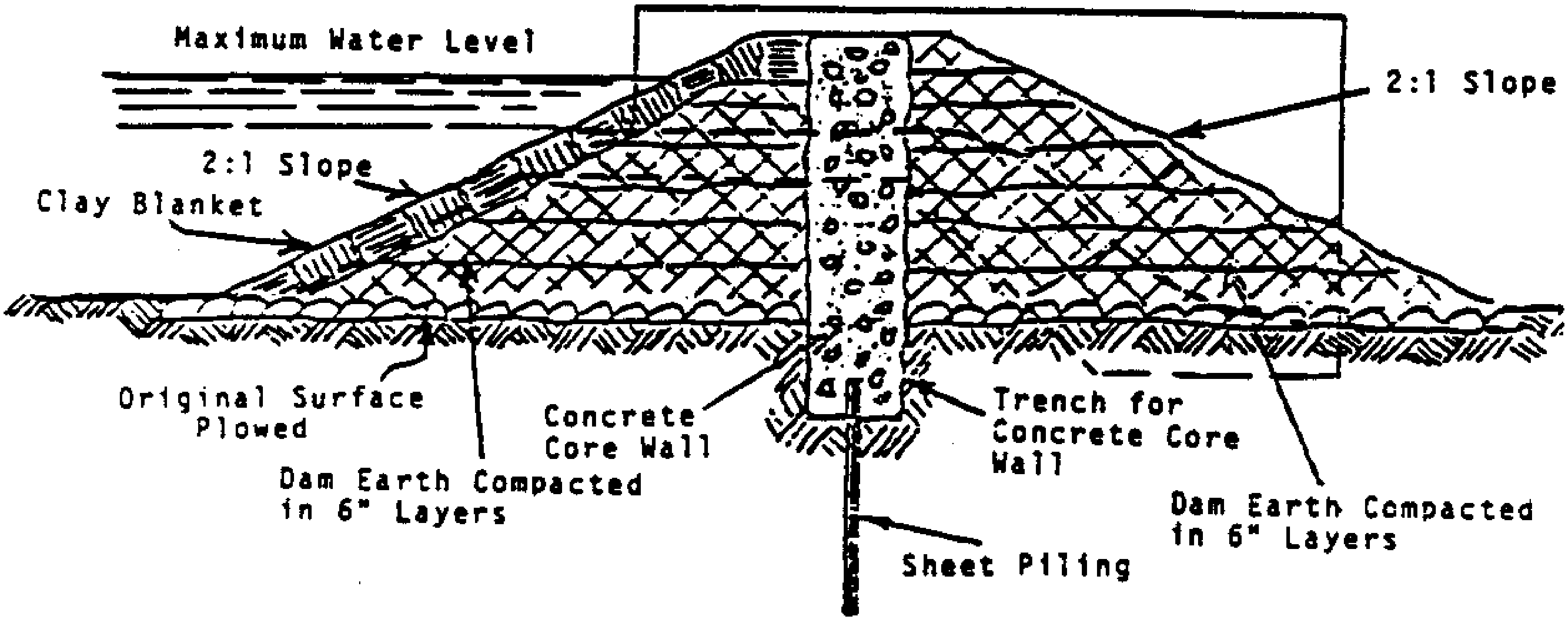


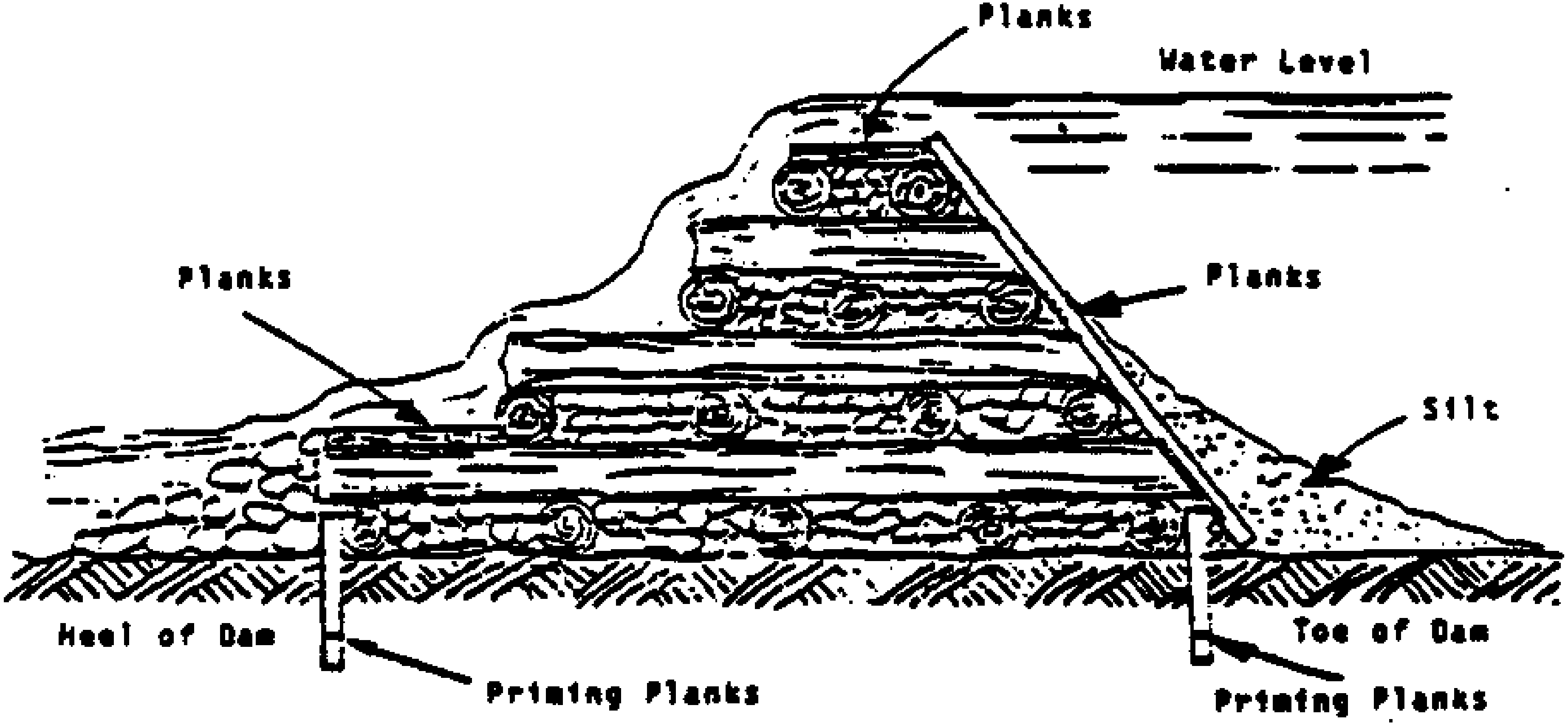
Figure 32. Undershot Water Wheel



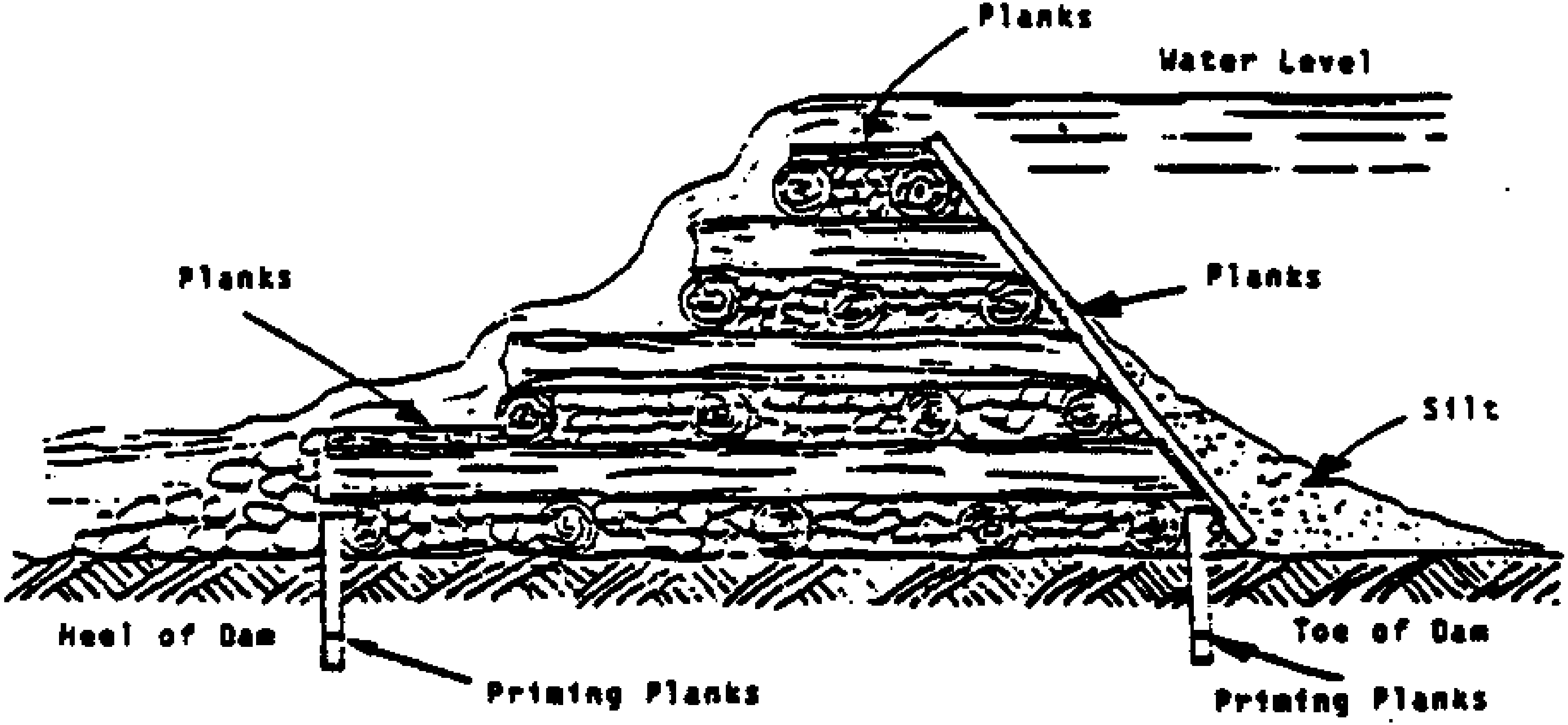
EARTH-FILL DAM



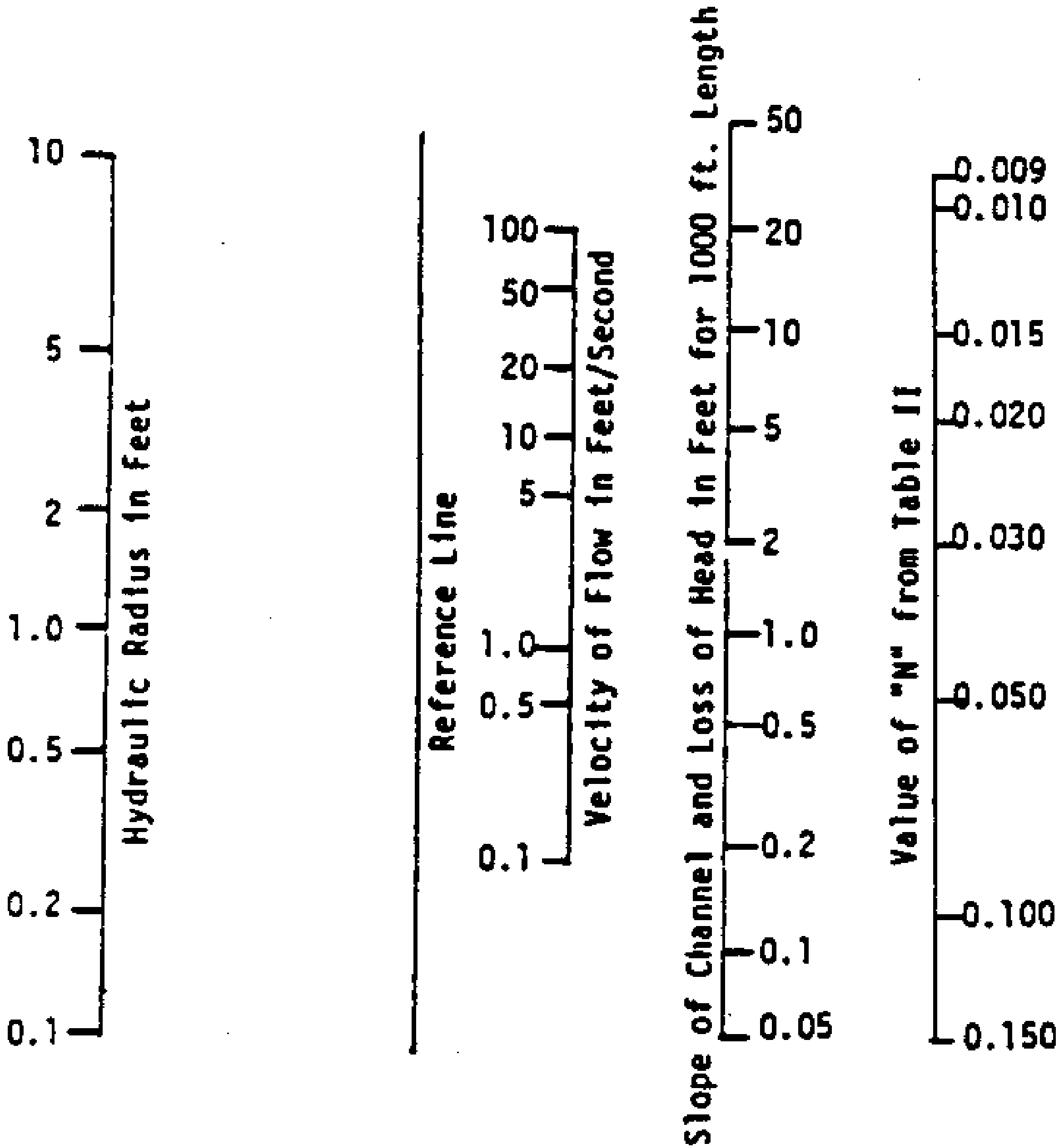
EARTH-FILL DAM



Crib Dam Without
Downstream Planking



Crib Dam Without
Downstream Planking



Fall of Channel (or Slope) in feet per 1000 feet of Channel Length

(The total fall is equal to the Loss of Head in Feet through the Channel)

Materials Account

	Item	Cost Per Item	# Items	Total Costs
1				
2				
3				
4				
5				
			Total Costs	

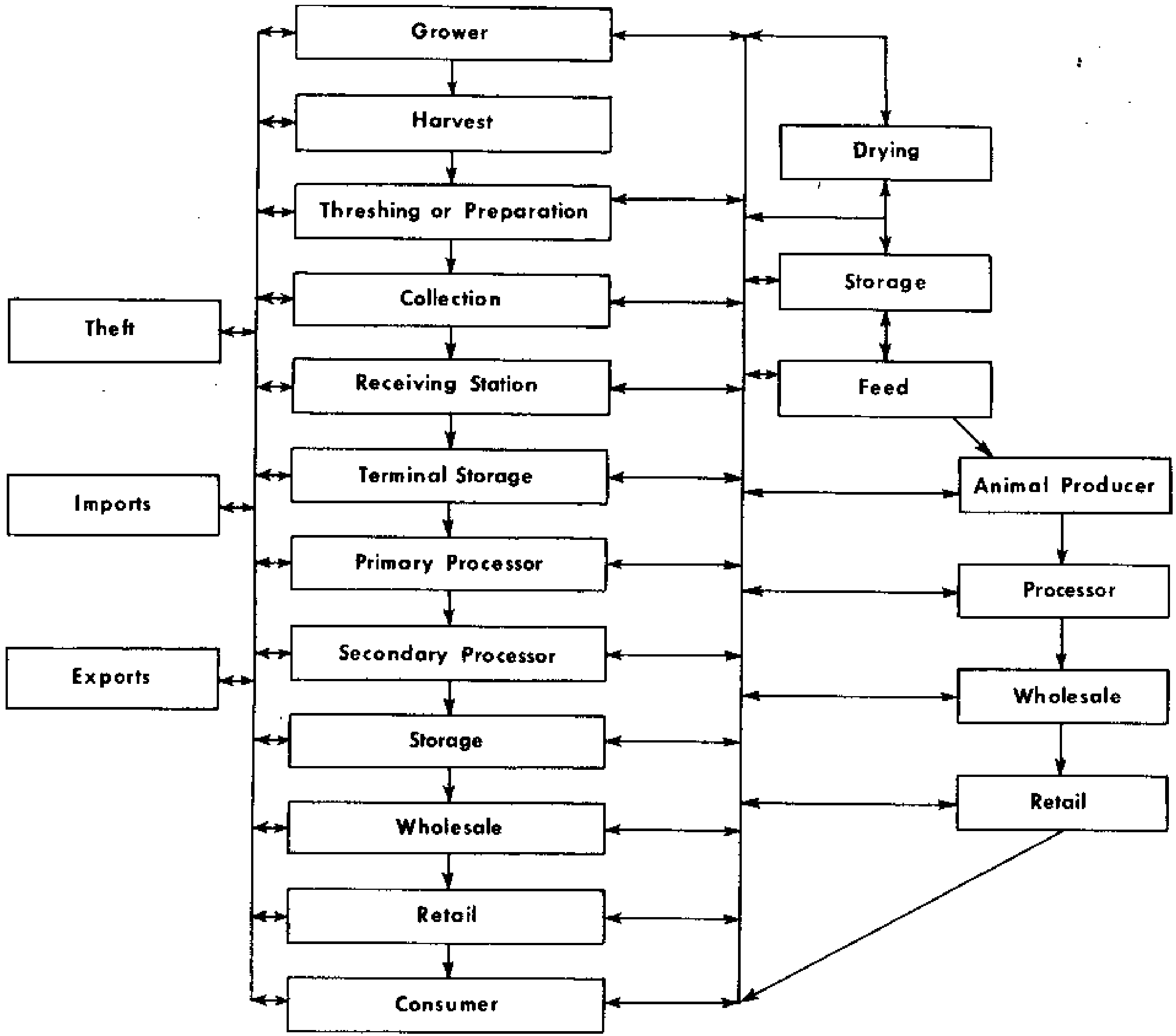


Fig. 4. Grain use flow patterns.

TABLE VIII *(continued)*

Details of Some Available Proprietary Moisture Meters

Meters Under Principles of Action		Power Supply	Test Speed	Accuracy (Within % MC)	Price Rating	Manufacturer/Supplier
Ec.2	Universal Moisture Tester	Self-germinating	1-5 min	0.2	Over £100	Burrows Equipment Co. 1316 Sherman Avenue Evanston, IL 60204 USA
Ec.3	Safe Crop Moisture Tester	Battery, Mains	1-5 min	0.5	£50-£100	
Ec.4	Agil Moisture Meter	Battery	Under 1 min	1.0-2.0	Under £50	Agil Ltd., Nicholson House Nicholson's Walk Maidenhead, Berks, England
Ec.5	Hart Moisture Meter K101, K103	Battery, Mains	Under 1 min	0.2	Over £100	Hart Moisture Meters, Inc. 400 Bayview Ave. Amityville, NY 11701 USA
Ec.6	'Hydraprobe' Copra Moisture Meter	Battery	Under 1 min	2.0	Under £50	Coe's (Derby) Ltd. Thirsk Place, Ascot Drive Derby DE2 8JL, England
Ec.7	Marconi Moisture Meter TF933B	Battery, Mains	1-5 min	0.5	£50-£100	Marconi Instruments Ltd. Longacre St. Albans, Herts, England
Ec.8	Protimeter Grainmaster	Battery	1-5 min	0.5	£50-£100	Protimeter Ltd. Field House Lane Marlow, Bucks, England
Ec.9	ScotMec-Oxley	Self-germinating	Under 1 min	1.0	£50-£100	Scottish Mechanical Light Industries Ltd. 42-44 Waggon Road Ayr, Scotland
Ec.10	Siemens Moisture Meter	Battery, Mains	1-5 min	0.5	Over £100	Siemens (UK) Ltd. Grt West House, Grt West Rd Brentford, Middx, England

(continued on next page)

TABLE VIII *(continued)*

Details of Some Available Proprietary Moisture Meters

	Meters Under Principles of Action	Power Supply	Test Speed	Accuracy (Within % MC)	Price Rating	Manufacturer/Supplier
	DIELECTRIC CONSTANT (Ed)					
Ed.1	Cera Tester	Battery	Under 1 min	0.3	£50-£100	A/S N. Foss Electric 39 Roskildevej, 3400 Hillerød, Denmark
Ed.2	Kappa-Janes Moisture Meter	Battery, Mains	1-5 min	0.5	Over £100	Kappa Janes Electronics 27 Stewart Avenue Shepperton, Middx, England
Ed.3	Burrows Moisture Recorder	Mains	Over 5 min	0.3	Over £100	Burrows Equipment Co. 1316 Sherman Ave. Evanston, IL 60204 USA
Ed.4	Lippke Moisture Meter FK-R-6	Mains	Under 1 min	0.5	Over £100	Paul Lippke K.G. 545 PO Box 1760 Neuwied, Germany
Ed.5	Wile	Battery	1-5 min	1.0	Under £50	OY Fima Ltd. Helsinki 70, Finland
Ed.6	Super-Matic Foss	Mains	1-5 min	0.3	Over £100	A/S N. Foss Electric 39 Roskildevej, 3400 Hillerød, Denmark
Ed.7	Transhygrolair	Battery	...	1.0	Under £50	Les Applications Industrielles de la Radio 236 Chemin des Vitarelles Tournefeuille (31), France
Ed.8	Steinlite Meters	Battery, Mains	1-5 min	0.3	Over £100	Seedburo Equipment Co. 618 West Jackson Boulevard Chicago, IL 60606 USA
Ed.9	Dole 300 Moisture Tester	Battery, Mains	Under 1 min	...	£50-£100	Eaton Yale & Towne Inc. Dole Division, 191 E. North Ave. Carol Stream, IL 60187 USA

(continued on next page)

TABLE VIII *(continued)*

Details of Some Available Proprietary Moisture Meters

	Meters Under Principles of Action	Power Supply	Test Speed	Accuracy (Within % MC)	Price Rating	Manufacturer/Supplier
Ed.10	Cae Moisture Meter Model 919	Battery	Under 1 min	0.3	£50-£100	Canadian Aviation Electronics Ltd. Winnipeg 4, Canada
Ed.11	G-c-Wyndham Moisture Meter	Battery	Under 1 min	0.5-1.0	Under £50	E.J. Chapman & Co. Ltd. Martley, Worcester, England
Ed.12	C.D.C. Automatic Moisture Meters	Mains	Under 1 min	0.3	Over £100	Compagne des Compteurs (GB) Ltd. Terminal House, Grosvenor Gdns. London SW1, England
	Hyb 24, Hyb 25 Hyb 42, Hyb 43	Battery	Under 1 min	0.5	Over £100	
	INTER-GRANULAR RH (H)					
H.1	Dip-Shaft Humidity Indicator	None required	Over 5 min	1.0	Under £50	Abrax Inc. 179/15H Jamaica Ave. Jamaica, NY 11432 USA
H.2	Quicktest Models 1 and 2	None required	Over 5 min	1.0	Under £50	Opancol Ltd. 10/11 Gamage Building Holborn Circus London EC1, England

[a] All information in this table has come from manufacturers. The exclusion of an instrument from this table does not necessarily imply the author's disapproval of its use with agricultural produce.

TABLE IX

Commodities and Some Candidate Moisture Meters[a]

Meter Ref. No.[b]	Moisture Meter	Range of Produce Moisture Content[c] (%)	Sample Size[d] (g)	Commodities (+) Beans	Cashewnut	Cereals and Products	Cocoa Beans and Products	Coconut (Copra)	Coconut Desiccated	Coffee Beans	Cottonseed	Cowpeas/Peas/Grams	Dried Fruit and Nuts	Fishmeal/Shreds	Groundnut	Horticultural Seed	Milk Powder	Palm Kernel	Sesame or Benniseed	Soya Bean	Sunflower Seed	Tea	Tobacco
C.1	Speedy	0-50	S-M			+										+							
D.1	X17 Agat Moisture Meter	M	M			+																	
D.2	Cenco Moisture Balance	M	S-M			+	+			+	+					+	+			+			+
D.3	Dynatronic IR Moisture Analyzer	M	S-M			+	+			+	+					+	+			+			
D.4	ts Crop Tester	M	L			+																	
D.5	Vacuum Moisture Tester	M	S			+																	
Ec.1	KPM Aqua Boy	2-30	L			+	+	+		+	+		+									+	+
Ec.2	Universal Moisture Tester	9-40	L	+		+					+				+	+		+					
Ec.3	Safe Crop Moisture Tester	11-30	. . .			+				+					+					+			
Ec.4	Agil Moisture Meter	14-30	L			+																	
Ec.5	Hart Moisture Meter K101, K103	Variable	M-L			+			+				+		+					+			+
Ec.6	'Hydraprobe' Copra Moisture Meter	4-14	M					+															
Ec.7	Marconi Moisture Meter TF933B	4-25	S	+		+				+		+	+		+								+
Ec.8	Protimeter Grainmaster	10-35	M-L			+																	
Ec.9	ScotMec-Oxley	10-25	L	+		+	+									+							
Ec.10	Siemens Moisture Tester	3-45	. . .			+																	+
Ed.1	Cera Tester	8-30	M			+				+				+	+	+		+	+	+	+		
Ed.2	Kappa-Janes Moisture Meter	0.5-60	L	+		+	+			+		+					+					+	+
Ed.3	Burrows Moisture Recorder	6-35	L	+		+				+		+			+					+	+		

(continued on next page)

TABLE IX *(continued)*

Commodities and Some Candidate Moisture Meters

Meter Ref. No.[b]	Moisture Meter	Range of Produce Moisture Content[c] (%)	Sample Size[d] (g)	Commodities (+)																			
				Beans	Cashewnut	Cereals and Products	Cocoa Beans and Products	Coconut (Copra)	Coconut Desiccated	Coffee Beans	Cottonseed	Cowpeas/Peas/Grams	Dried Fruit and Nuts	Fishmeal/Shreds	Groundnut	Horticultural Seed	Milk Powder	Palm Kernel	Sesame or Benniseed	Soya Bean	Sunflower Seed	Tea	Tobacco
Ed.4	Lippke Moisture Meter FK-R-6	0-20	L			+								+									+
Ed.5	Wile	10-34	M			+															+		
Ed.6	Super-Matic Foss	6-40	L	+		+				+		+			+				+	+	+		
Ed.7	Transhygrolair	9-40	L			+																	
Ed.8	Steinlite Meters	4-36	L	+	+	+							+		+	+							
Ed.9	Dole 300 Moisture Tester	6-30	M	+		+	+			+					+					+	+		
Ed.10	Cae Moisture Meter Model 919	9-25	L			+				+										+			
Ed.11	G-c-Wyndham Moisture Meter	10-30	L			+																	
Ed.12	C.D.C. Moisture Meters	5-35	L			+	+			+		+			+						+		
H.1	Dip-Shaft Humidity Indicator	M	L			+																	
H.2	Quicktest Models 1 and 2	M	L			+																	
	Least available number of meters			8	1	29	7	2	1	12	4	5	4	2	10	7	3	2	2	9	6	2	7

[a] All information in this table has come from manufacturers. The exclusion of an instrument from this table does not necessarily imply the author's disapproval of its use with agricultural produce.
[b] As used in Table VIII.
[c] M = Max. range encountered in practice.
[d] S = Small (under 10 g); M = moderate (10-100 g); L = large (above 100 g).

Stratified Random Sample

Strata

5 strata of 5 units each for a total of 25 units for potential sampling

I	II	III	IV	V
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5

1. The area or volume is divided into equal-sized larger units, each of which contains an equal number of smaller units.
2. The units are numbered equally in each stratum.
3. A unit for sampling from each stratum is selected by a table of random numbers (Appendix B).

Some advantages of this system are that locating sampling units is easier, it forces samples not to be grouped, and it gives a better estimate of variance since less clumping occurs.

LABORATORY PORTION

1. Data sheet for information to be collected from each ear.

Ear Number[a]	No. of kernels completely damaged: Insects	Fungi	Birds	Rats	No. of kernels partially damaged: Insects	Birds	Rats	Wet wt of Grain[b]
TOTALS								

[a] If ear selected (based on table of random numbers) is missing, leave blank all spaces to the right of ear number. Try to determine if each missing ear is the result of rodents, birds, dogs, or man. Record observations.

[b] Total weight of grain, insects, dust, etc. from each ear.

2. Total Wet Weight of grain collected (from lower right-hand box above)= ________ Wet wt

3. Combine the grain from all the ears, mix grain 3 times in a Boerner or Gamet Divider.

4. Fill the weight/volume vessel, then take the grain weight (g) and the percent moisture content (% mc) of the grain in the sample. Record data below:

	1	2	3	4	5	Av
Weight/Volume (g)						
Moisture content (%)						

Recombine samples and mix well.

Repeat above process 5 times and average, as indicated at right.

(Figure 11 continued)

5. Recombine samples and mix at least 3 times in a Boerner or Gamet Divider.

6. Divide down sample to obtain a series of subsamples, approx. 100 g.

7. Take weights of 100 undamaged kernels from 5 randomly selected subsamples and record data below:

	1	2	3	4	5	Av 100 kernel wt
Weight (g)						

8. Special notes on the samples:
   For instance, number of insects (immatures and adults) per sample, species of insects present, problems in handling sample (lost or broken samples), damaged container, or spoiled sample.

EXAMPLES OF CALCULATIONS BASED ON THE FIELD AND LABORATORY DATA GATHERED ABOVE

1. Average Wet Weight/ear = $\frac{\text{Total wet wt}}{\text{No. of ears collected}} = \frac{(\quad)}{(\quad)} =$ ______________.

2. Total Dry Weight = (Total wet wt) - [(Total wet wt) (Av % mc)

   Total dry wt = ( ) - [( )( )] = ______________.

3. Average Dry Weight/ear = $\frac{\text{Total dry wt}}{\text{No. ears collected}} = \frac{(\quad)}{(\quad)} =$ ______________.

4. Estimated wet weight corn yield/field = $(n)(\bar{x}_1)(\bar{x}_p)(\bar{x}WW/e)$

   field data No. 1 above

   ( )( )( )( ) = ______________.

5. Estimated dry weight corn yield/field = $(n)(\bar{x}_1 (\bar{x}_p)(\bar{x}DW/e)$

   field data No. 3 above

   ( )( )( )( ) = ______________.

6. For other calculations see chapters VI and VIII.

Fig. 11. Example of sample field/laboratory data sheet for maize.

Brand[b]	Model	Address	Price (U.S. $) March 1978	Automatic Weighing	Digital Display	Printout	Calibration by Manufacturer Only (Card)	Calibration by Manufacturer or User (Keyboard)	Sample Mass (g)	Power Source Mains Supply	Power Source Batteries	Weight (kg)
						Other Apparatus						
Cedem	HD 1000	See above	480	No	No	No	Yes	No	400	No	Yes	4
Foss-Electric	M.K.-I	See above	1,990	No	No	Yes	Yes		250	Yes	No	20
	Cera-Tester	See above	450	No	No	No	Yes		100	No	Yes	2
Chopin Tripette and Renaud	ERI-I	See above	670	No	No	No	...		10	Yes	No	10

[a]As summarized by J. L. Multon and G. Martin (see Chapter VI, Section F).
[b]All instruments use measurement of impedance of the grain, except the two ERAG ovens which use heat drying).

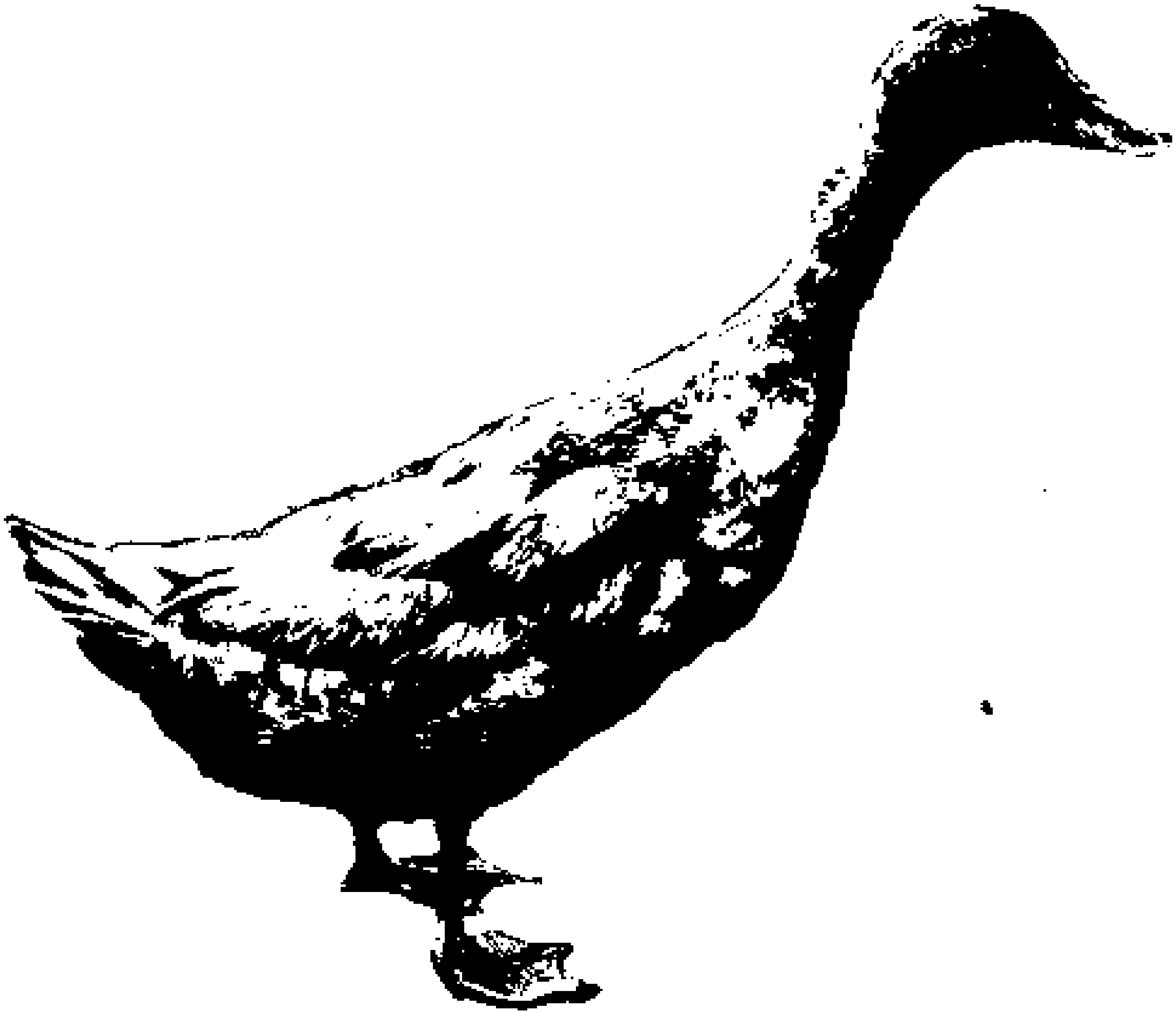
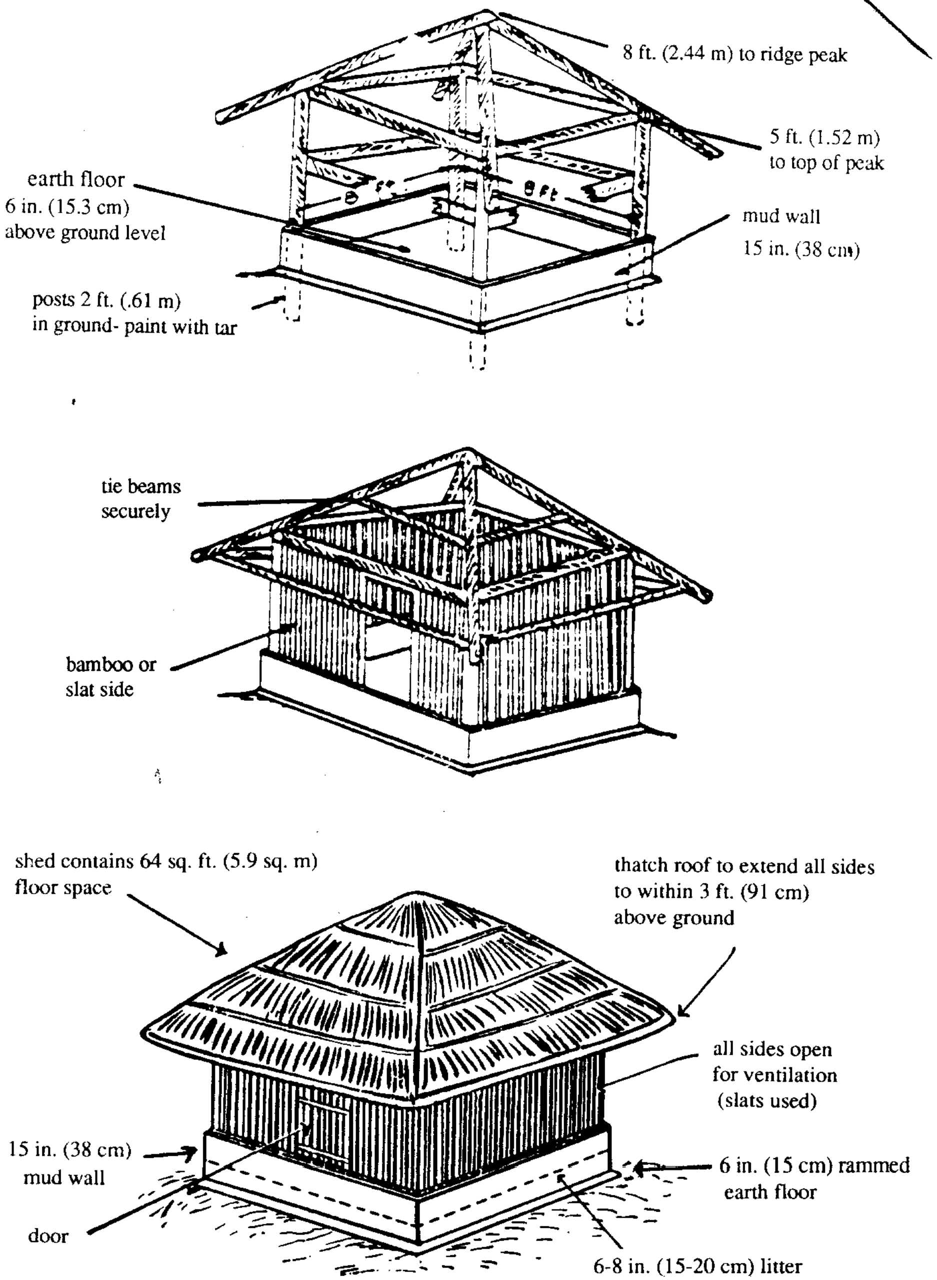
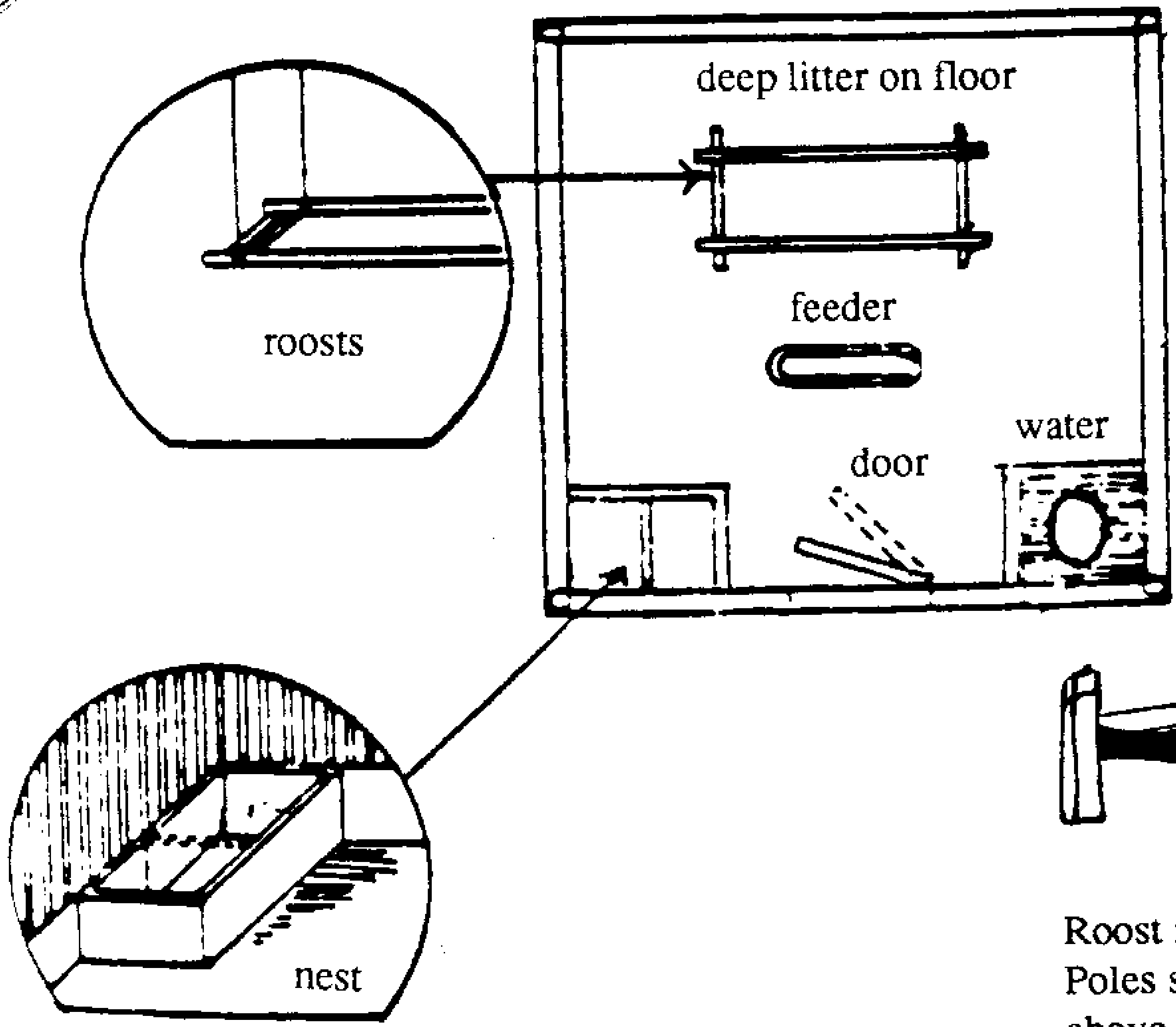


Figure 2

Improved ducks have longer legs and slender bodies.



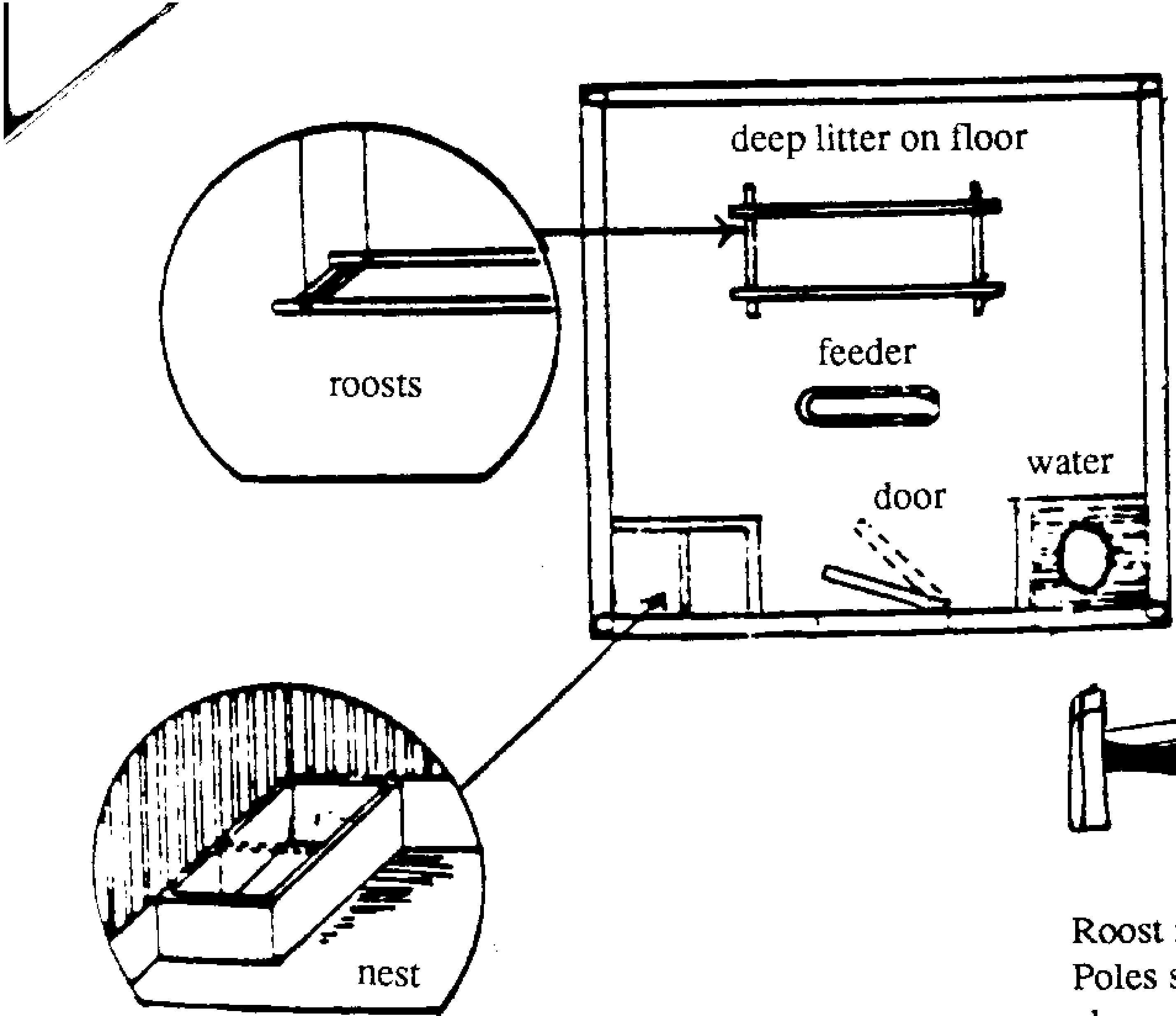
Figures 7
Building a deep-litter shed

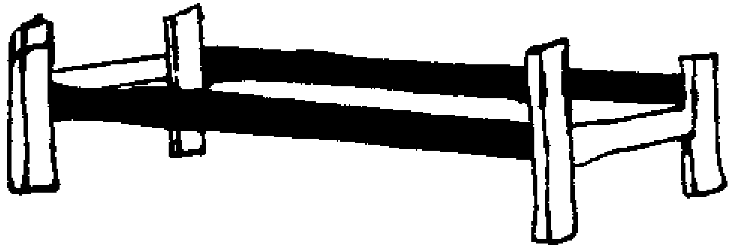


Roost is made with two 4 ft. (1.2 m) poles. Poles should be at least 2 ft. (.61 m) above the surface of the litter.

Figure 8

A diagram of the floor of a deep-litter shed.

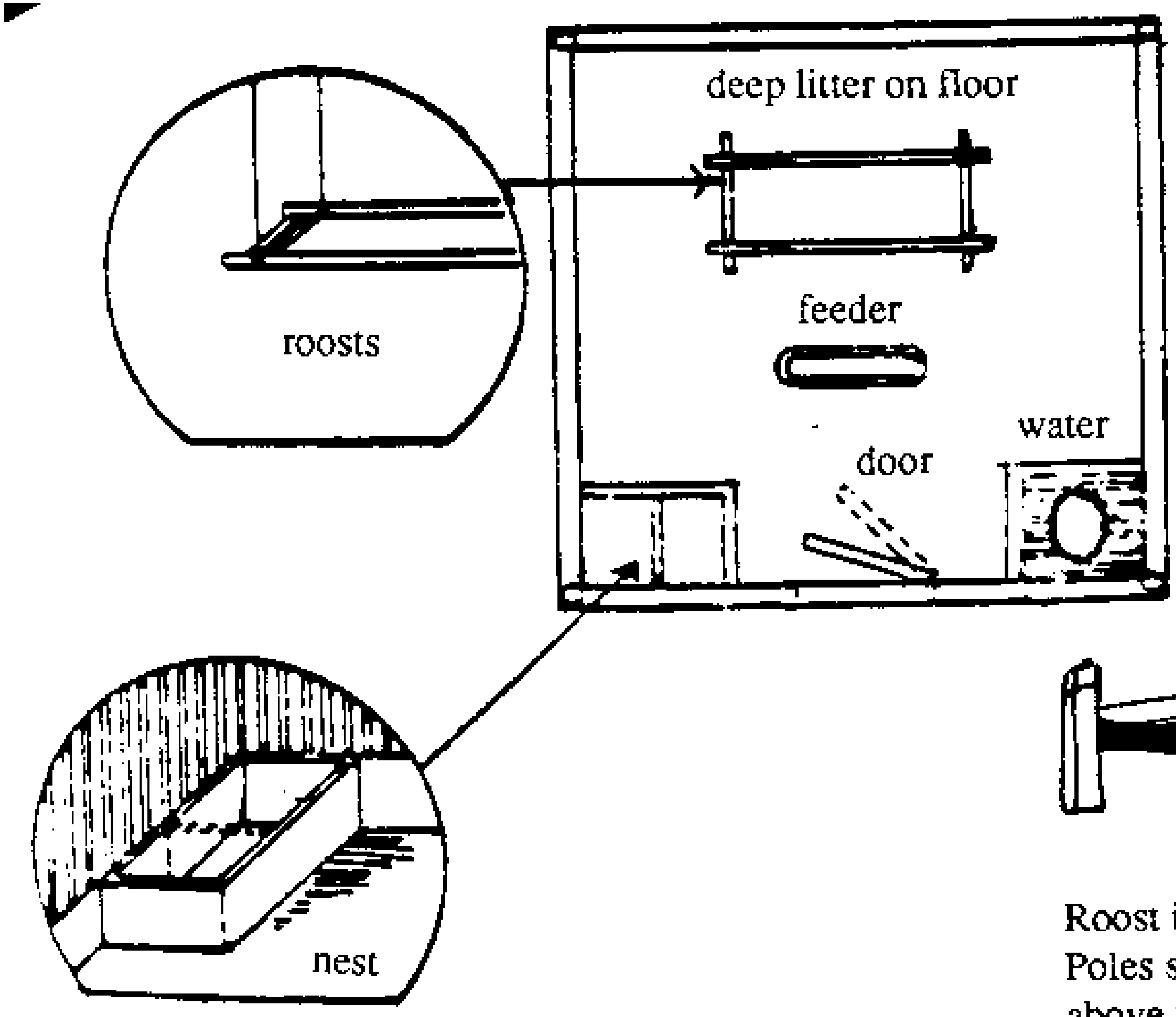




Roost is made with two 4 ft. (1.2 m) poles. Poles should be at least 2 ft. (.61 m) above the surface of the litter.

Figure 8

A diagram of the floor of a deep-litter shed.



Roost is made with two 4 ft. (1.2 m) poles. Poles should be at least 2 ft. (.61 m) above the surface of the litter.

Figure 8
A diagram of the floor of a deep-litter shed.

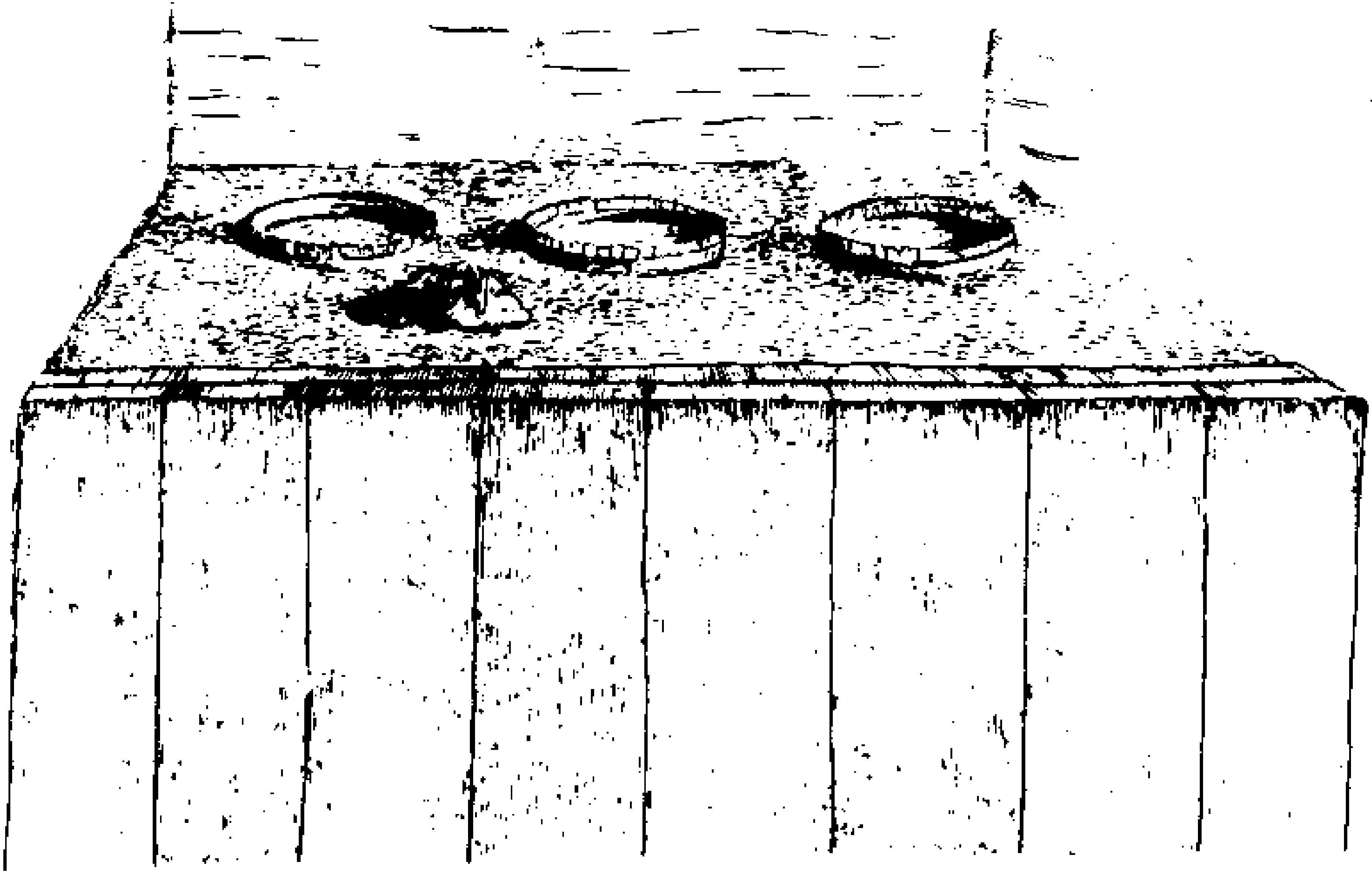


Figure 9b

Installing and insulating cylinders in incubation room.

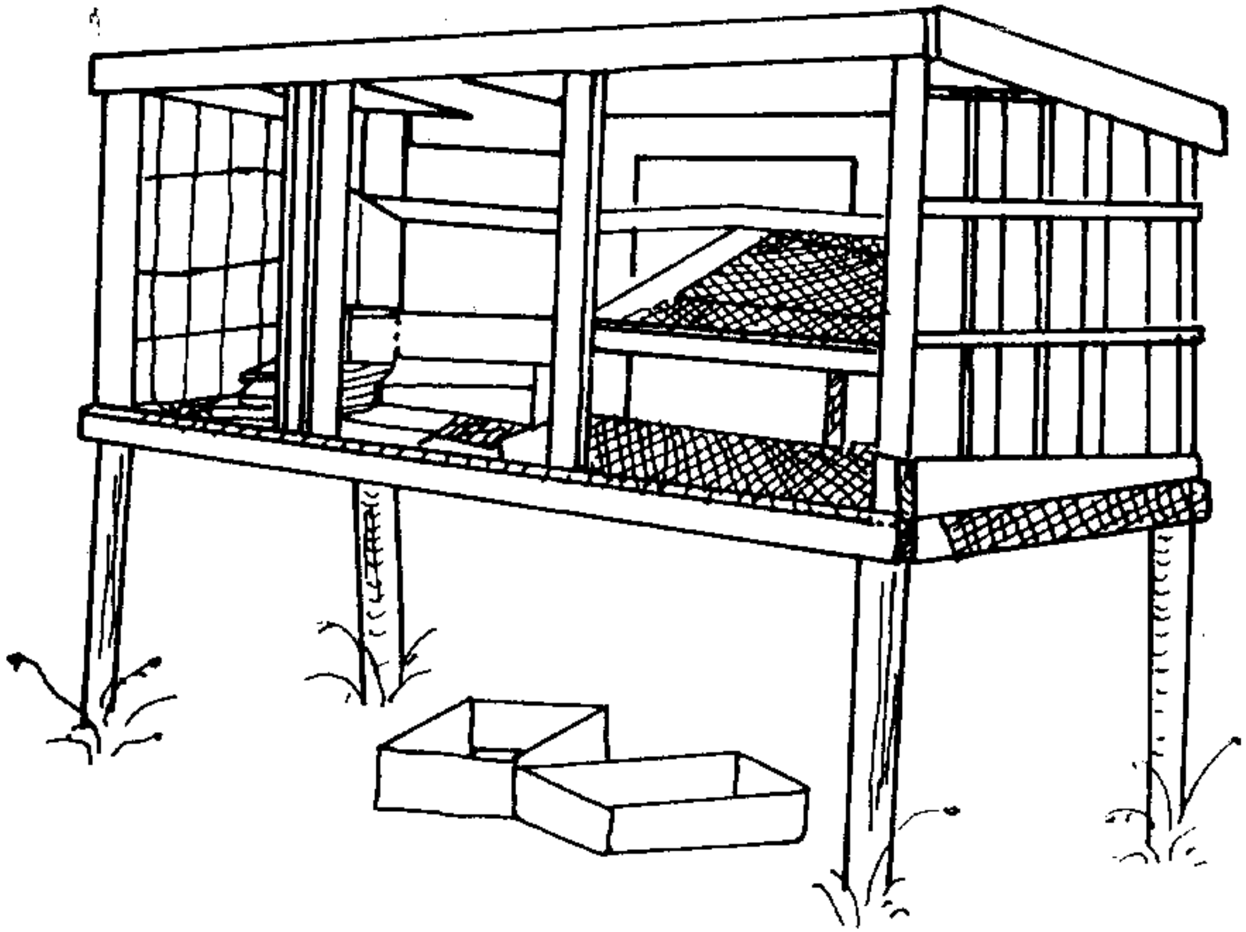


Figure 13
Building the colony cage

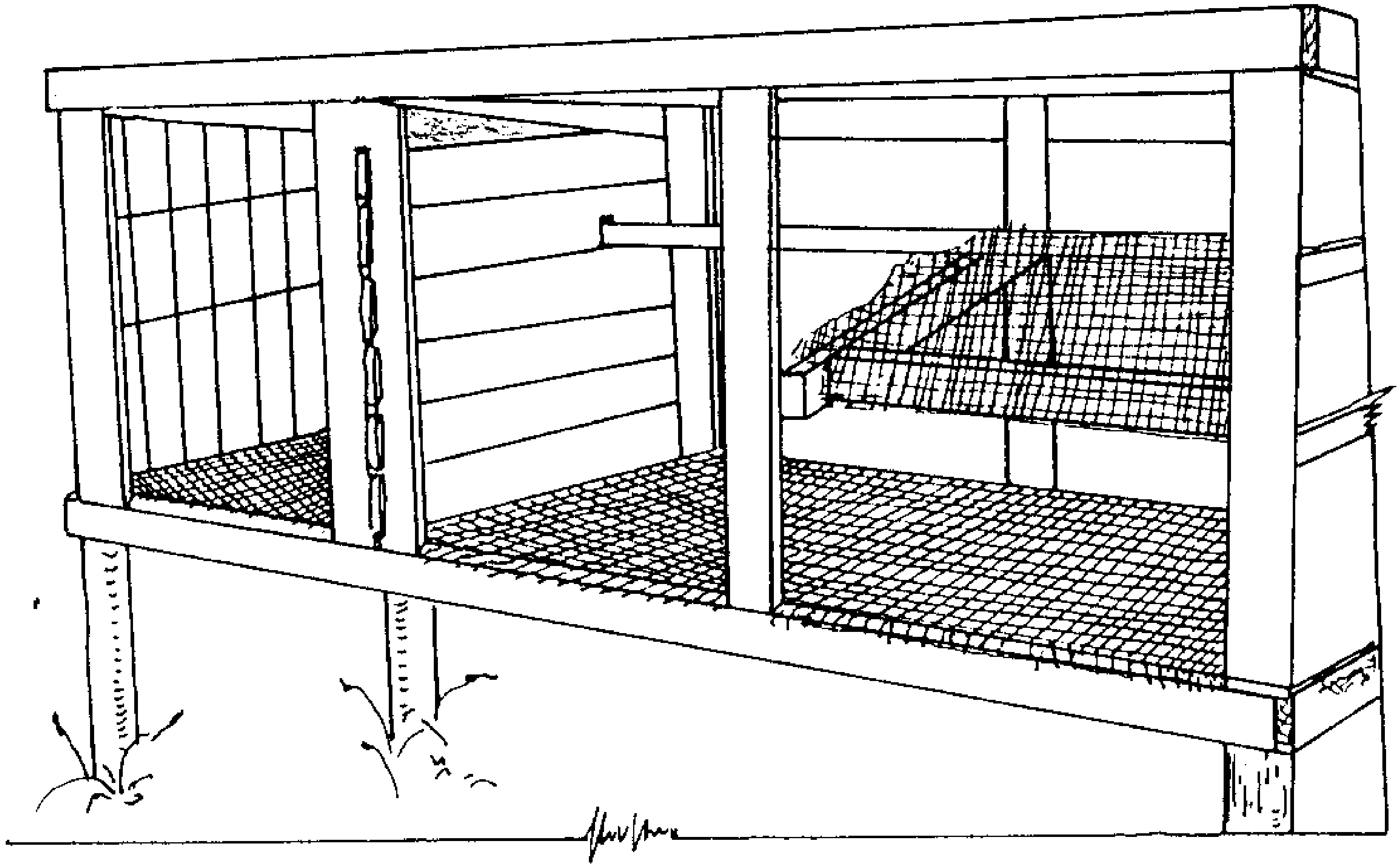
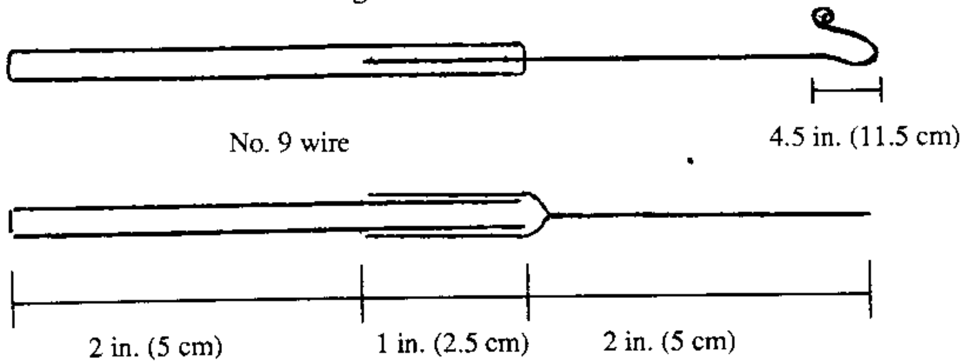


Figure 14

Note the removable wall and roost pole.

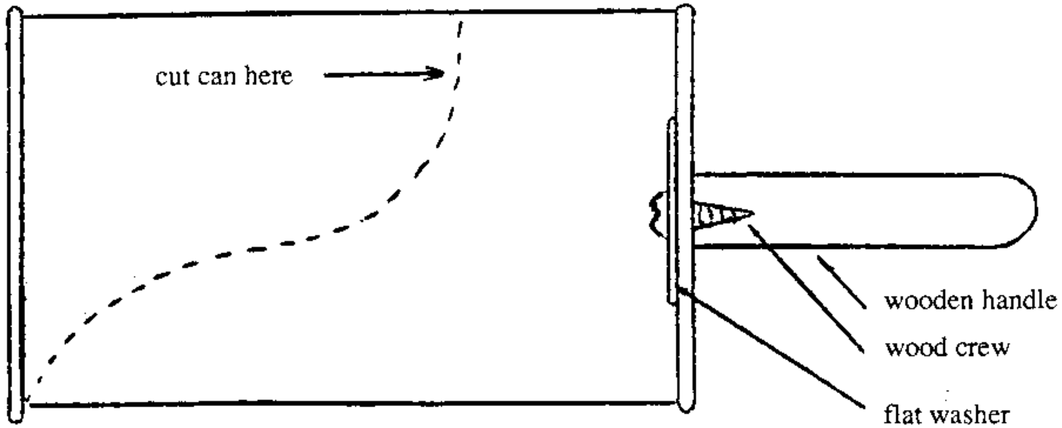
Catching Hook



Used to snag a leg and restrain a chicken.

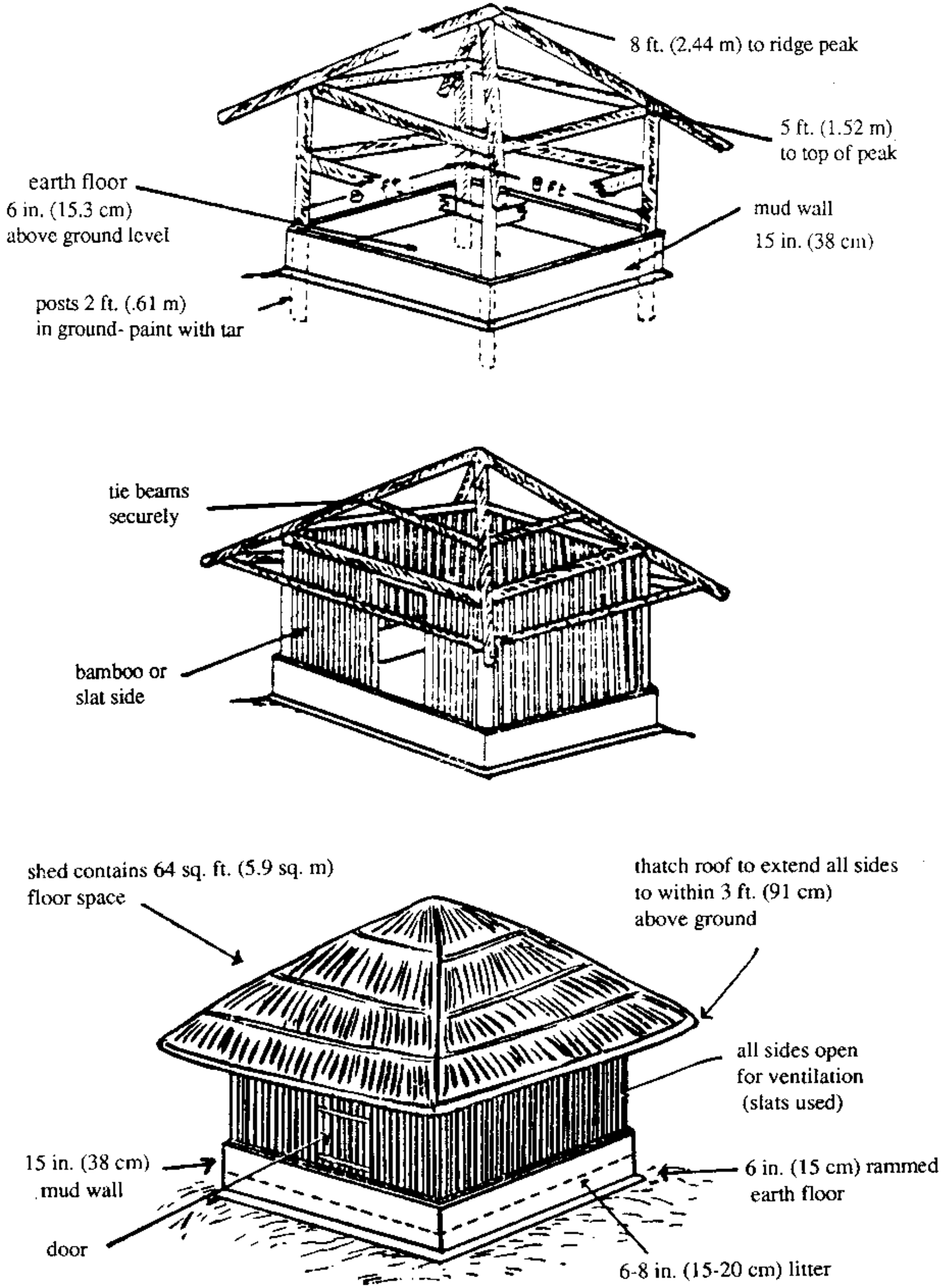
Grain Scoop

(cross section)



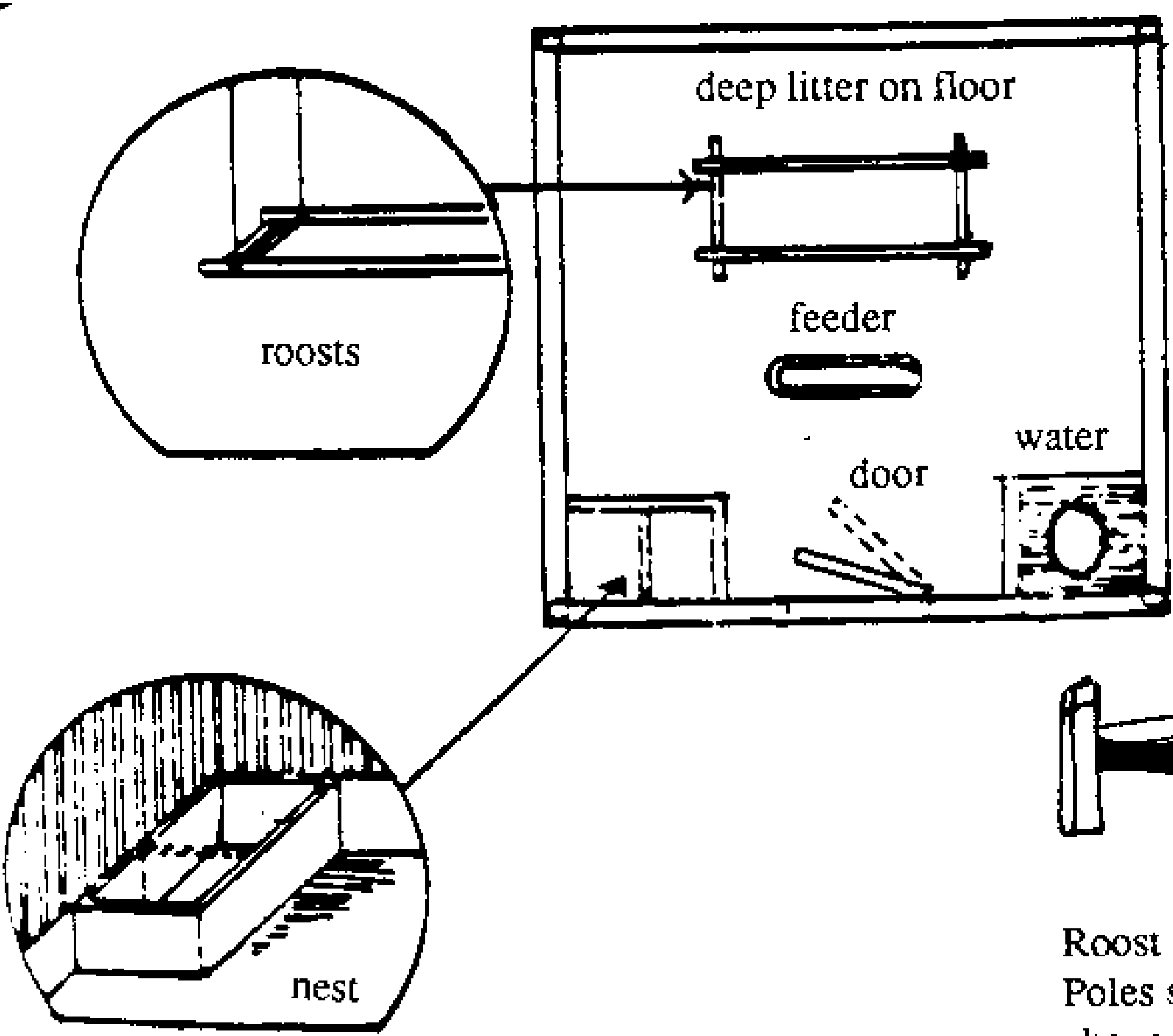
A grain scoop made from a tin can.

Figure 45
Miscellaneous Equipment
(Source: Krusch)



Figures 7

Building a deep-litter shed



Roost is made with two 4 ft. (1.2 m) poles. Poles should be at least 2 ft. (.61 m) above the surface of the litter.

Figure 8

A diagram of the floor of a deep-litter shed.

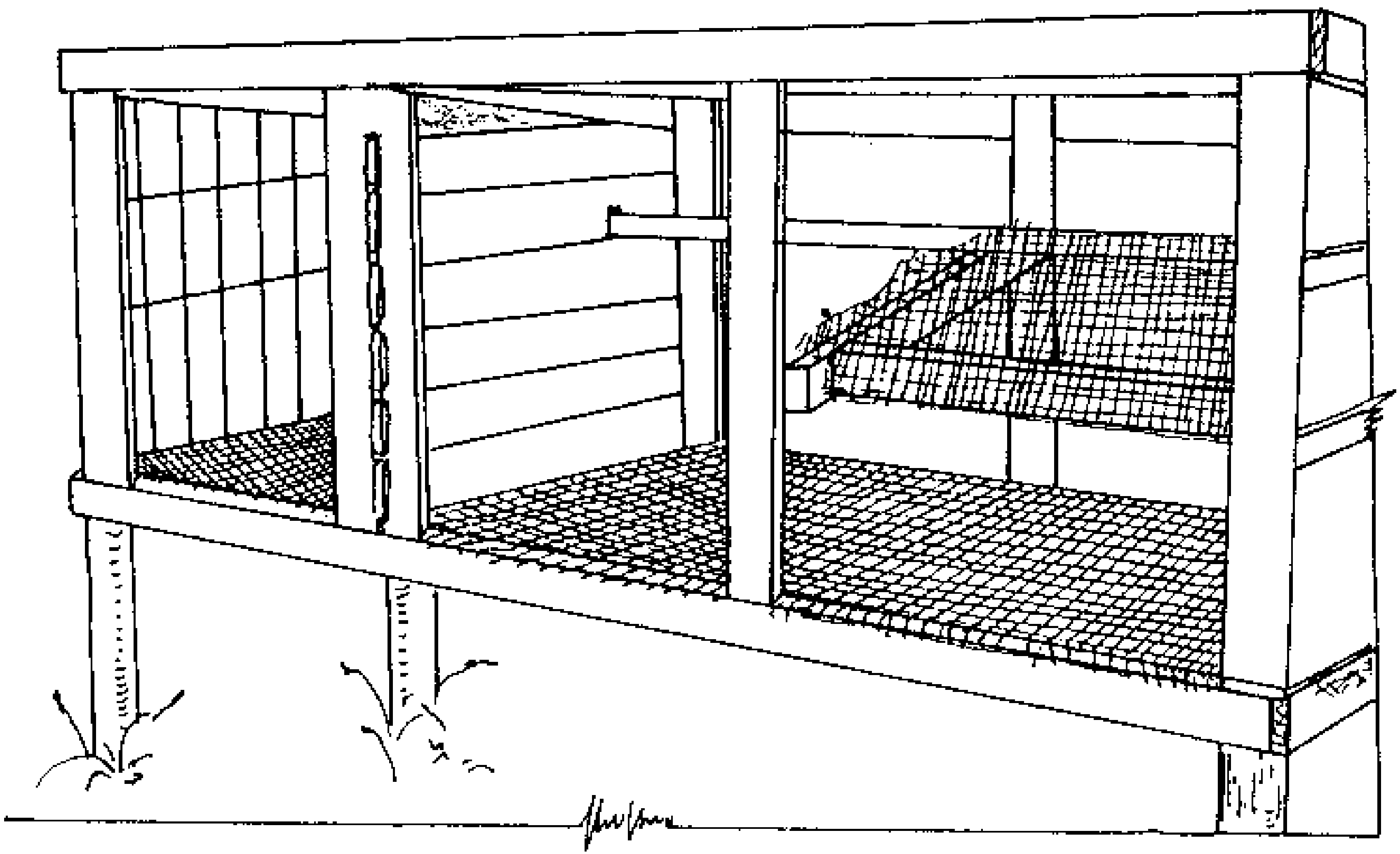


Figure 14

Note the removable wall and roost pole.

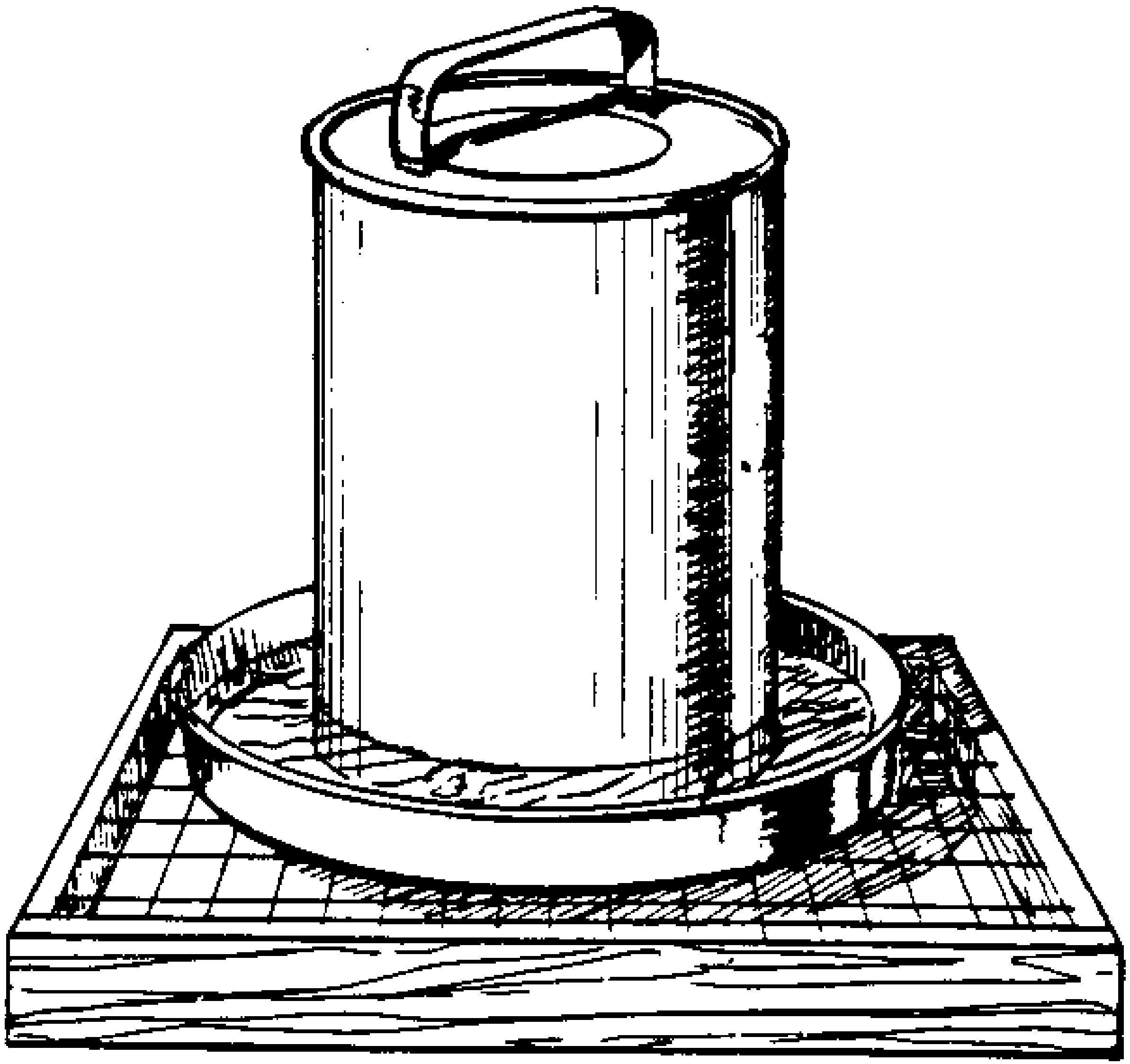


Figure 21

The completed waterer fitted with a convenient handle. Note the platform.

(Source: Mercia, 1990)

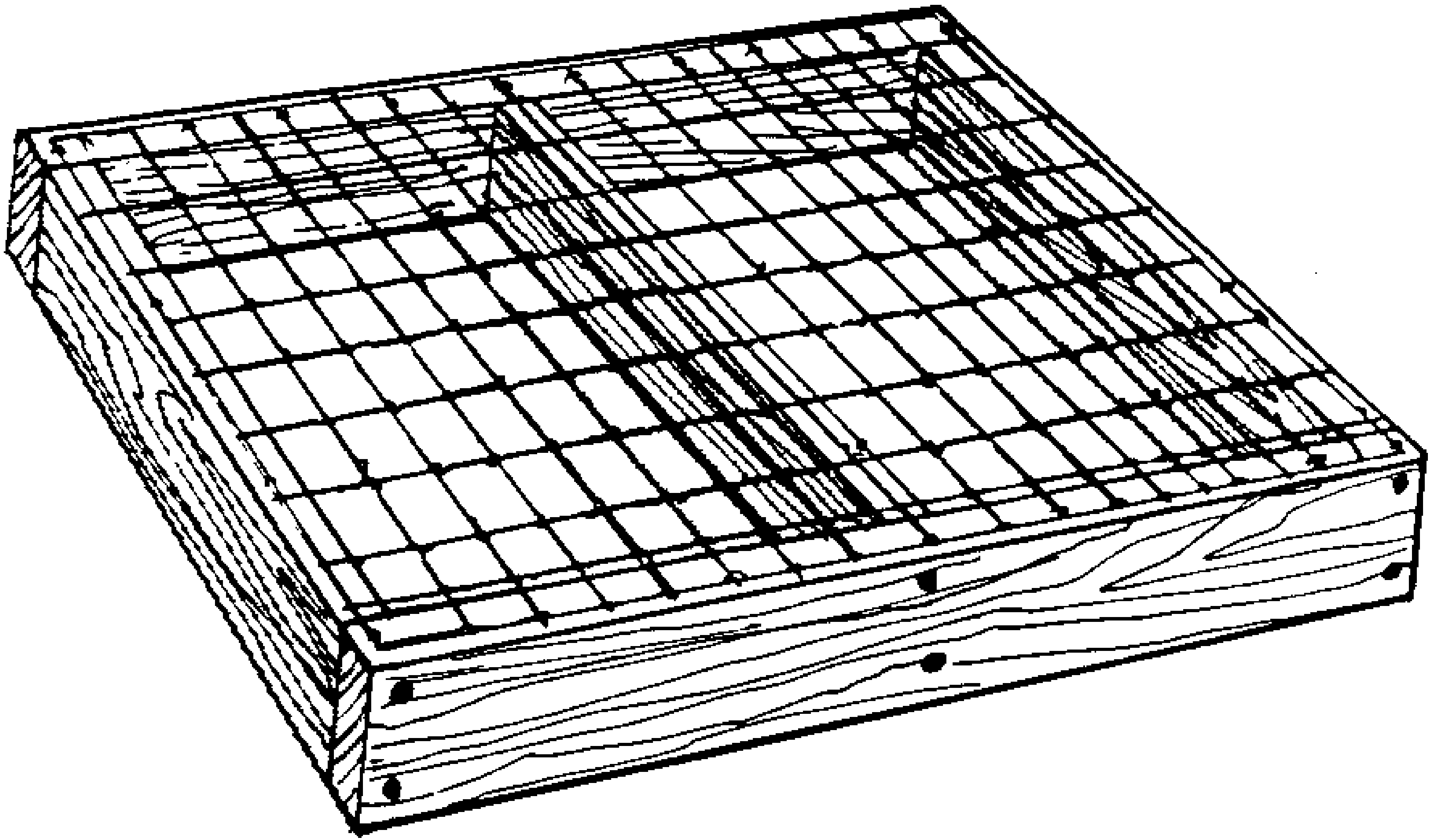


Figure 23

The use of a simple wire-and-wood platform will keep the litter around the waterer dry and disease-free. (Source: Mercia, 1990)

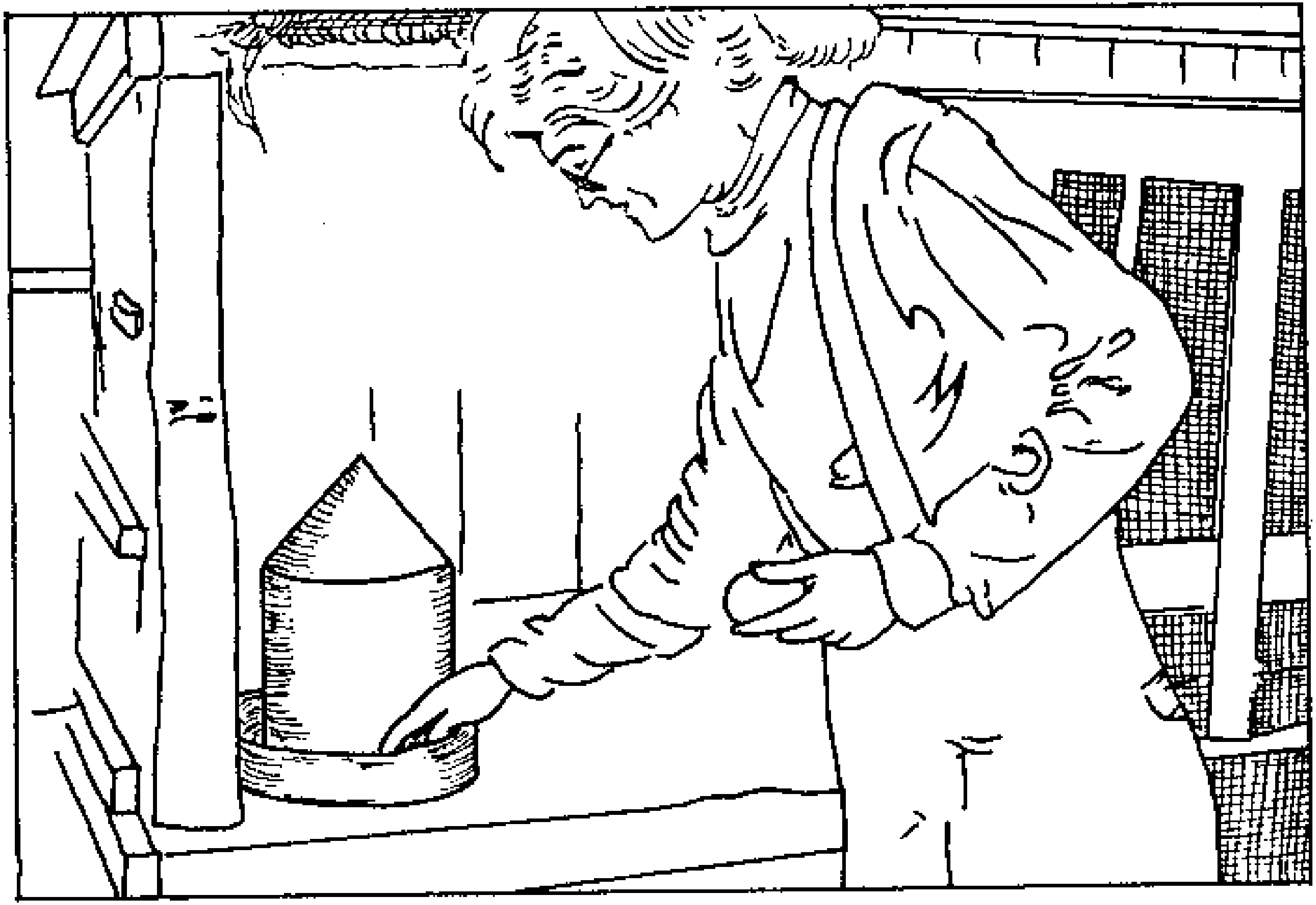


Figure 24

Gravity waterer. Note the peaked top, which prevents chickens from roosting on it.

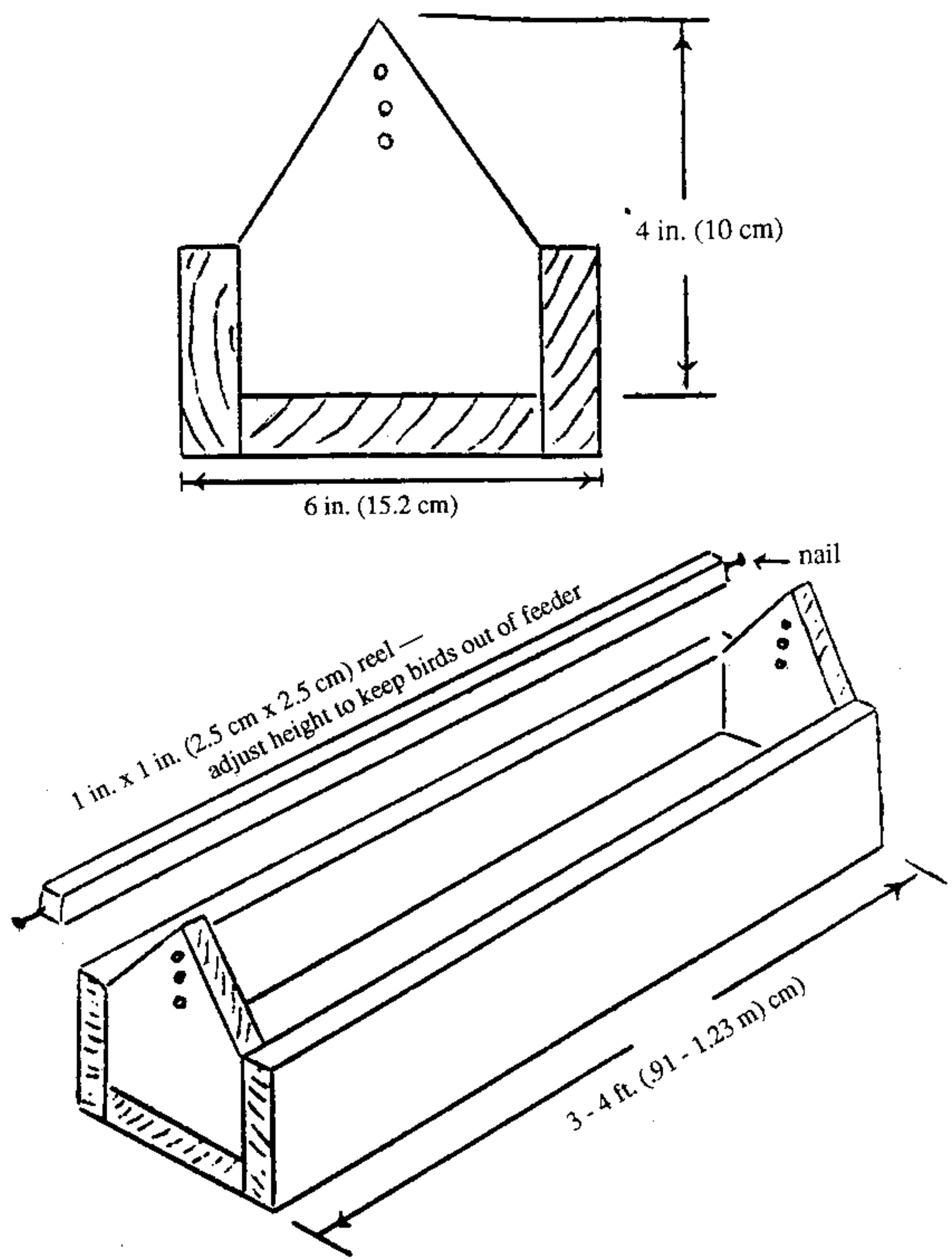


Figure 26
Intermediate feeder for chicks 2 to 10 weeks old.

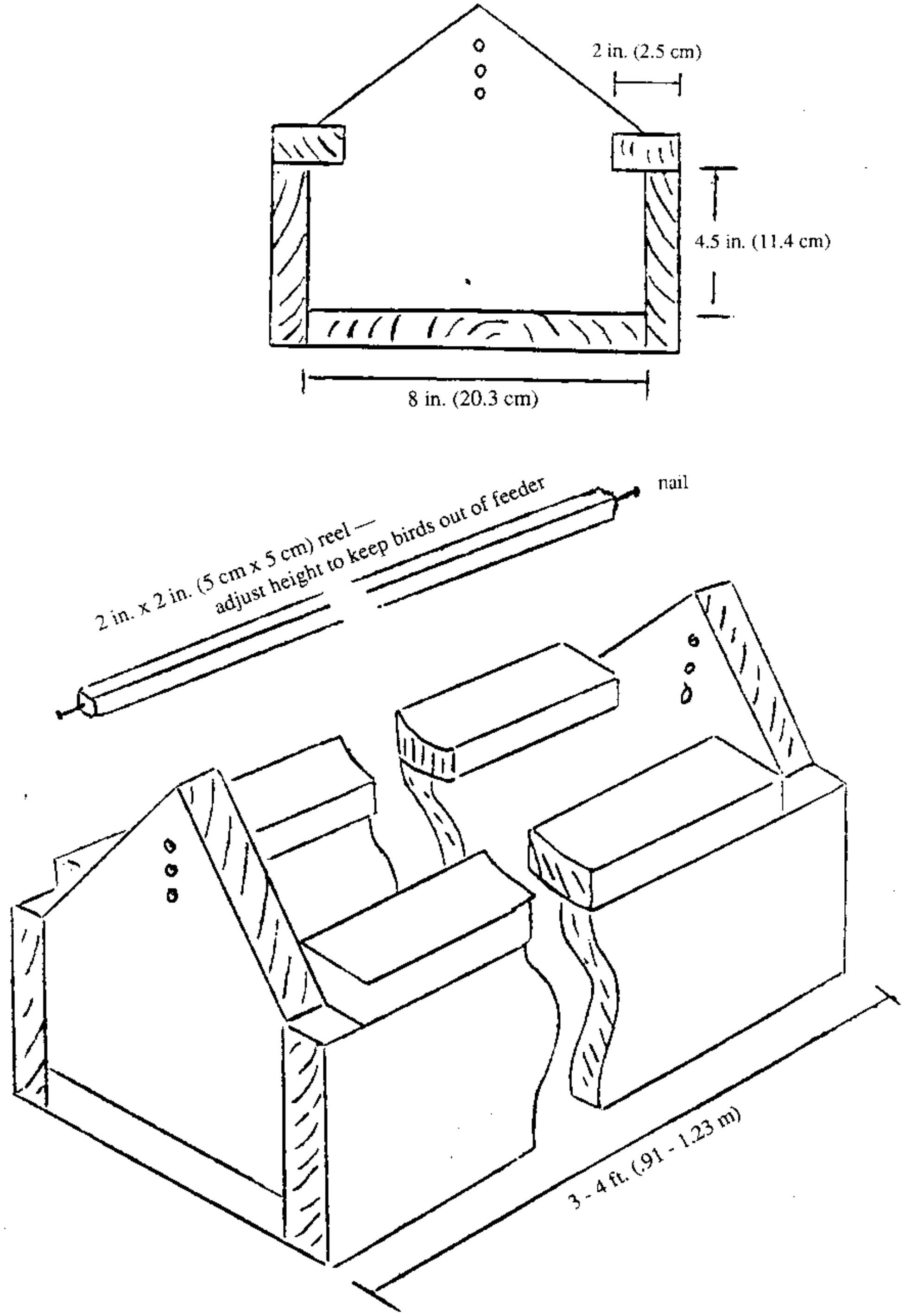
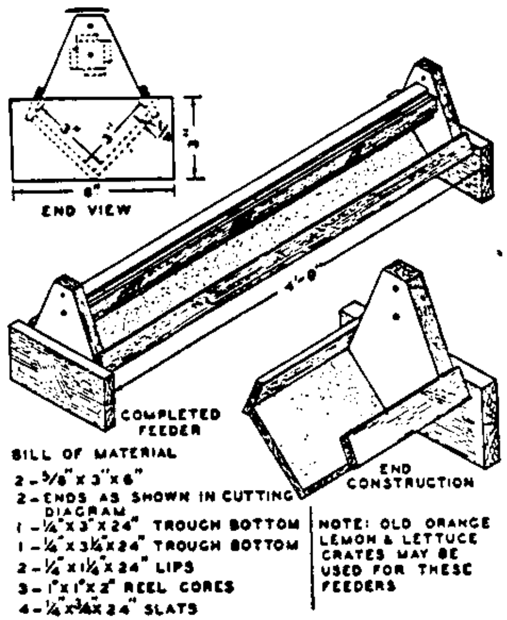


Figure 27
Feeder suitable for mature birds.



The "V" shaped feed troughs are more waste proof and filth proof and hold more feed than the flat bottom troughs.

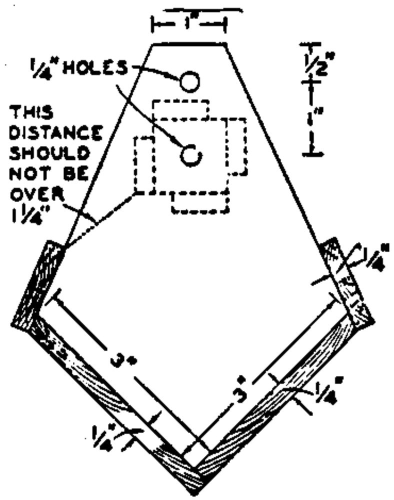
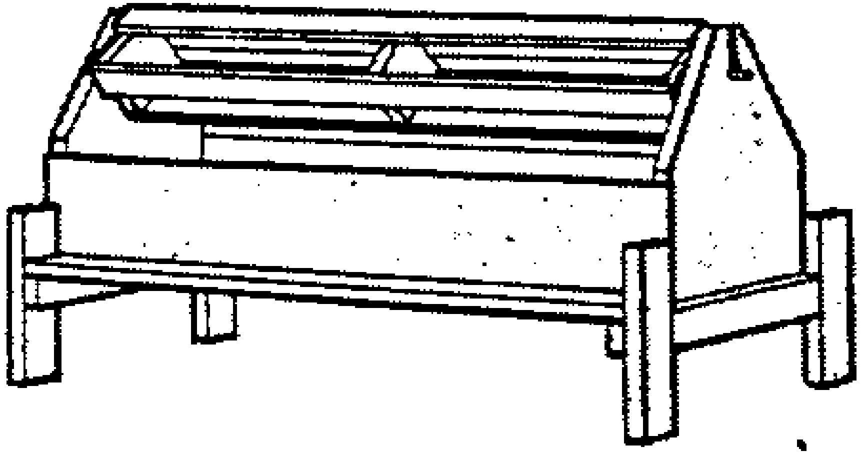
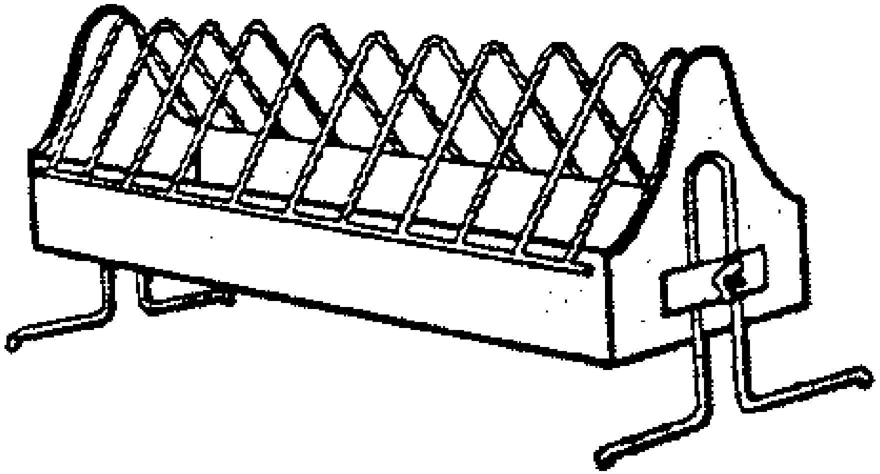


Figure 28
"V"-shaped feed trough.
(Courtesy, Nebraska State University)

The swivel crosspiece prevents roosting.





This feeder can be raised or lowered
to fit different sizes of birds.

Figure 29
Some good types of feeders.
(Courtesy, University of California, Davis)

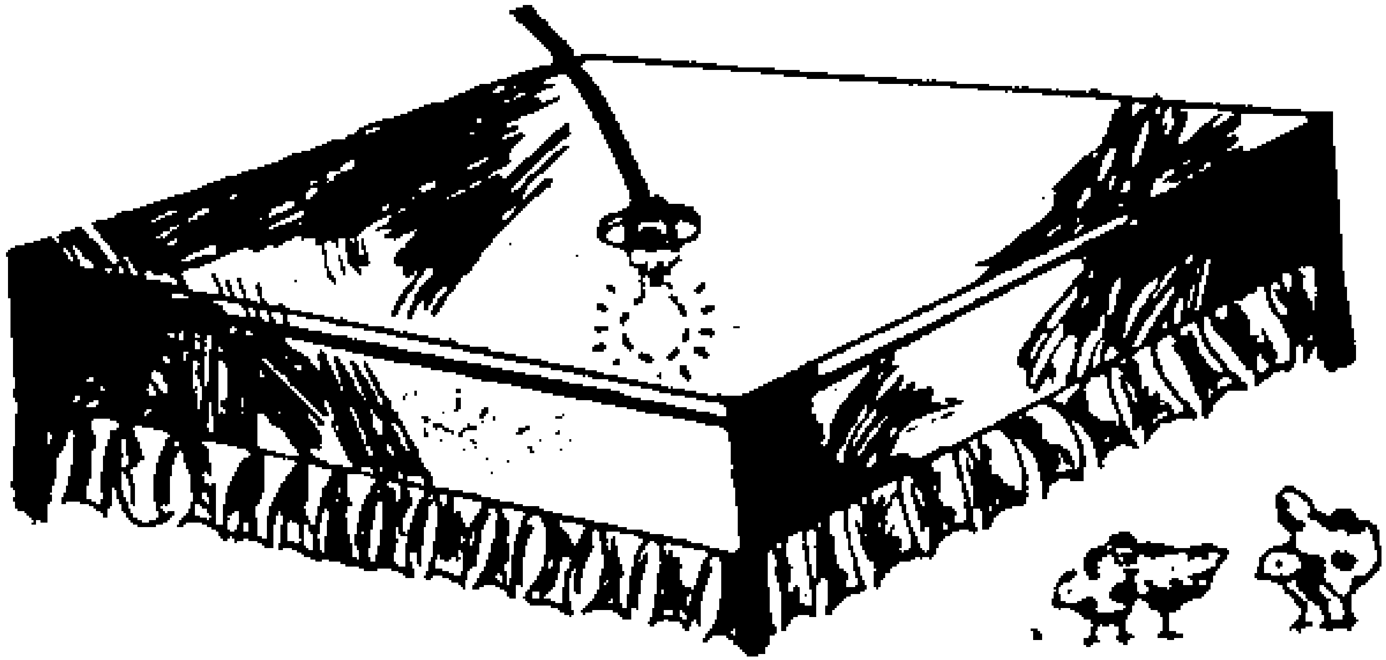


Figure 32

A simple brooder can be made using a cardboard box. It can be fitted with a 60-watt light bulb or a kerosene lantern. Skirting (cloth) fastened around the open edges of the box is not necessary, although it does help to conserve heat.

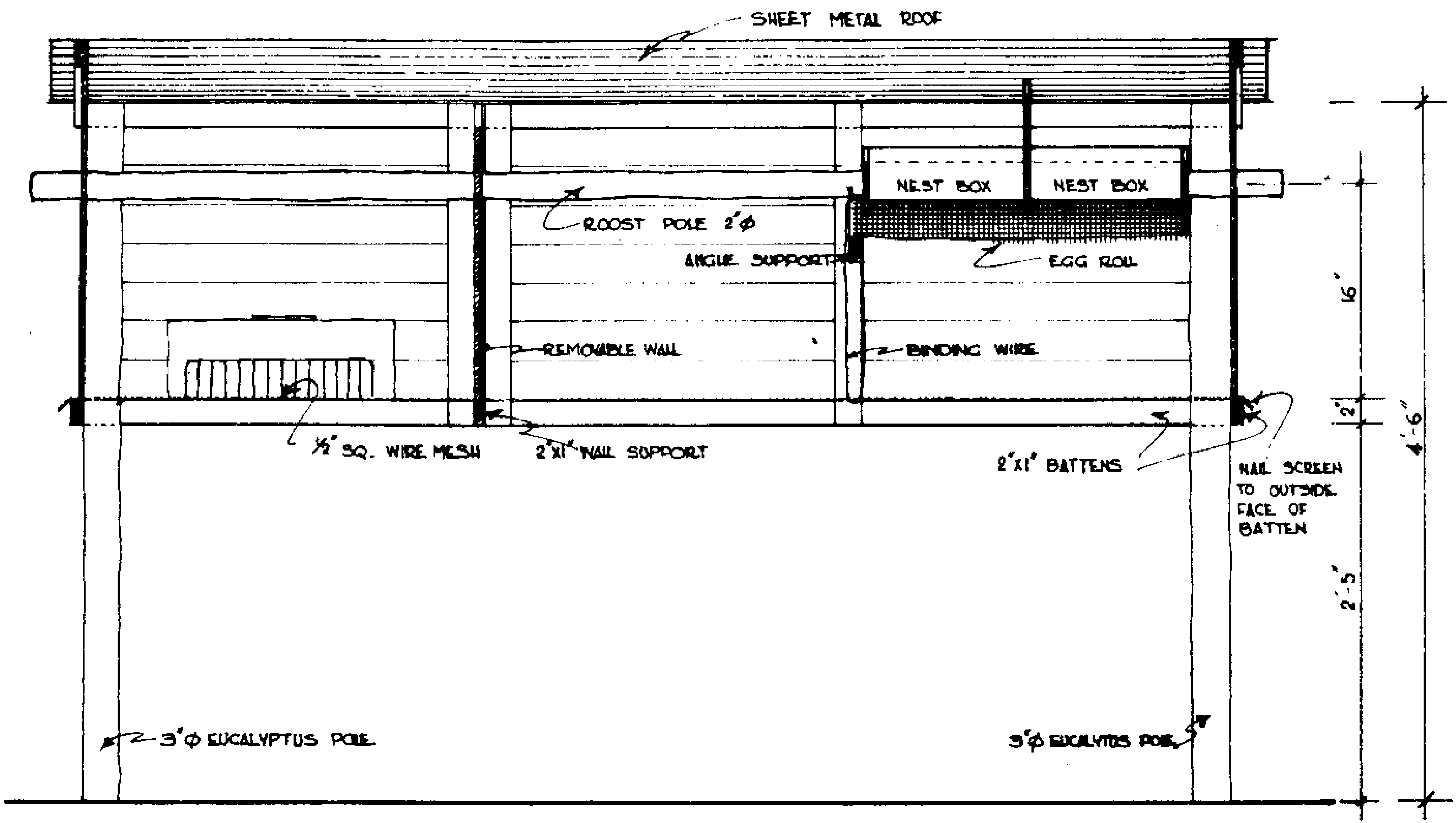
Record of Income from Eggs and Birds

Month________Year________ Date Hatched________Date Housed__________No. of Birds________

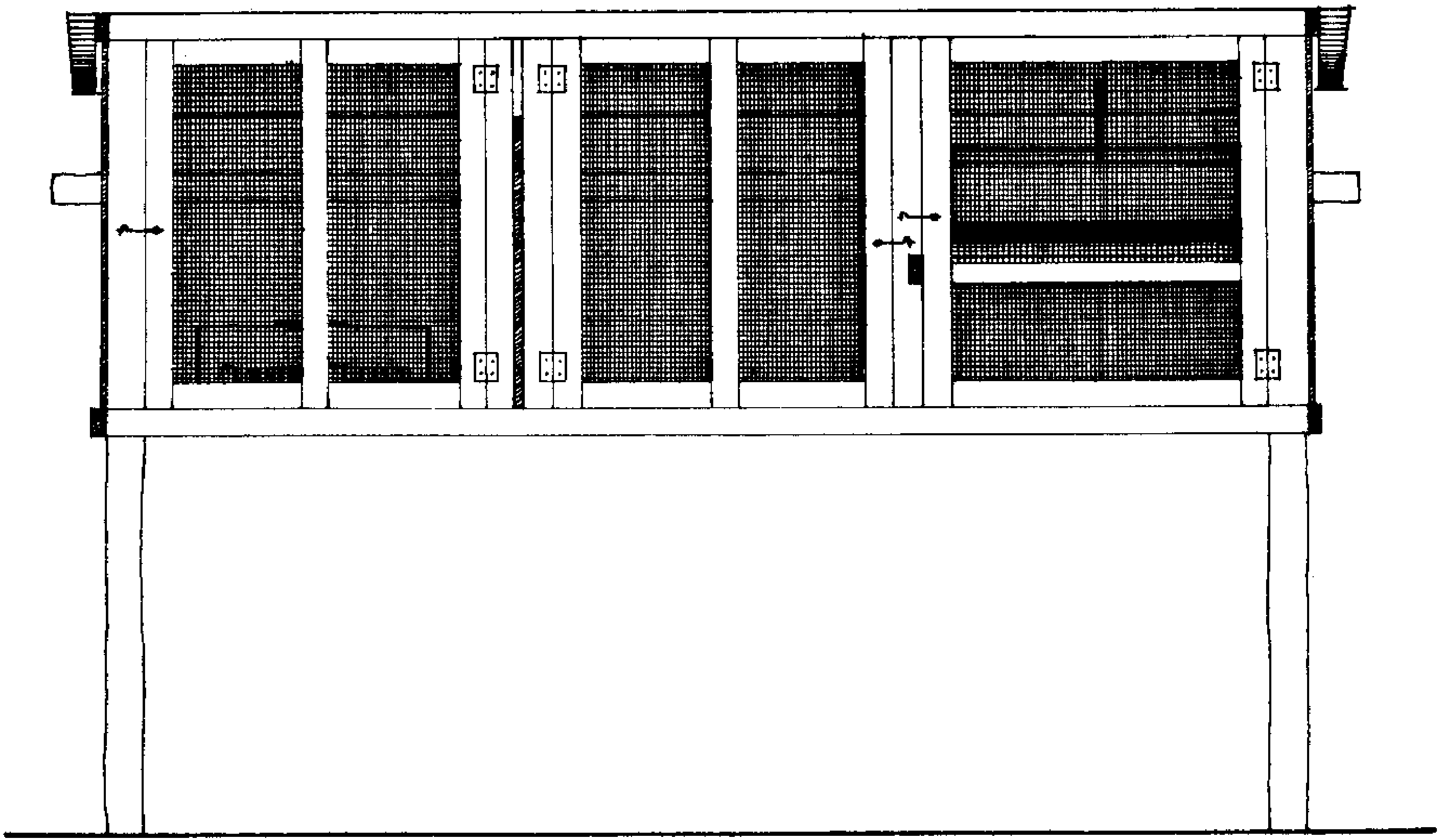
EGGS SOLD				EGGS EATEN, GIVEN AWAY, OR BROKEN			BIRDS SOLD, EATEN, OR DEAD			
Date	No.	Value per Doz	Value	No.	Value per Doz	Value	No.	Value per Bird	Value	Total Value
Total this Month										
Previous Total										
Total to Date										

This record keeps track of all eggs sold, eaten, given away, or broken. It also lets you know how many birds were sold, eaten, culled, or found dead.

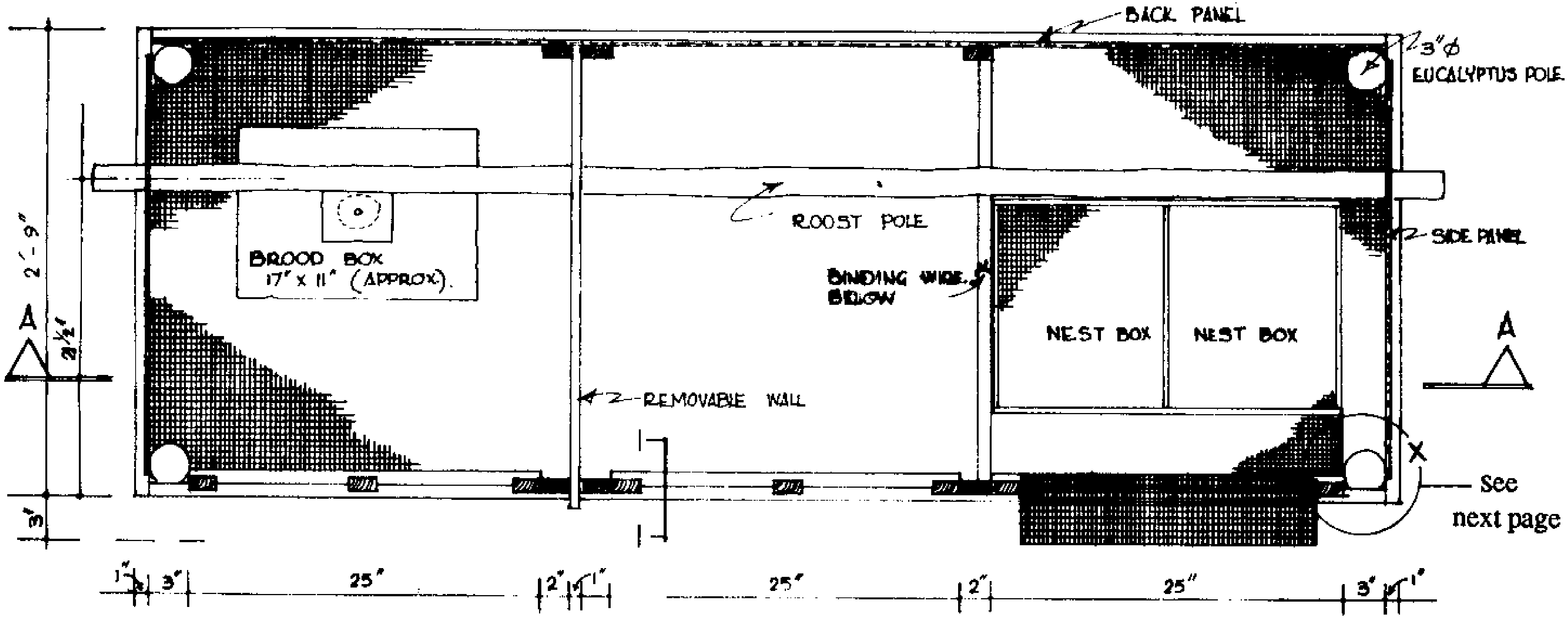
Figure 43



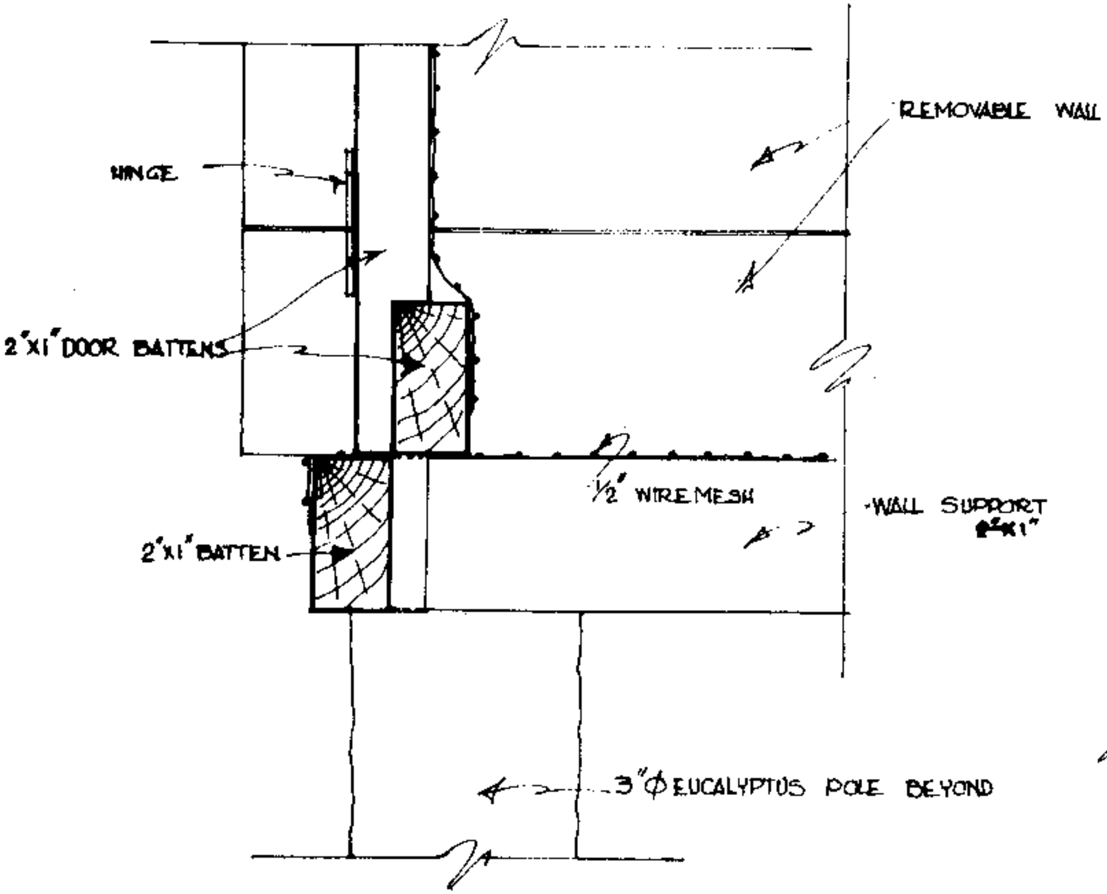
Front View: showing roost poles, nest boxes, and brooder.



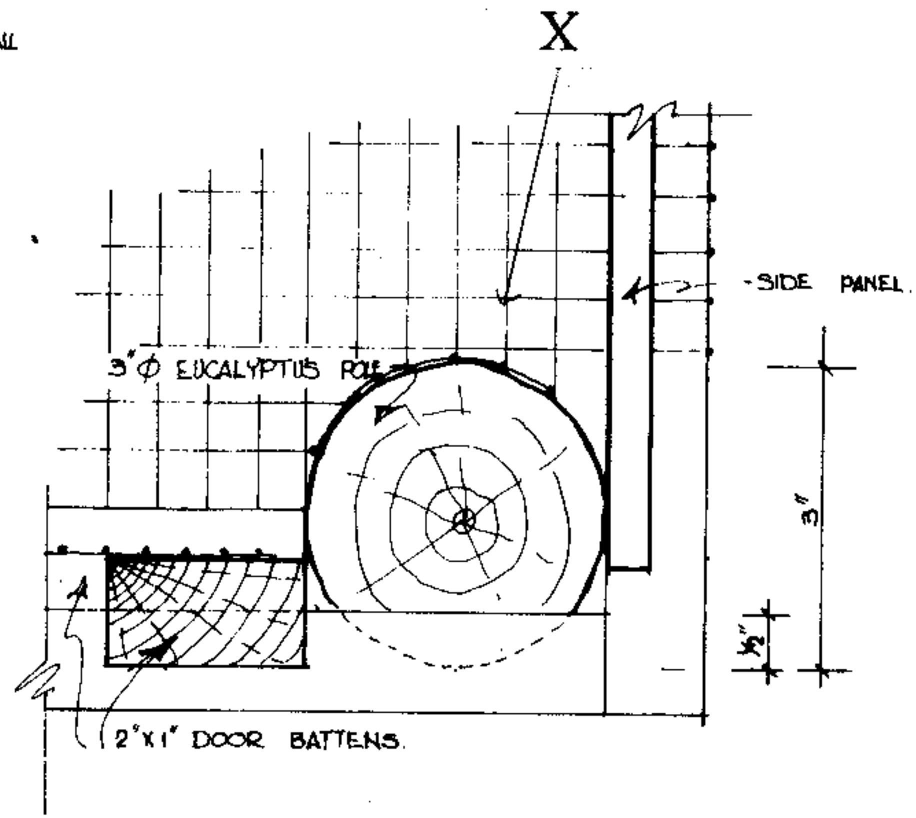
Front View



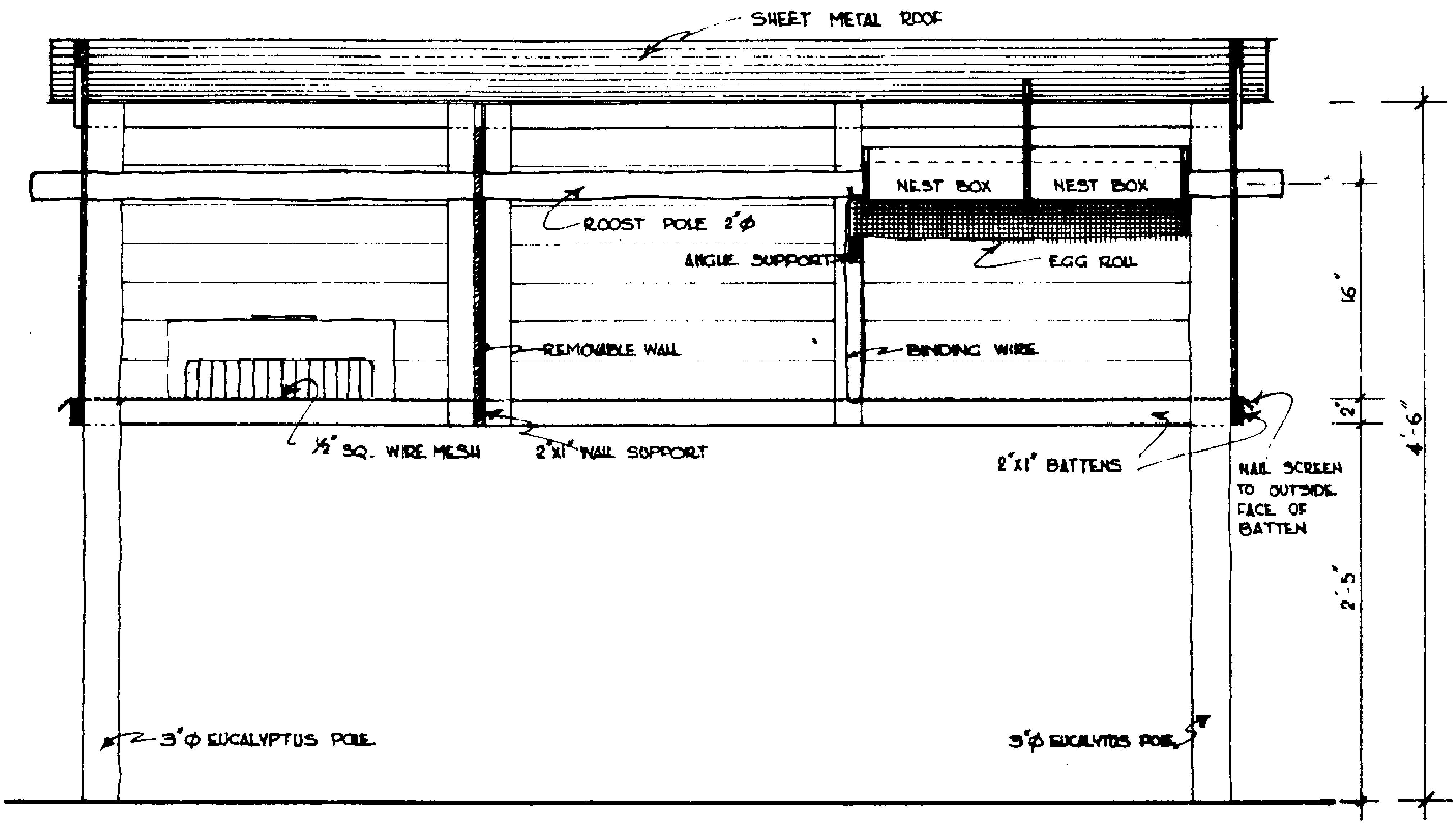
Overview (with roof removed)



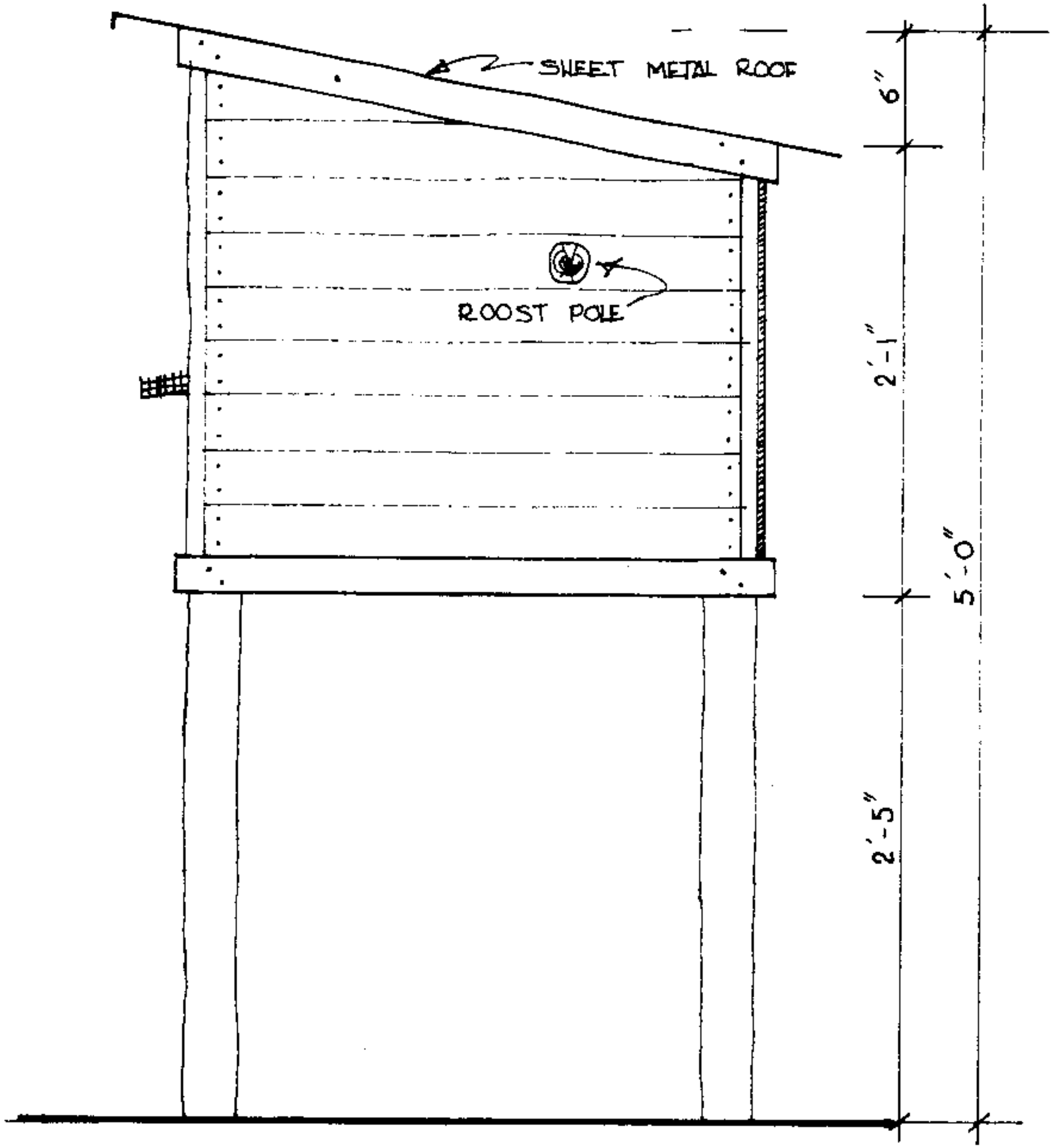
Detail at "X" (Side View)



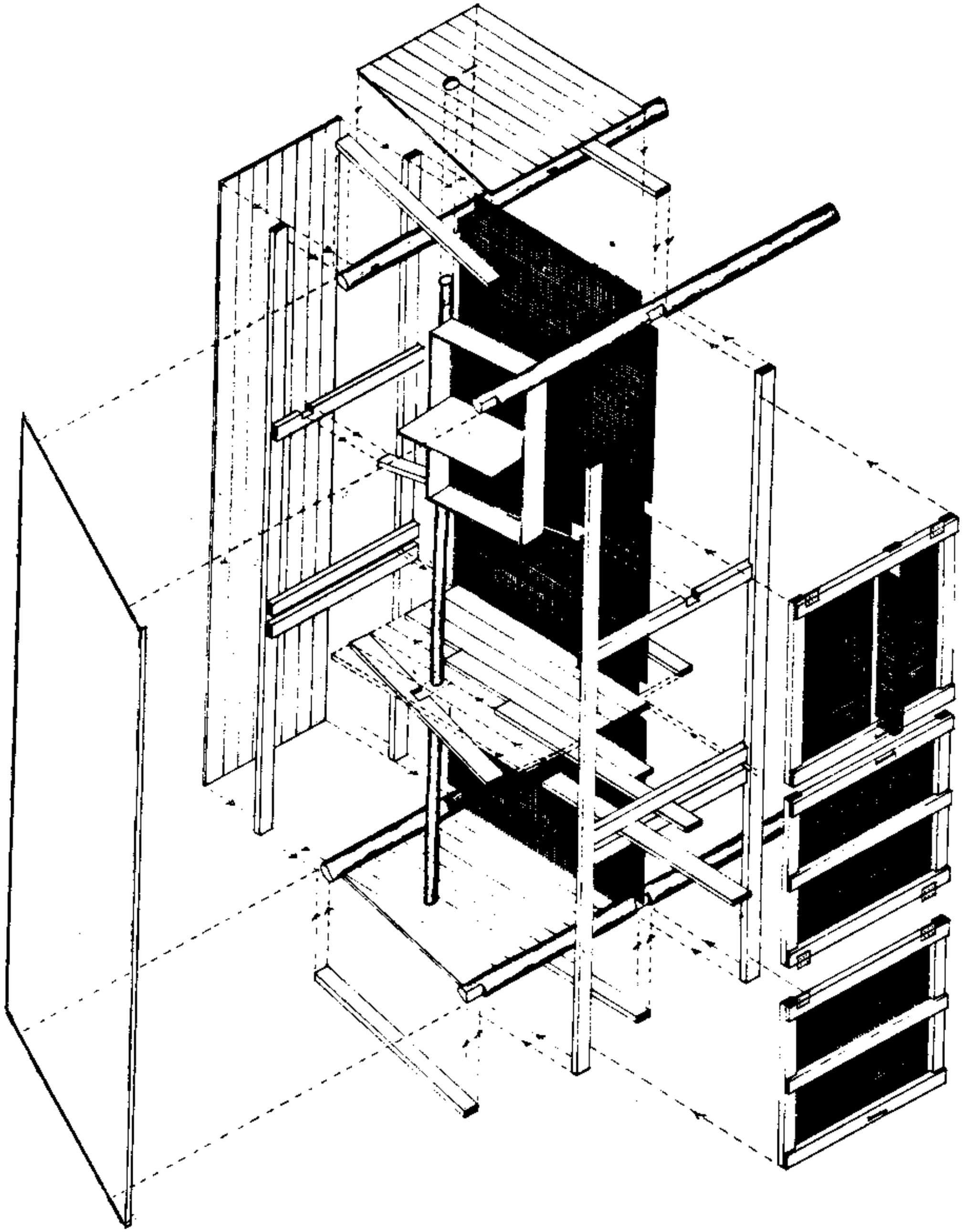
Detail at "X" (Cut Away)



Front View: showing roost poles, nest boxes, and brooder.



Side View



Exploded Drawing of Colony Cage
(Note wire mesh attatched to piece of wood on door.)

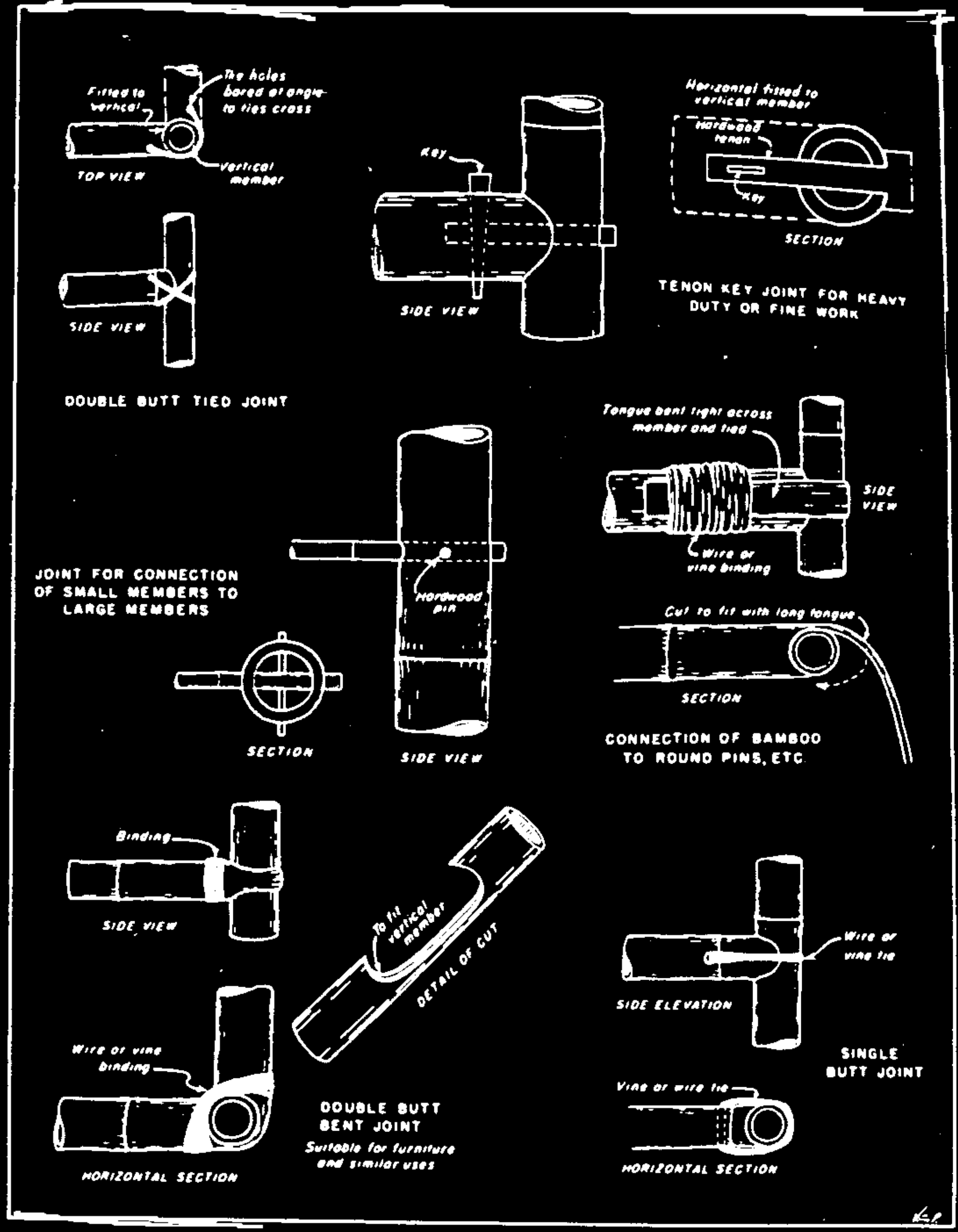
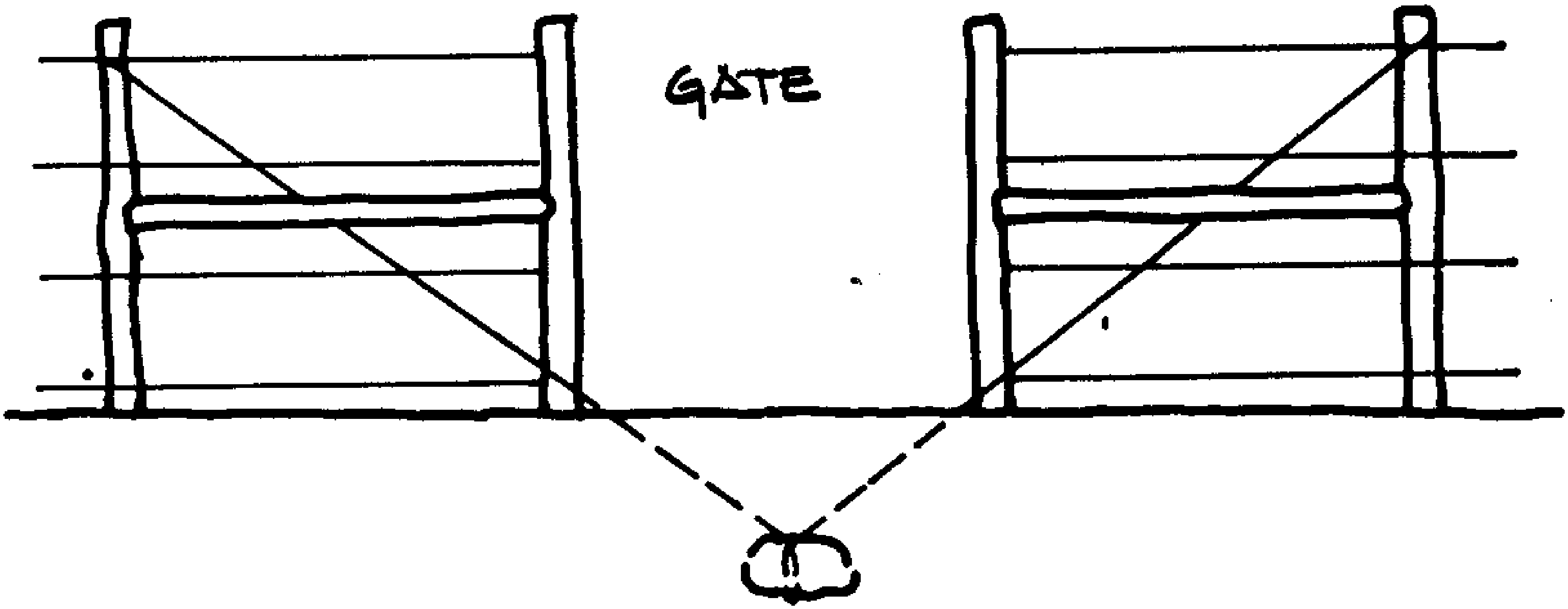
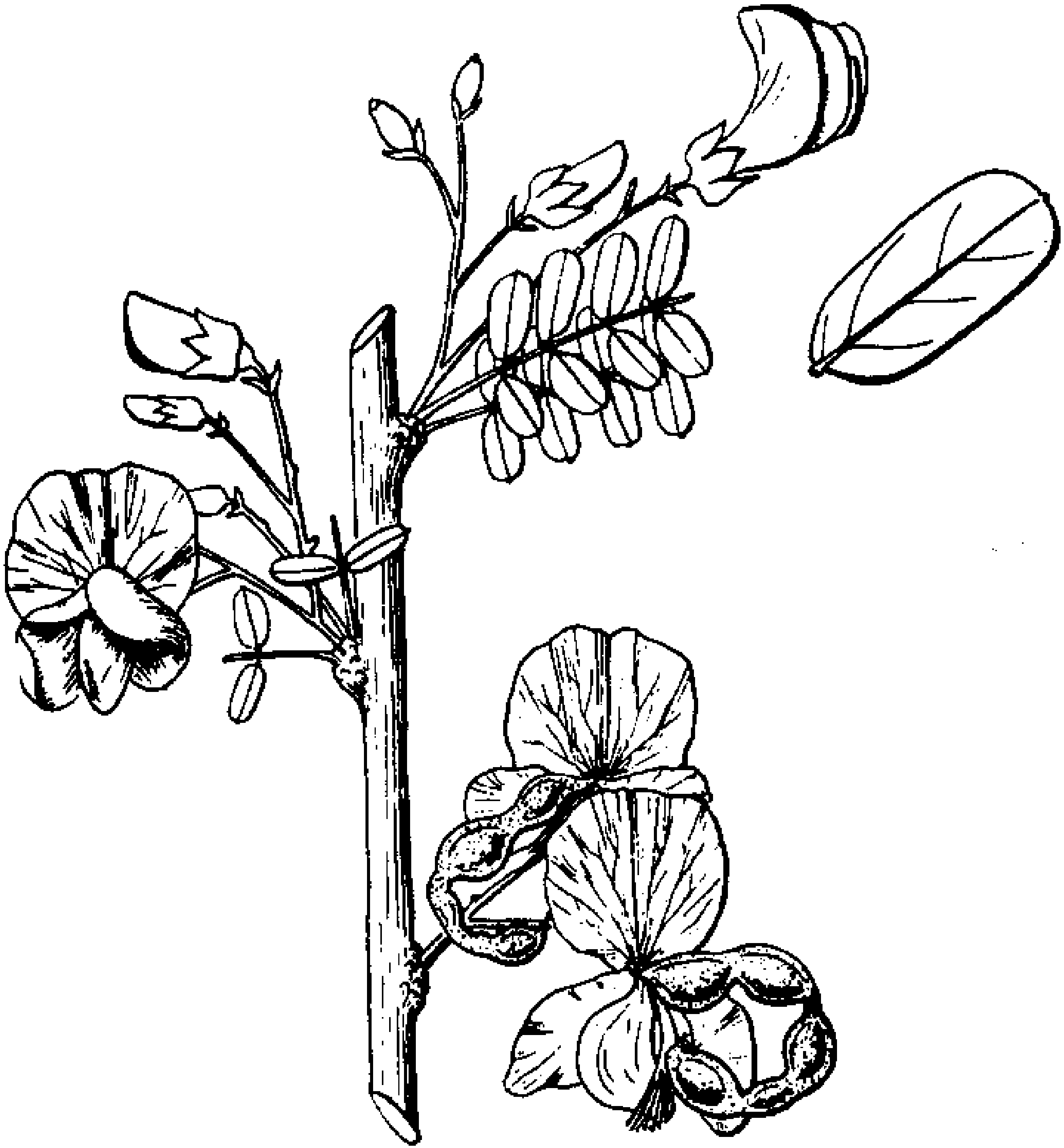
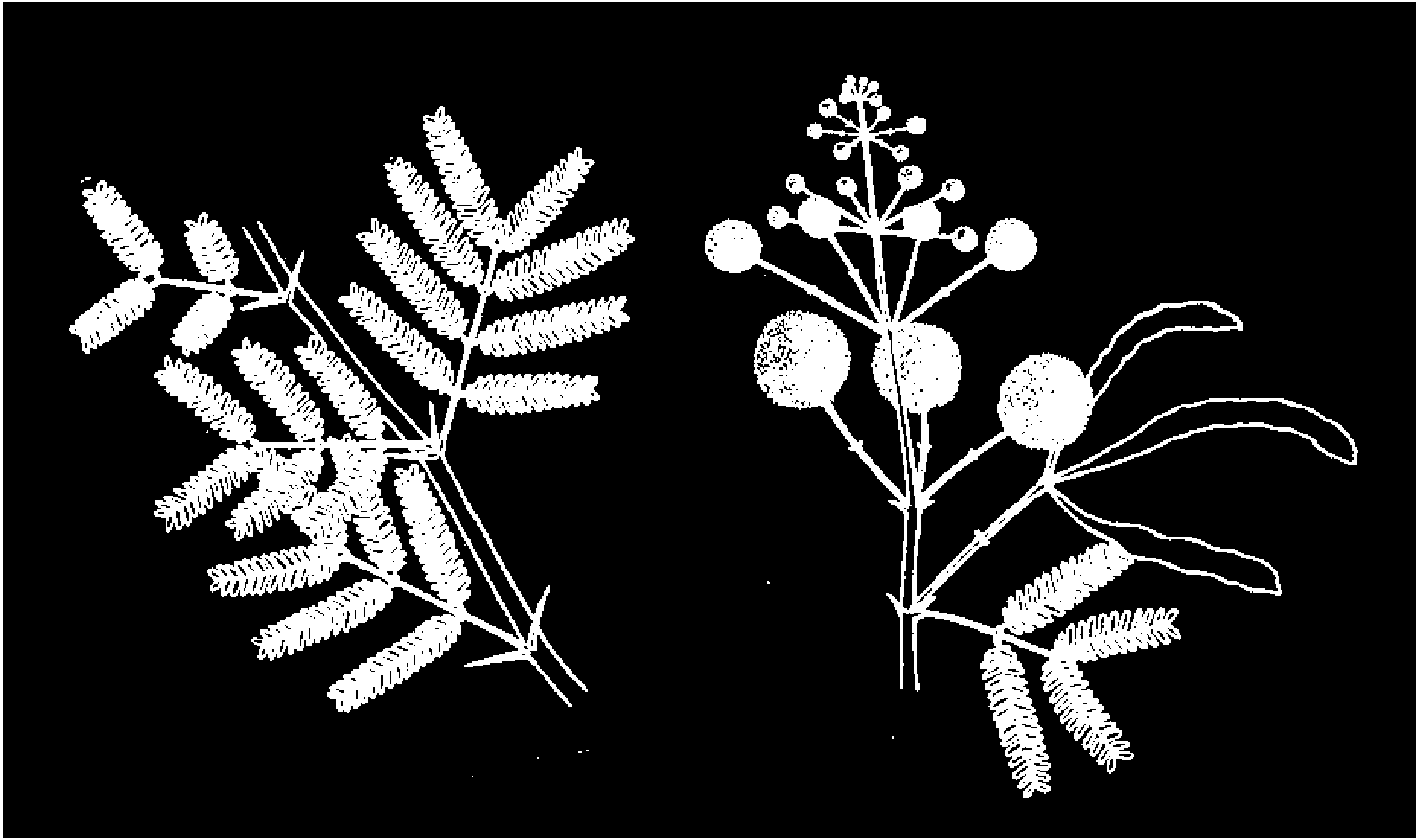


FIGURE 11--Joints used in building with bamboo.

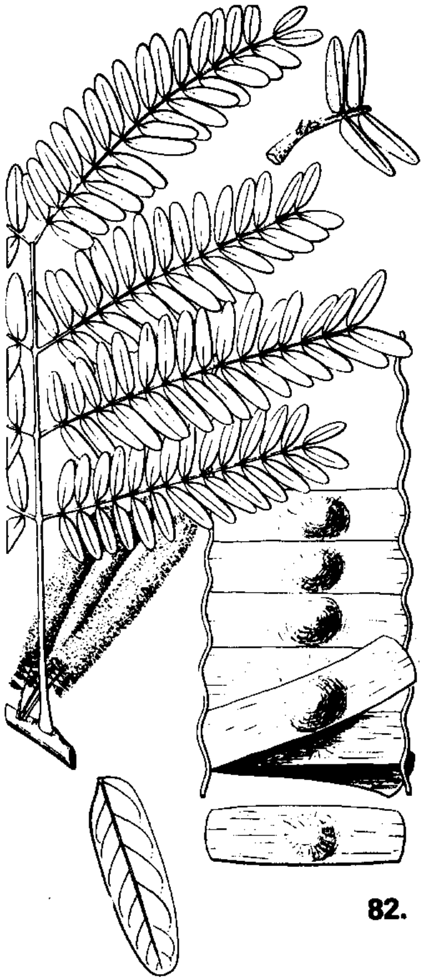


Single deadman anchoring two posts.

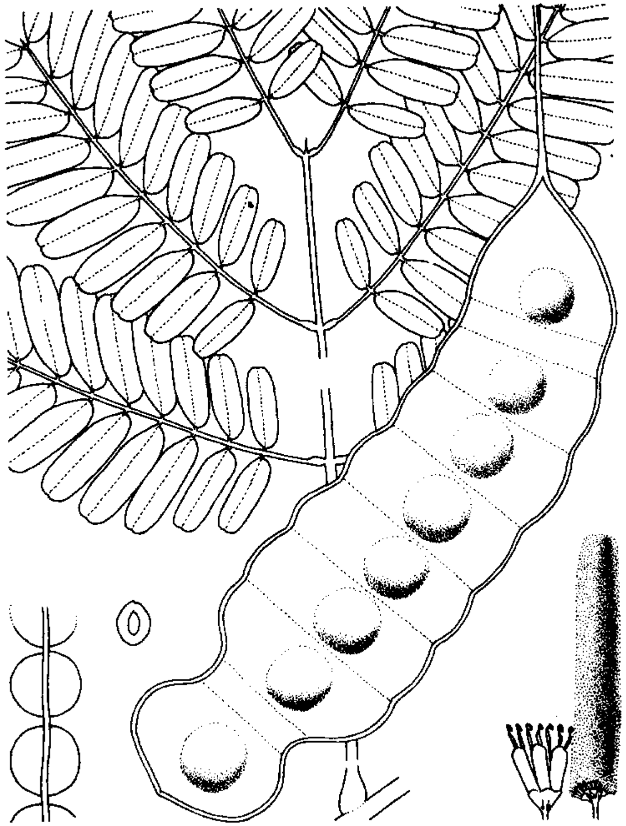




39



82.



83.

82. Entada africana Guill. & Perr.

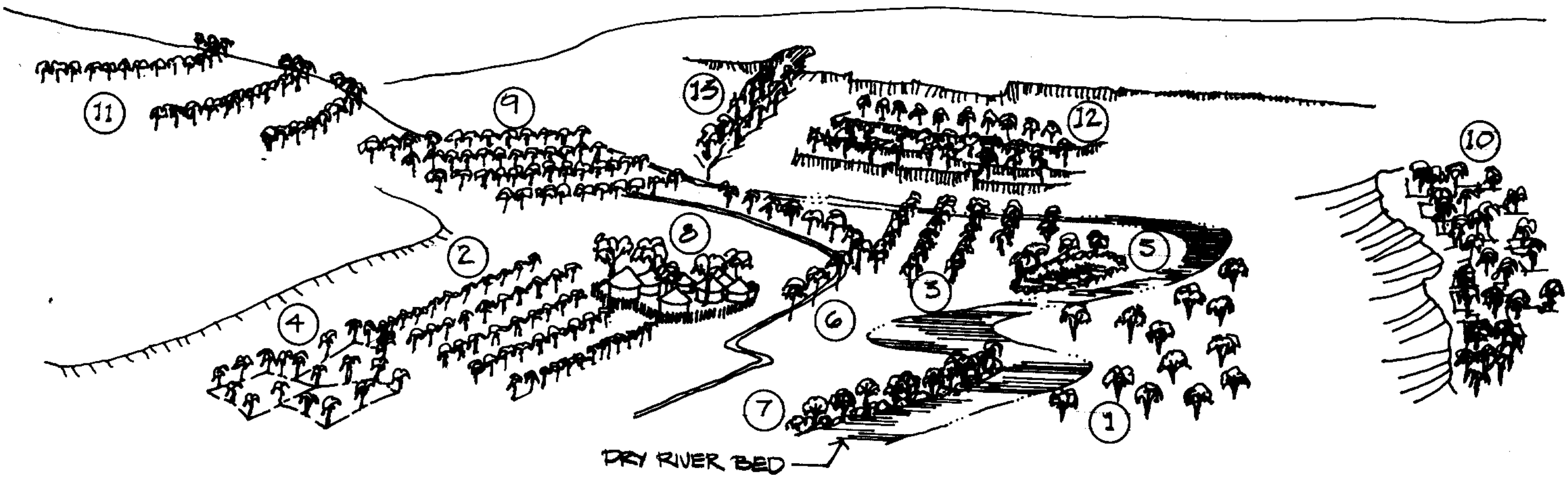
83. Entada sudanica Schweinf.

Also see APPENDIX B

CHAD ARABIC	dorot	HAUSA	tawatsa
BAMBARA	diamba	KANOURI	falofala
	samanere	MORE	sianiogo
FULANI	fado-wanduhl		

Use for firewood, **medicine**

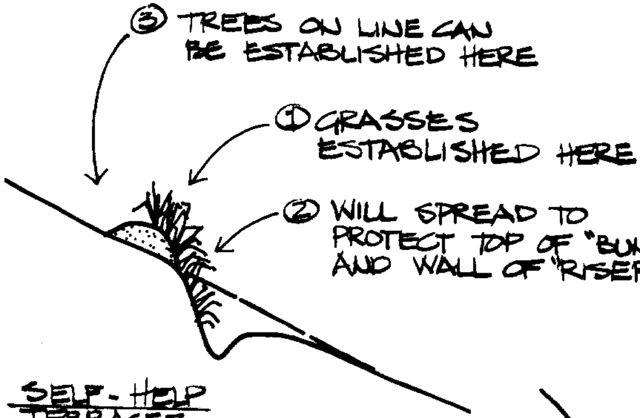
ZONE	SUB-AREA	MEAN ANNUAL RAINFALL (in millimeters)	GRASSES	BUSHES & TREES	SOILS
SAVANNA	 WOODED SAVANNA	900-1200mm	Thick, tall grasses	Terminalia Butyrospermum Parkia Borassus	Ferruginous Soils: See "Shrub Savanna".
SAVANNA	 WOODLAND	1200-1600mm		soberlinia doka Khaya Hyparrhenia Andropgon gayanus	Ferralitic Soils: Begin over 1200mm rainfall. Cation exchange capacity very poor. SiO_2/Al_2O_3 ratio less than 2. Often, these soils are very deep. (Oxisols USDA). Similar to laterized* red earth soils of East Africa. Sometimes layers of iron oxides but not as common as in ferruginous soils. Low Fertility



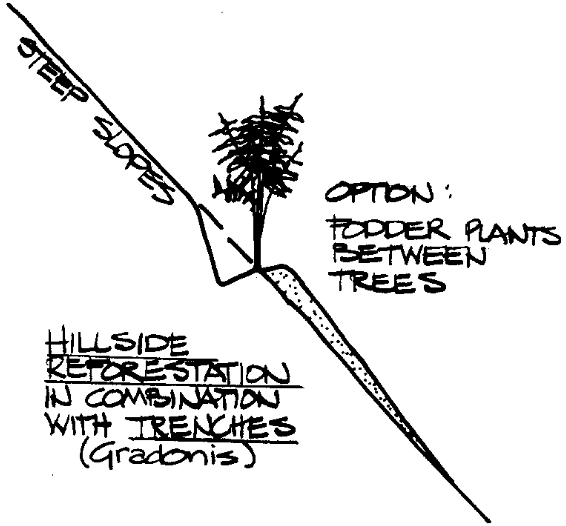
OBLIQUE VIEW

KEY

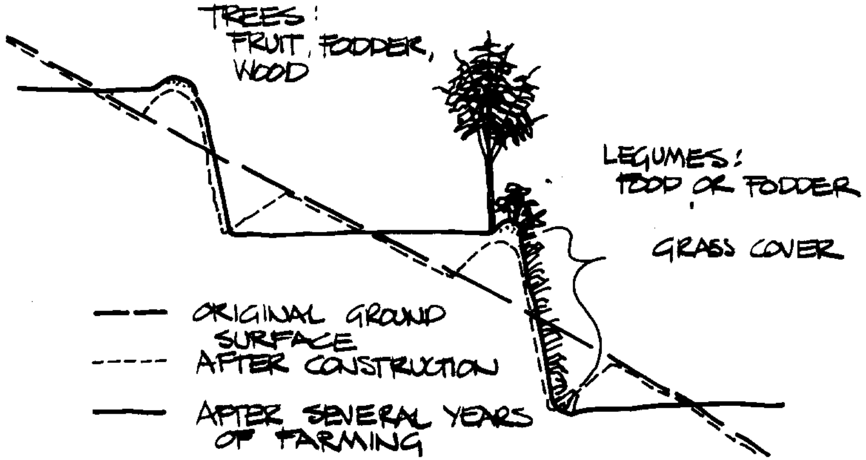
1 DISPERSED
2 ALLEY CROPPING
3. LINE PLANTATIONS
4. BOARDERLINES
5. LIVE FENCING
6. ROADS, TRAILS
7. WATER COURSES
8. SHADE
9. WIND BREAKS
10. SAND STABLIZATION
11. CONTOUR STRIPS
12. TREES ALONG CONTOUR RIDGING
13 GULLY RECLAMATION



SELF-HELP TERRACES
(Kenya)

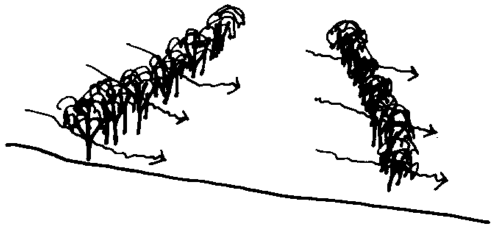


HILLSIDE REFORESTATION IN COMBINATION WITH TRENCHES
(Gradonis)



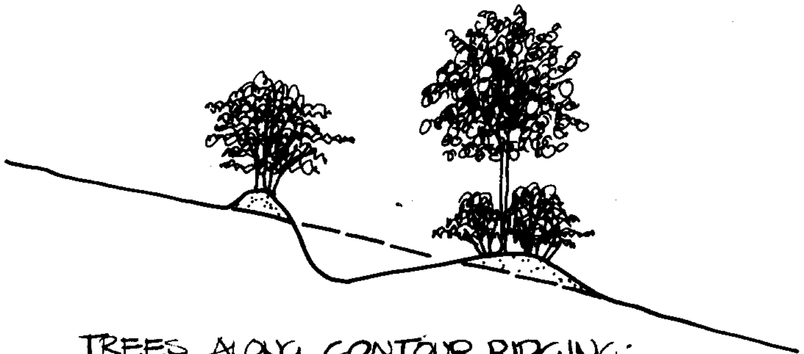
GRADUALLY DEVELOPING BENCH TERRACES

IMPORTANT DIFFERENCES BETWEEN:
ALLEY CROPPING (2)
CONTOUR STRIPS (11) AND
TREES ALONG CONTOUR RIDGING (12)



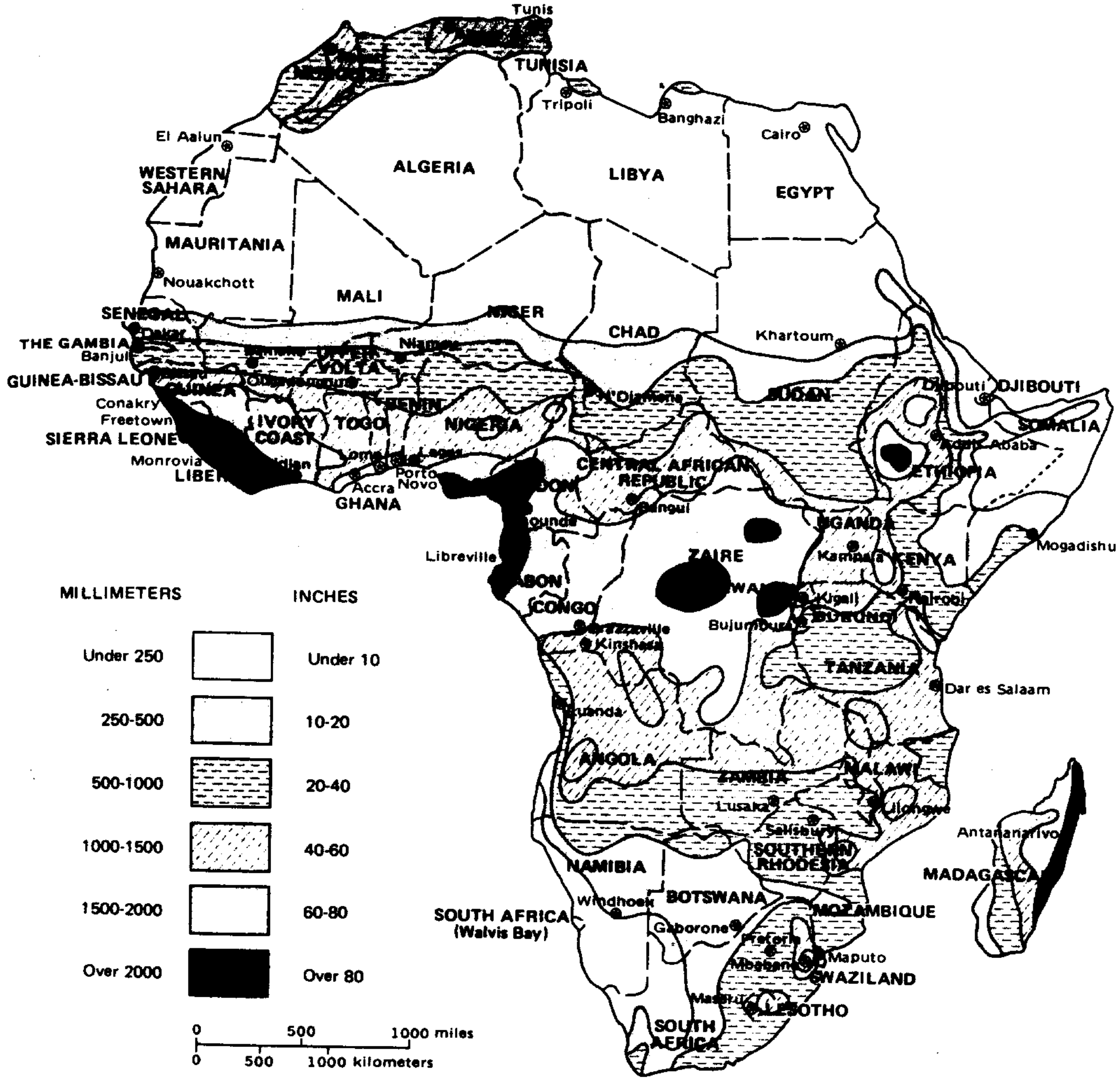
ALLEY CROPPING:
ONE OR TWO ROWS OF TREES, FREQUENTLY TRIMMED. FEW PLANTS (WEEDS) COVERING GROUND SURFACE. TOO MUCH SHADE, GROUND OFTEN CULTIVATED. RUNOFF FLOWS AROUND STEMS. LESS EROSION PROTECTION.

CONTOUR STRIP:
SOLID BAND OF MULTI-LAYERED PERMANENT VEGETATION, SEVERAL METERS WIDE. SLOWS RUNOFF AND TRAPS SEDIMENT.



TREES ALONG CONTOUR RIDGING:
HERE, VEGETATION (CAN BE GRASS, SHRUBS OR TREES) IS INTEGRATED INTO SURFACES WHICH HAVE BEEN MECHANICALLY CHANGED. EROSION IS REDUCED MAINLY BY CHANGING SURFACE FEATURES TO WHICH VEGETATION HAS BEEN ADDED TO INCREASE THEIR EFFECTIVENESS AND REDUCE MAINTENANCE WORK.

MAP 2
MEAN ANNUAL PRECIPITATION



VEGETATION AND SOILS

ZONE	SUB-AREA	MEAN ANNUAL RAINFALL (in millimeters)	GRASSES	BUSHES & TREES	SOILS
SAHEL	 GRASS STEPPE	0-200mm	Salvadora Leptadenia Aristida Panicum	Acacia radiana Some Balanites	Undifferentiated soils: less than 30cm deep; sub-desert sands in hot dry climate -- often rich in carbonates and soluble salts.
SAHEL	 TREE STEEPE	200-500mm	Aristida stipoides Cenchrus ciliaris Schoenfeldia gracilis	Acacia Comiphora Some thickets	Brown Soils: Highly saturated non-kaolinitic clays; fairly fertile but dry.
SAVANNA	 SHRUB SAVANNA	500-900mm		Acacia nilotica Terminalia Anogeissus (lower locations) Acacia albida Hyphaene thebaica Guiera senegalensis Annona senegalensis Ziziphus Bauhinia	Ferruginous Soils: Begin here often contain impermeable layers of iron oxides. Outcrops form "cuirace". SiO_2/Al_2O_3 ratio around 2. Cation exchange capacities rather poor. Free carbonates are lacking, but free iron oxide is common. Range: 500-1200mm rainfall (See also Wooded Savanna) Fair Fertility

ZONE	SUB-AREA	MEAN ANNUAL RAINFALL (in millimeters)	GRASSES	BUSHES & TREES	SOILS
SAVANNA	 WOODED SAVANNA	900-1200mm	Thick, tall grasses	<u>Terminalia</u> <u>Butyrospermum</u> <u>Parkia</u> <u>Borassus</u>	<u>Ferruginous Soils</u>: See "Shrub Savanna".
SAVANNA	 WOODLAND	1200-1600mm		<u>soberlinia doka</u> <u>Khaya</u> <u>Hyparrhenia</u> <u>Andropogon gayanus</u>	<u>Ferralitic Soils</u>: Begin over 1200mm rainfall. Cation exchange capacity very poor. SiO_2/Al_2O_3 ratio less than 2. Often, these soils are very deep. (Oxisols USDA). Similar to laterized* red earth soils of East Africa. Sometimes layers of iron oxides but not as common as in ferruginous soils. Low Fertility

* The term "laterite" is frequently used especially in connection with tropical soils. In spite of voluminous writings it is not possible to define this term to everyone's satisfaction. In its purest sense the following description is given: "zone(s) rich in <u>sesquioxydes</u> (Al_2O_3 and Fe_2O_3) that, when cut into bricks, become hard as they dry."

Geologists, on the other hand, frequently use the term to describe <u>ferruginous</u> layers, already hard and cellular or clinkerlike, including concretionary coatings of iron oxides.

As a given parent material is slowly transformed into laterite under the influence of its exposure to a certain climate, great chemical changes take place to considerable depths. Much of the original silica is removed. Aluminum oxide (Al_2O_3) leading -- in its purest form -- to commercially exploitable accumulations of bauxite.

ZONE	SUB-AREA	MEAN ANNUAL RAINFALL (in millimeters)	GRASSES	BUSHES & TREES	SOILS
SAVANNA	 MOSAIC	1600-1750mm	Patches of moist forest surround areas of dense, coarse savanna grass.	<u>Hymenocardia acida</u> <u>Lophira lanceolata</u>	Ferralitic Soils: Ferrisols, Kaolinite and oxides in clay complex. See also "Woodland".
SAVANNA	 TROPICAL RAIN FOREST	over 1750mm			

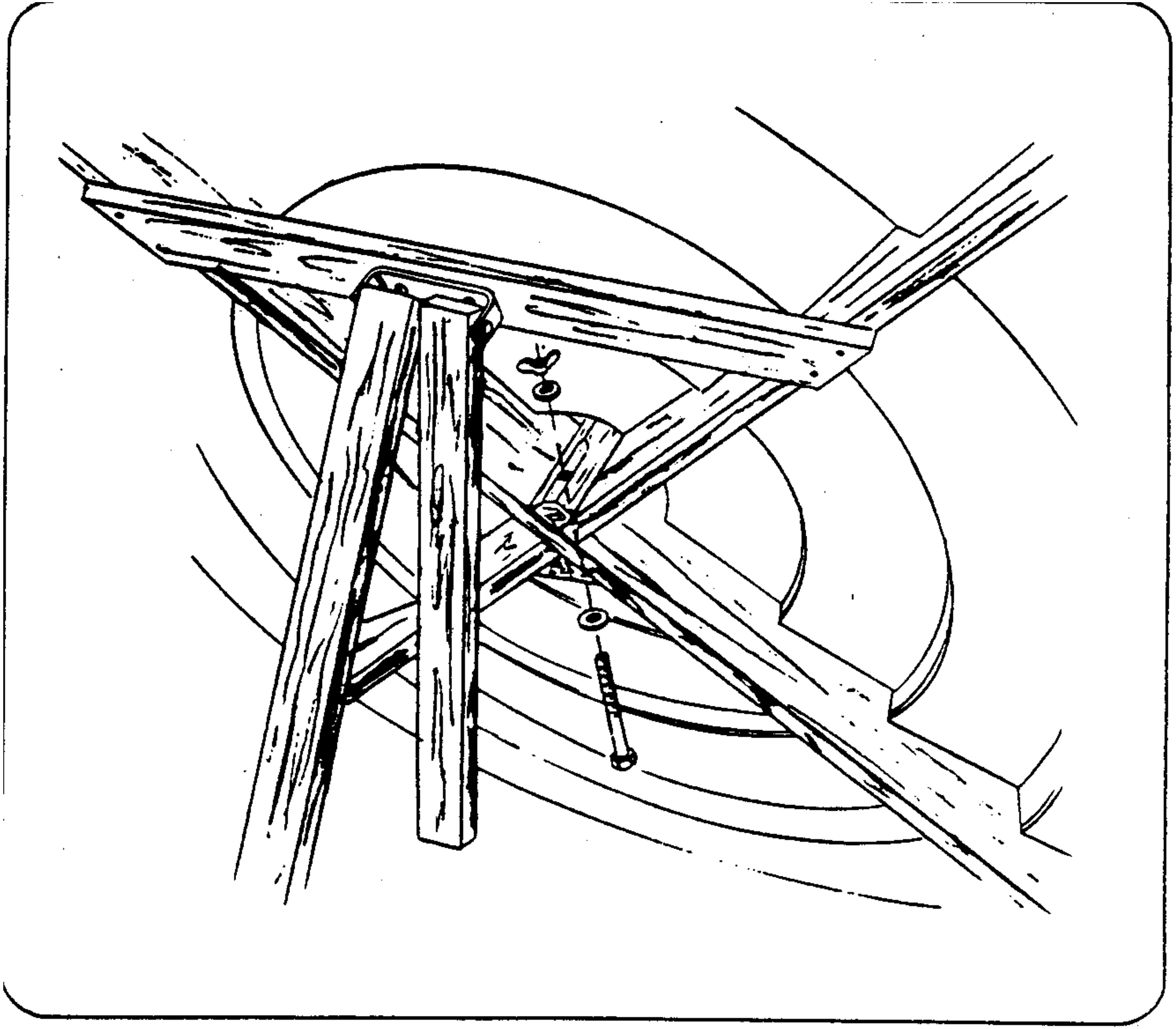
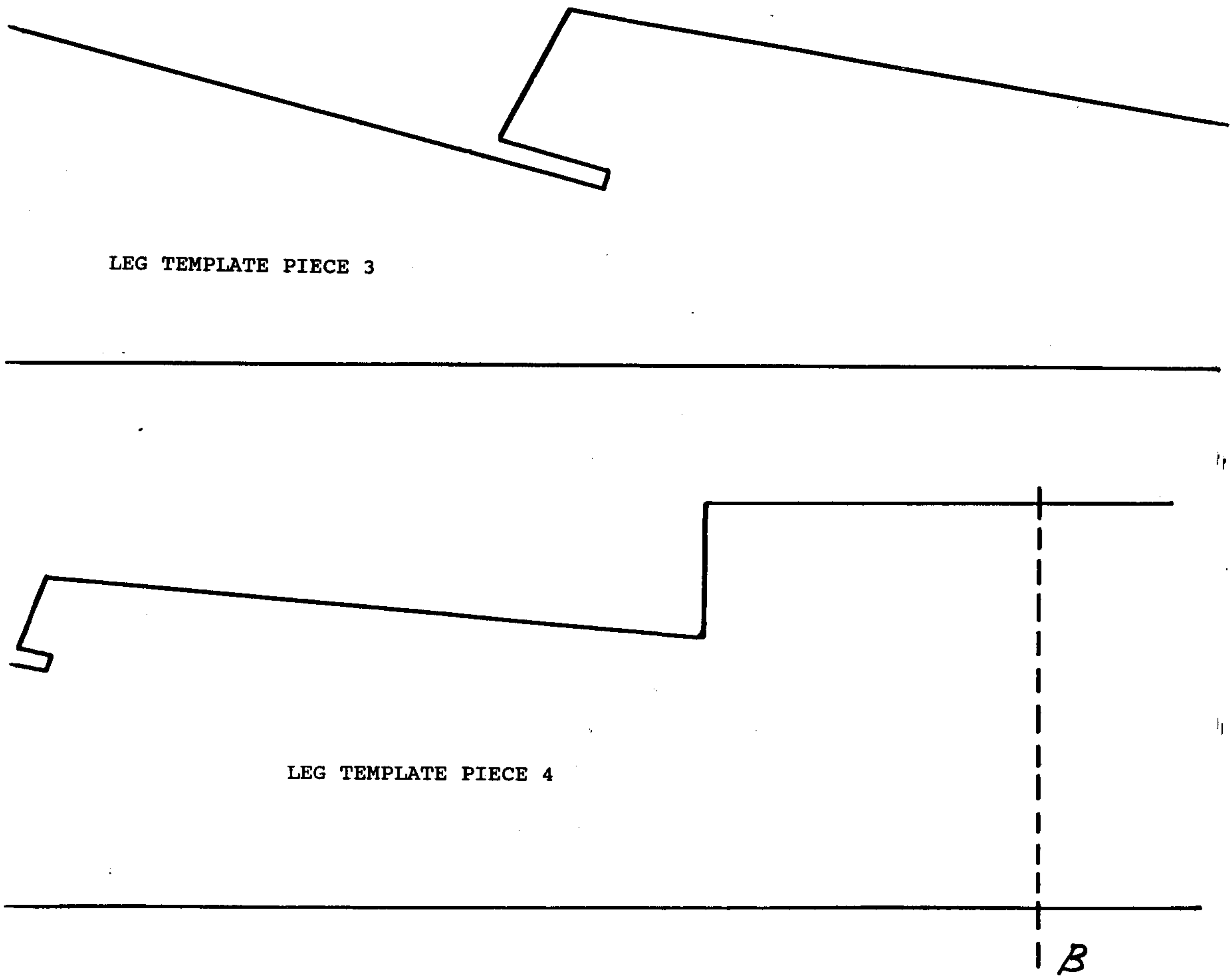


Fig. 9


LEG TEMPLATE PIECE 3
LEG TEMPLATE PIECE 4
B

MAINTENANCE

Labor Account

	Name	Hours & Date	Repair Done	Also down time Rate?	Pay?
1					
2					
3					
4					
5					
			Totals (by week or month)		

Materials Account

	Item	Cost	Reason Replaced	Date	Comments
1					
2					
3					
4					
5					
	Totals (by week or month)				

CONSTRUCTION

Labor Account

Hours Worked

Name	Job	M T W T F S S	Total	Rate?	Pay?
1					
2					
3					
4					
5					
		Totals			

Materials Account

	Item	Cost Per Item	# Items	Total Costs
1				
2				
3				
4				
5				
			Total Costs	

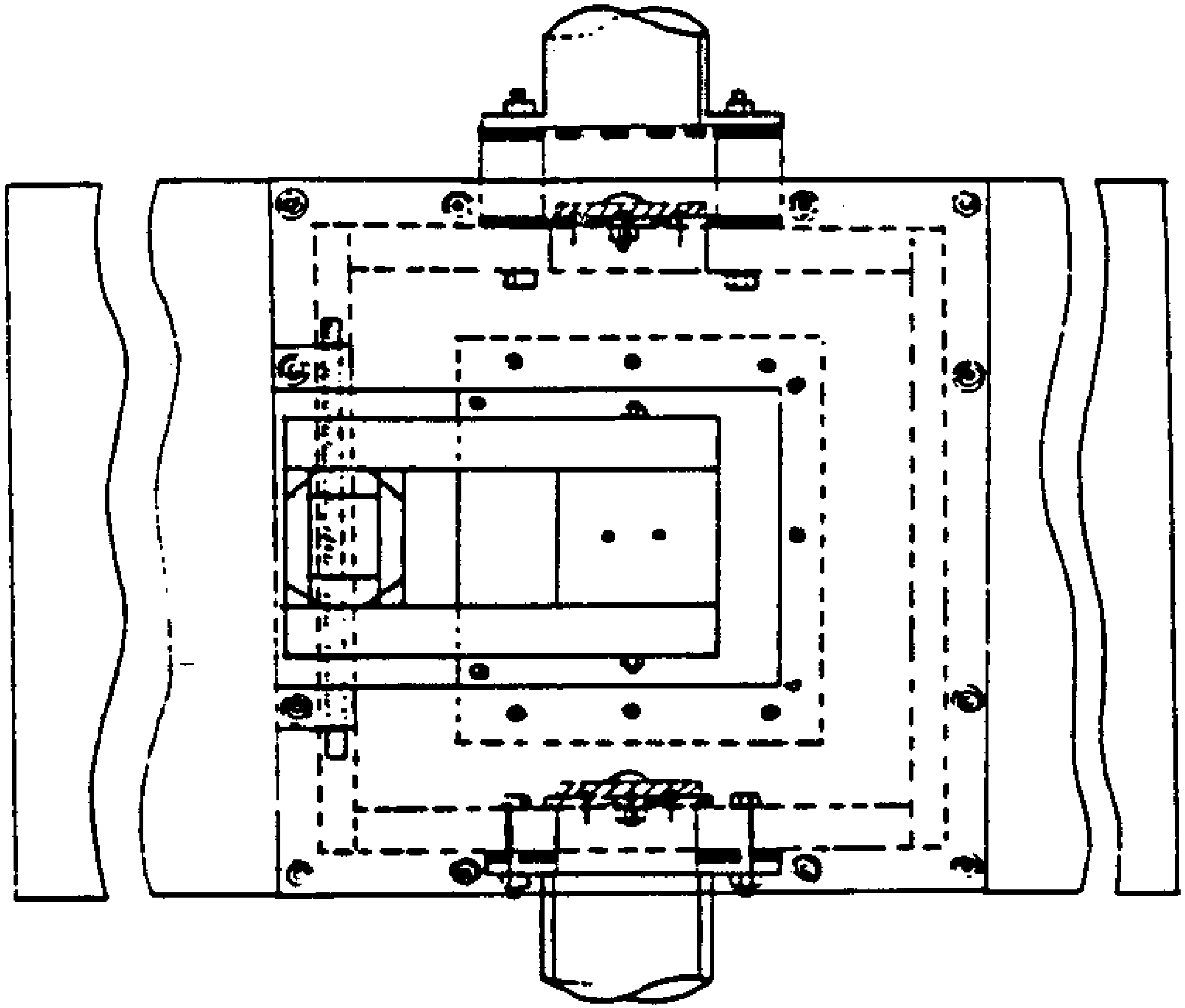


Figure 2. Diaphragm pump (top view)

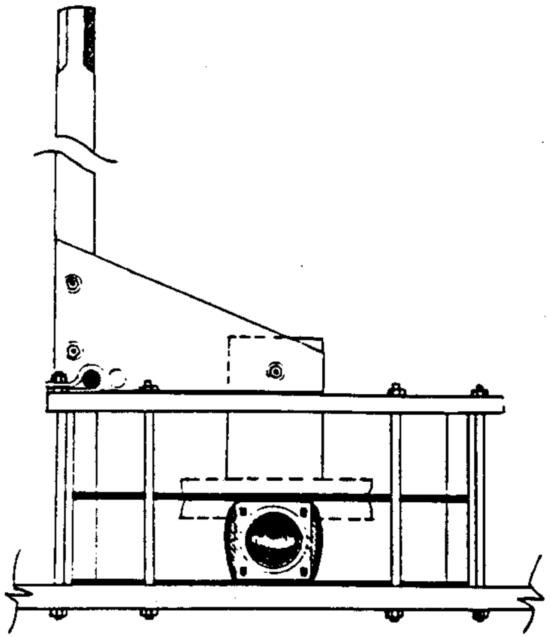


Figure 3. Diaphragm pump
(side view)

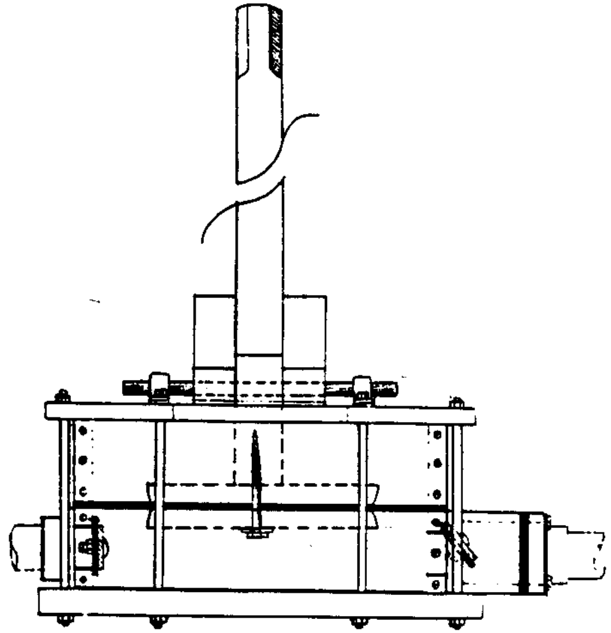


Figure 4. Diaphragm pump
(front view)

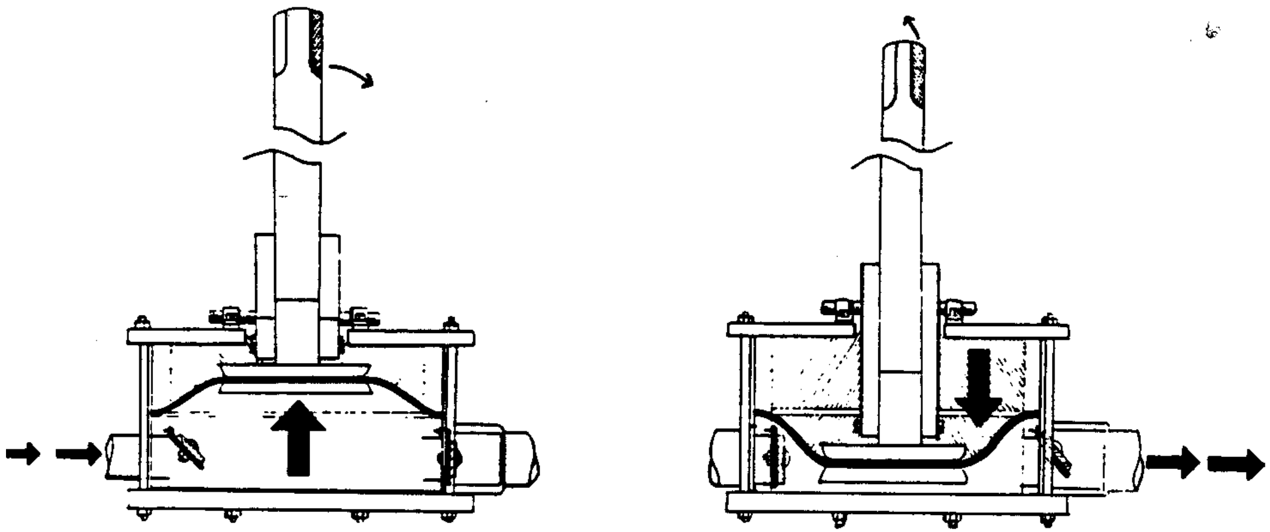


Figure 5. Pumping action

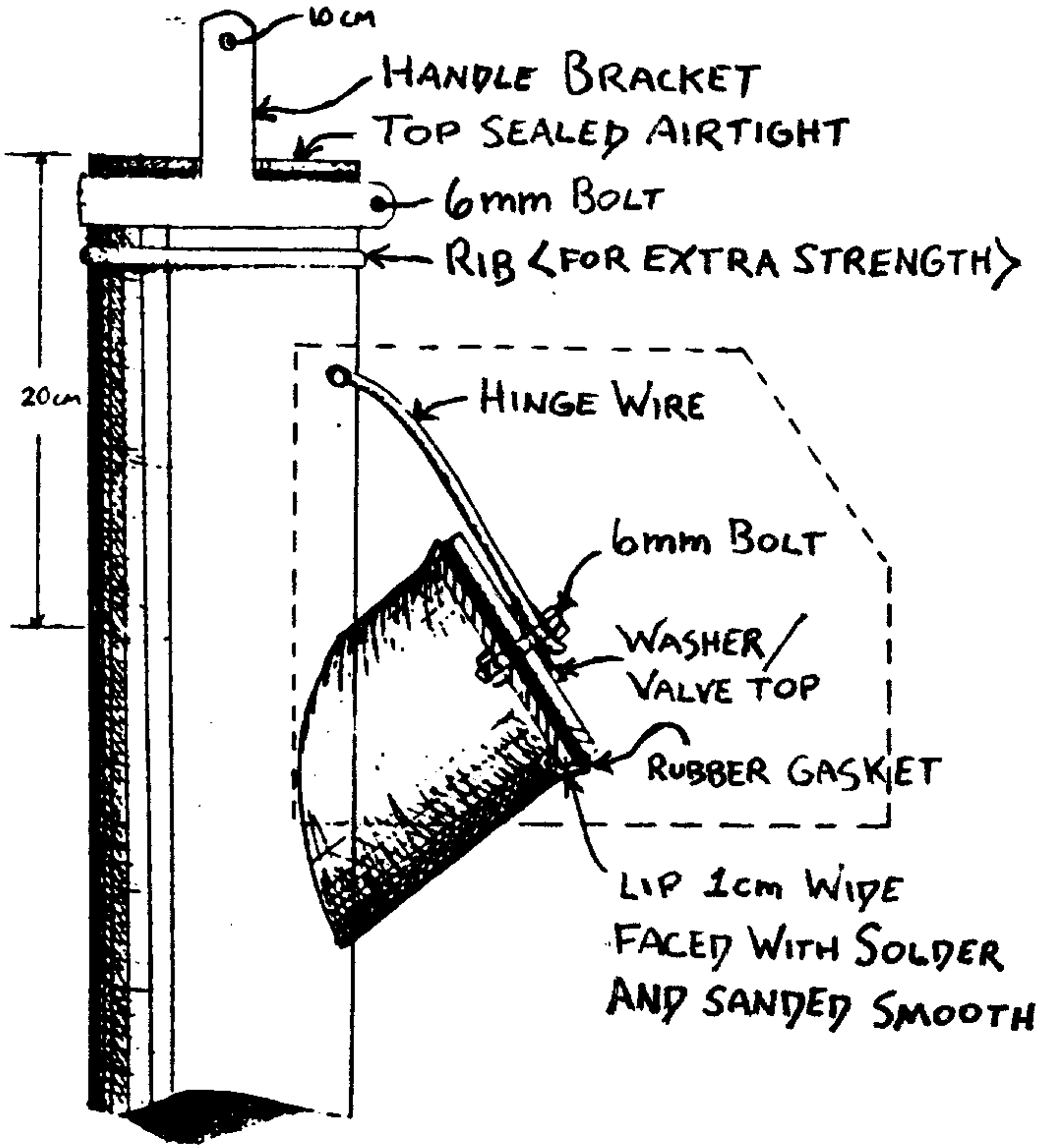


Figure 2.
Inertia pump (side view)

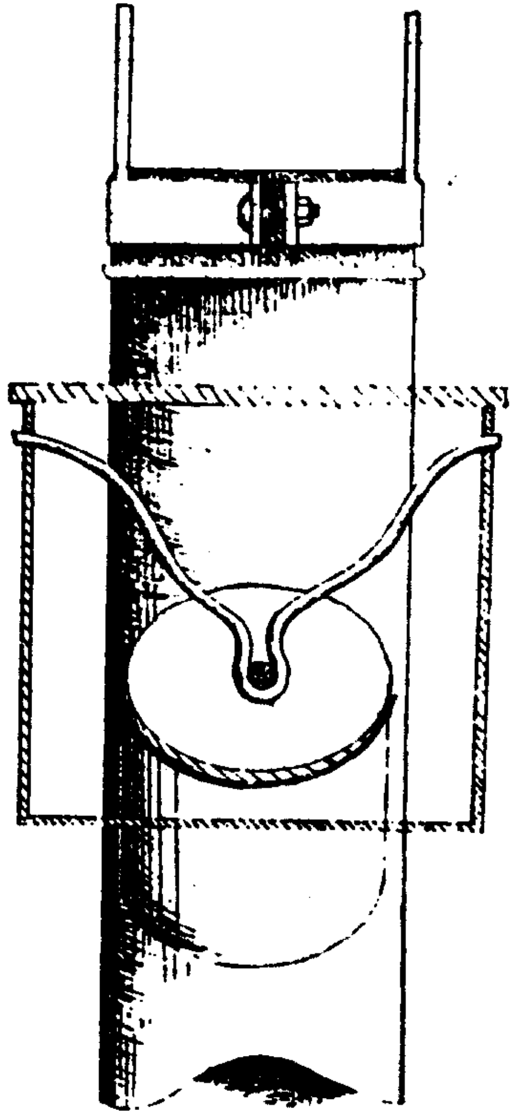


Figure 3.
(front view)

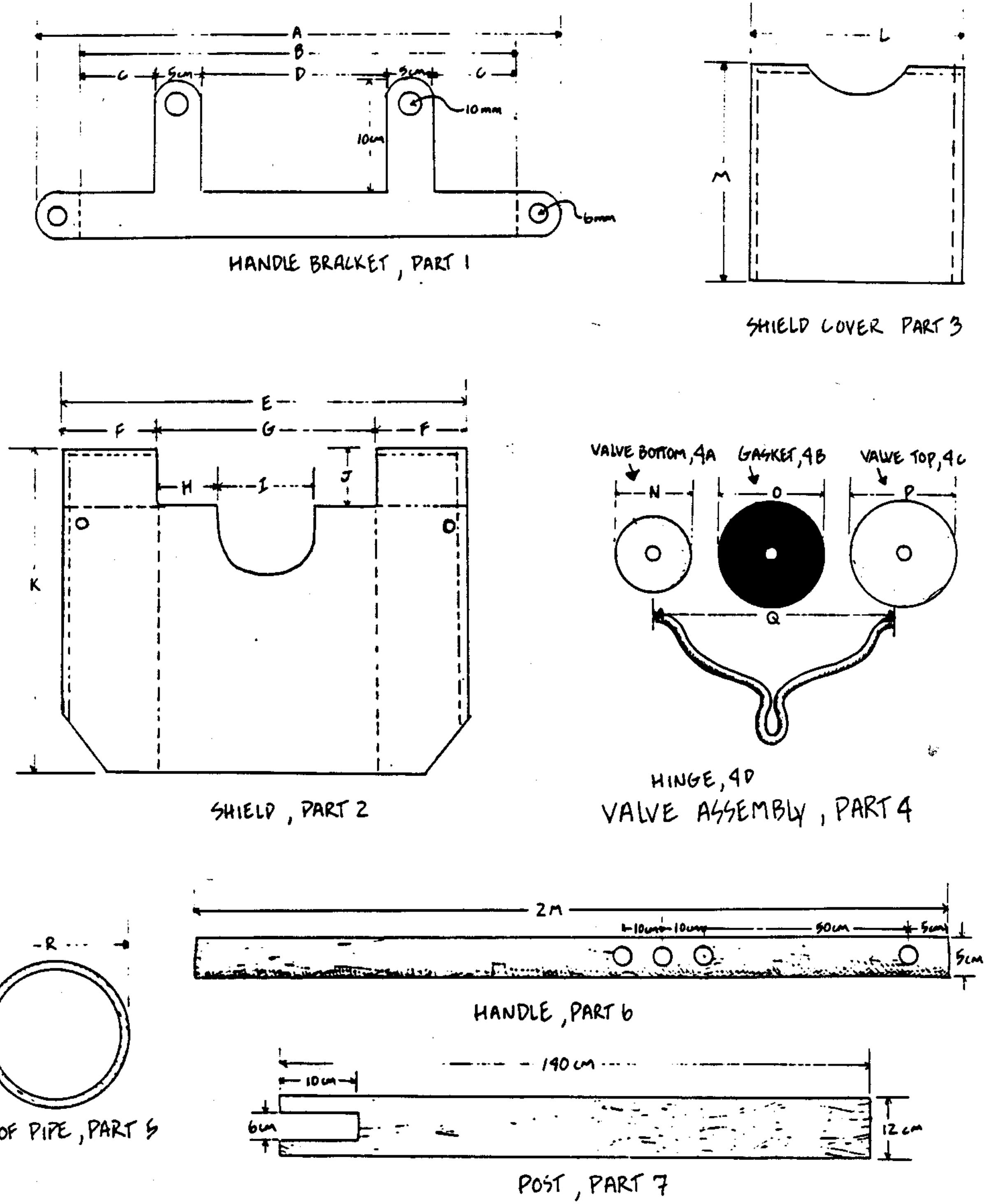


Figure 4. Inertia pump components

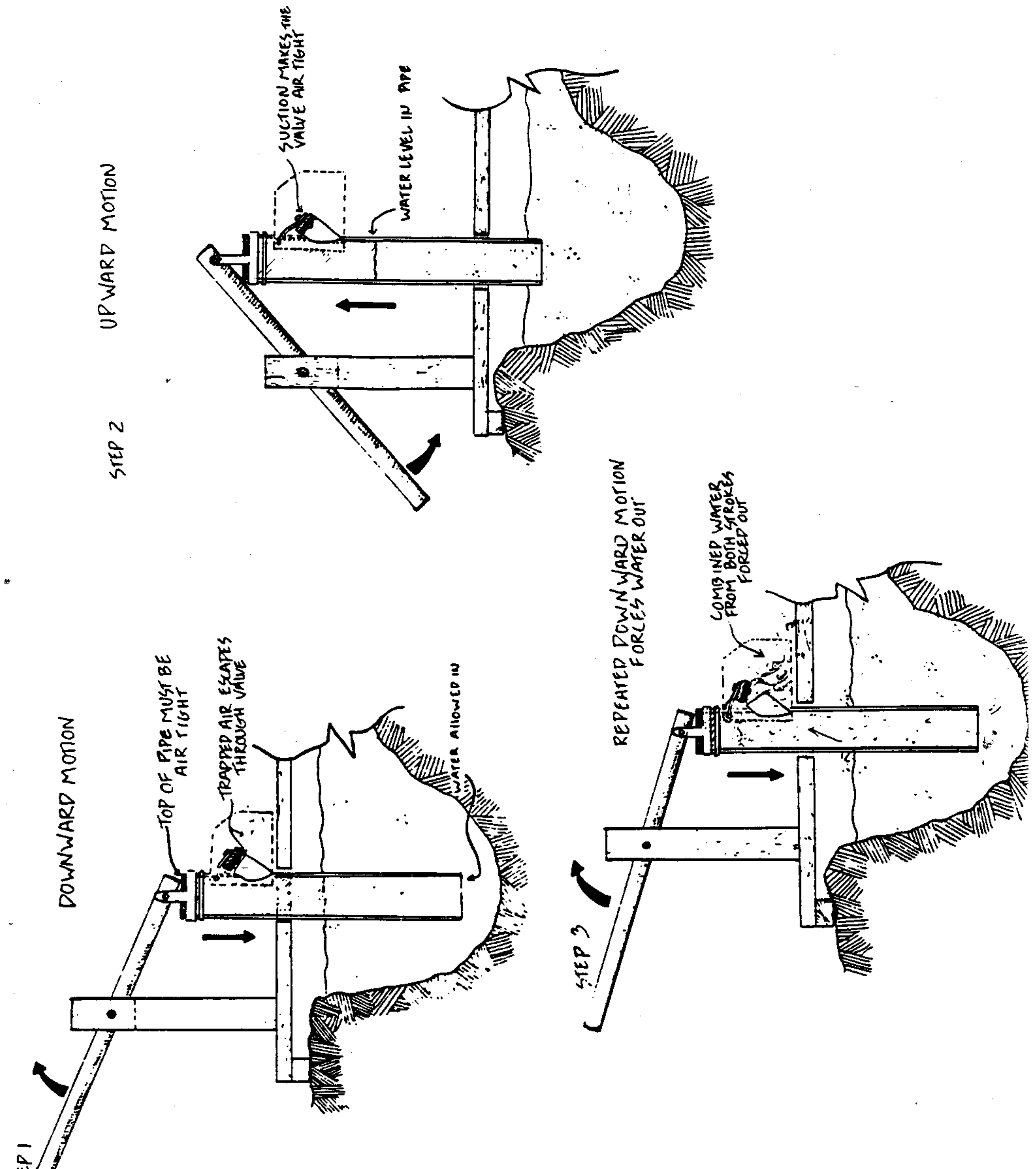


Figure 5. Action of inertia pump

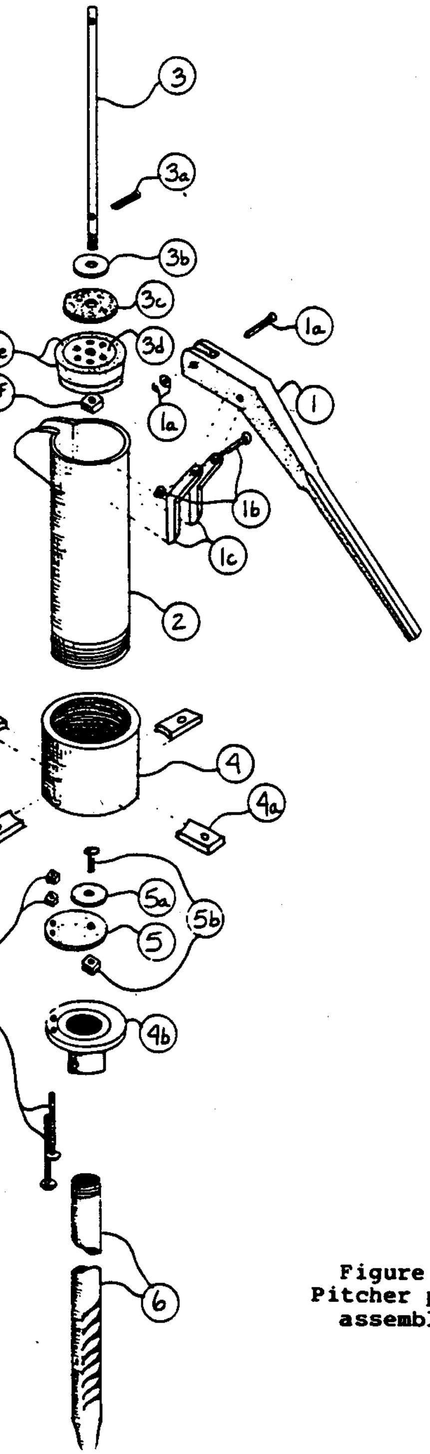


Figure 3.
Pitcher pump
assembly

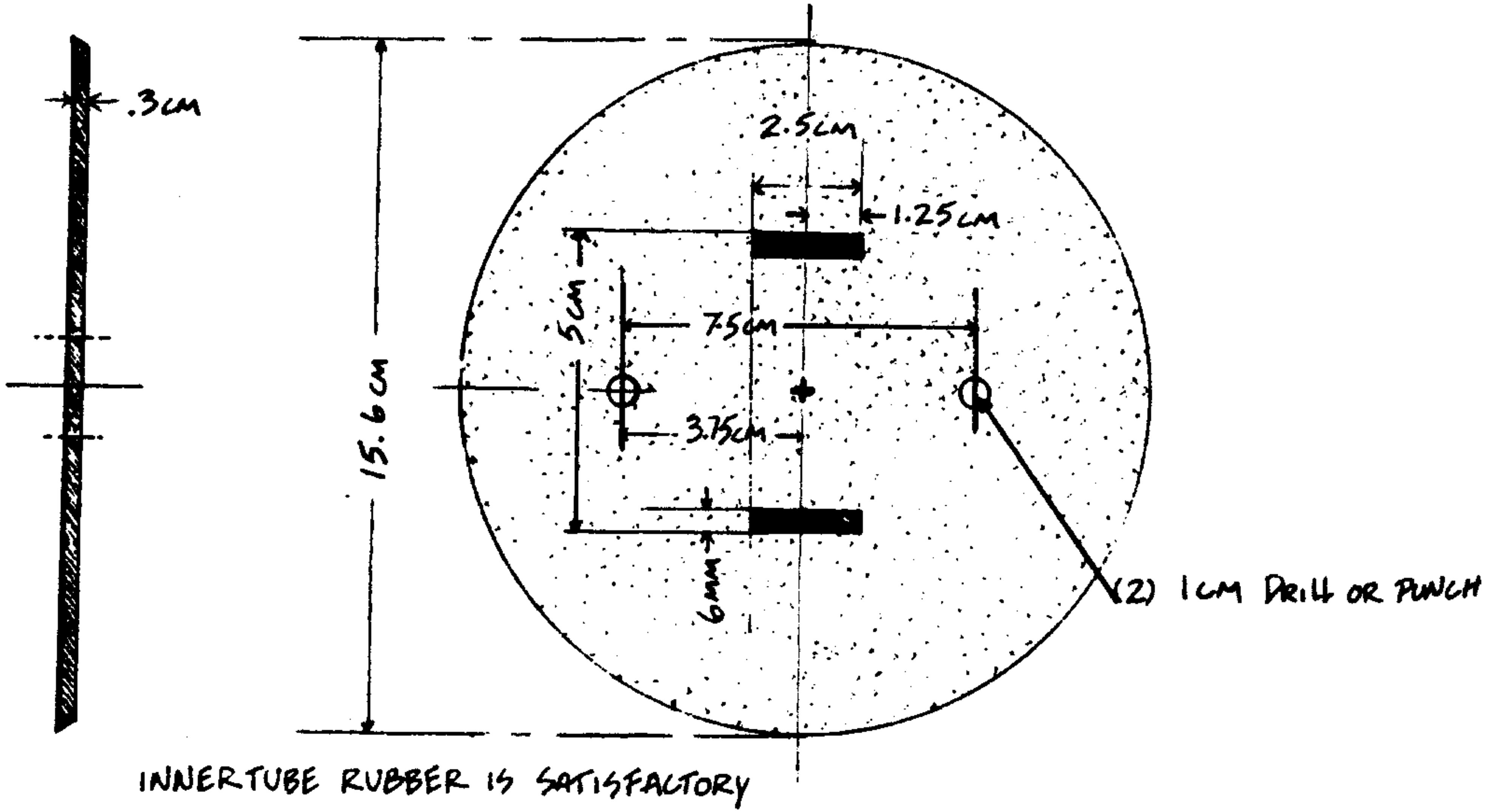


Figure 4. Rubber disk

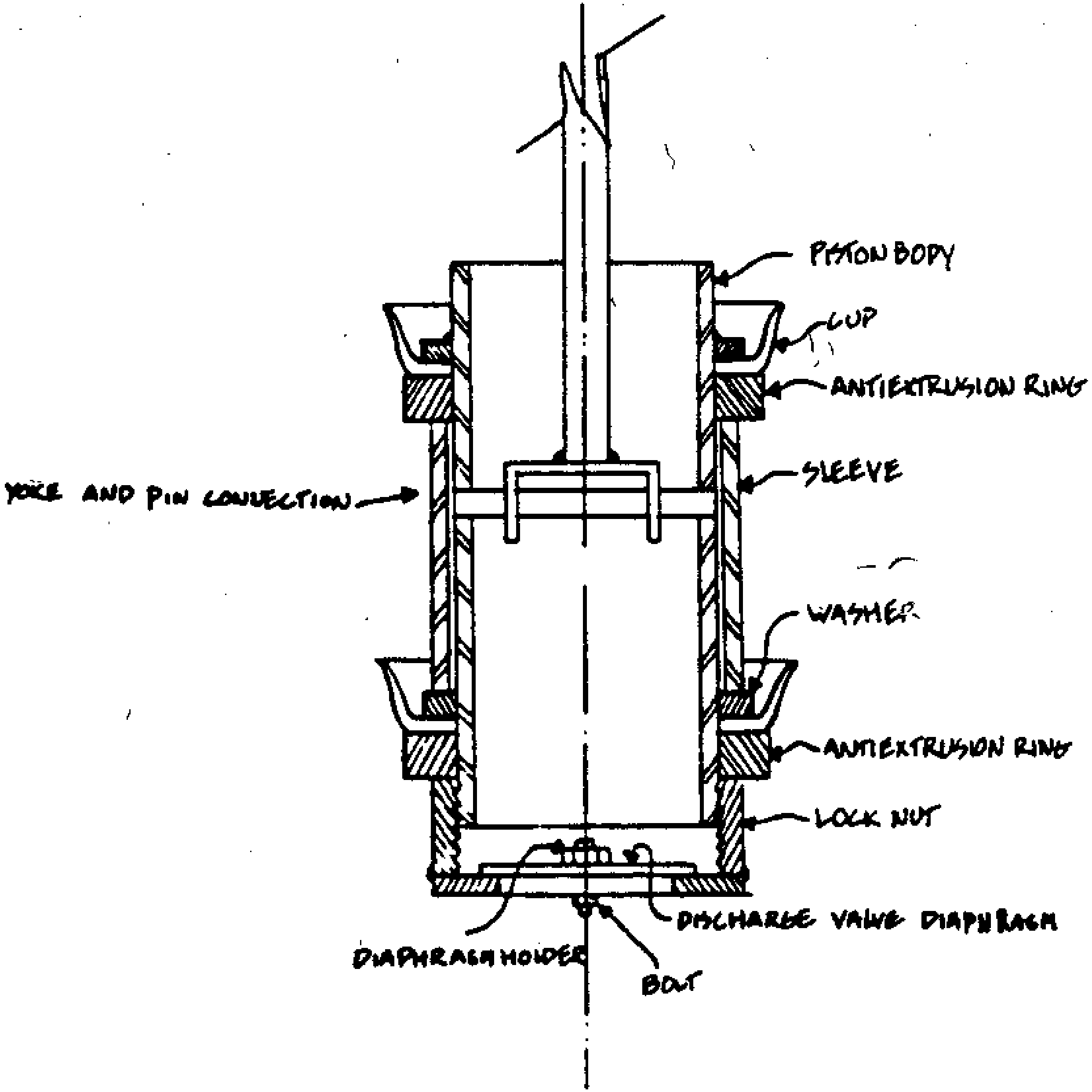


Figure 8. Thai double valve piston assembly

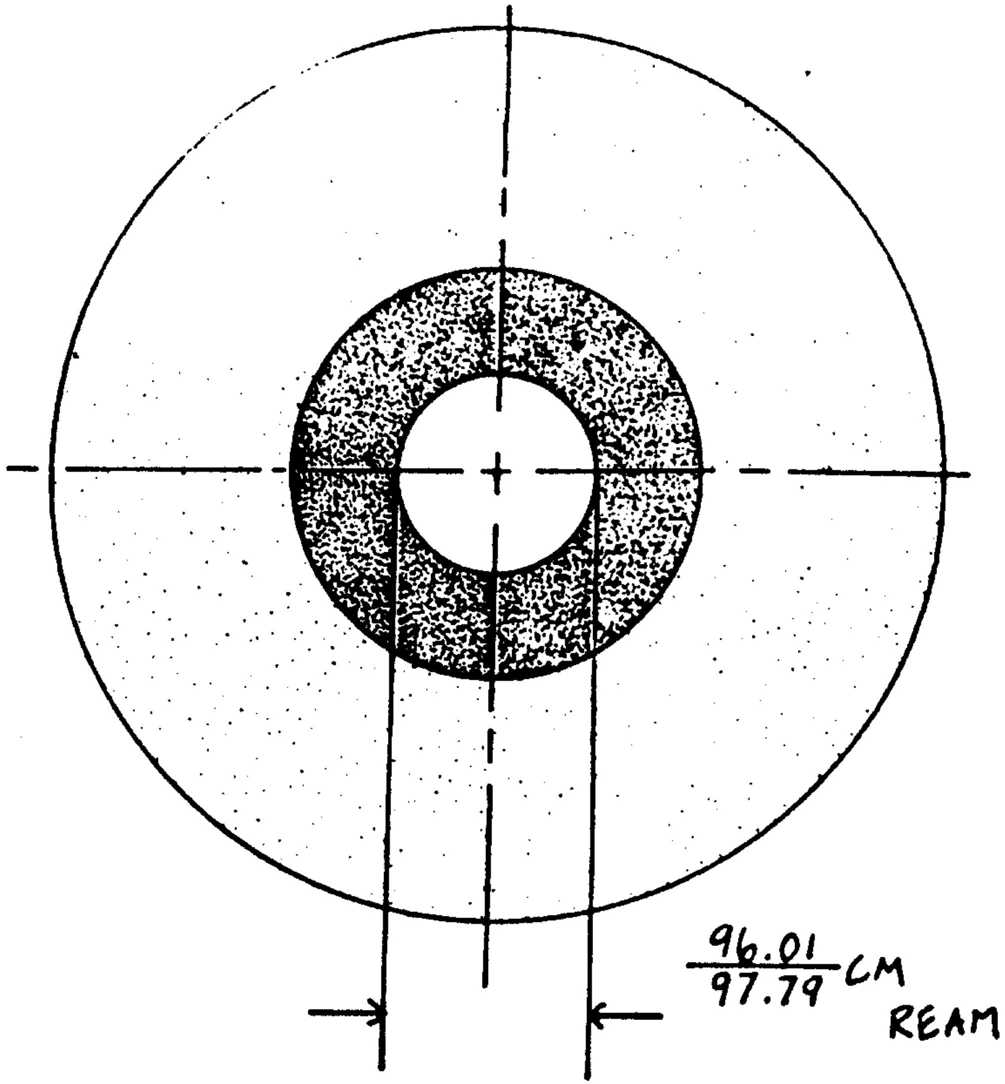


Figure 6. (top view)

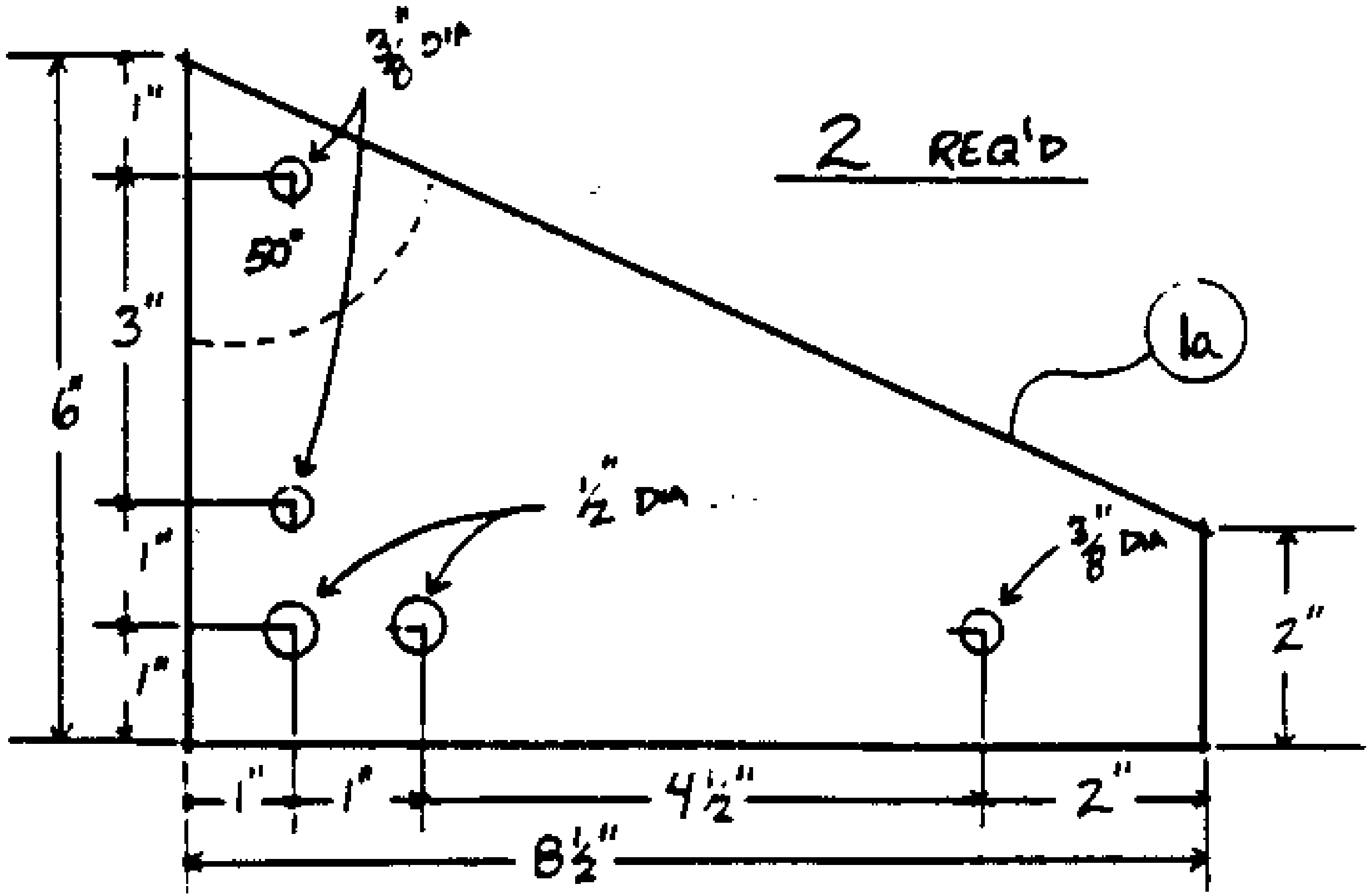


Figure 7. Handle arm schematic

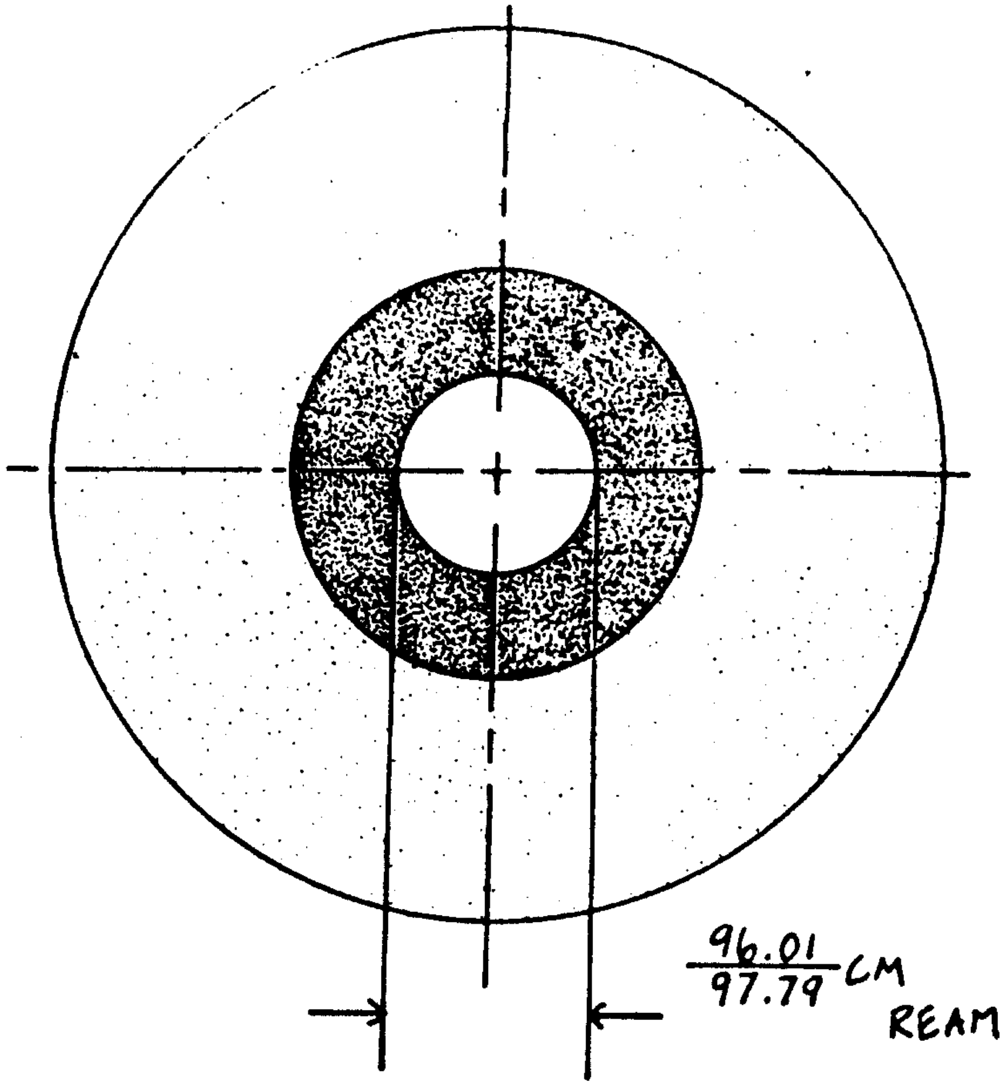


Figure 6. (top view)

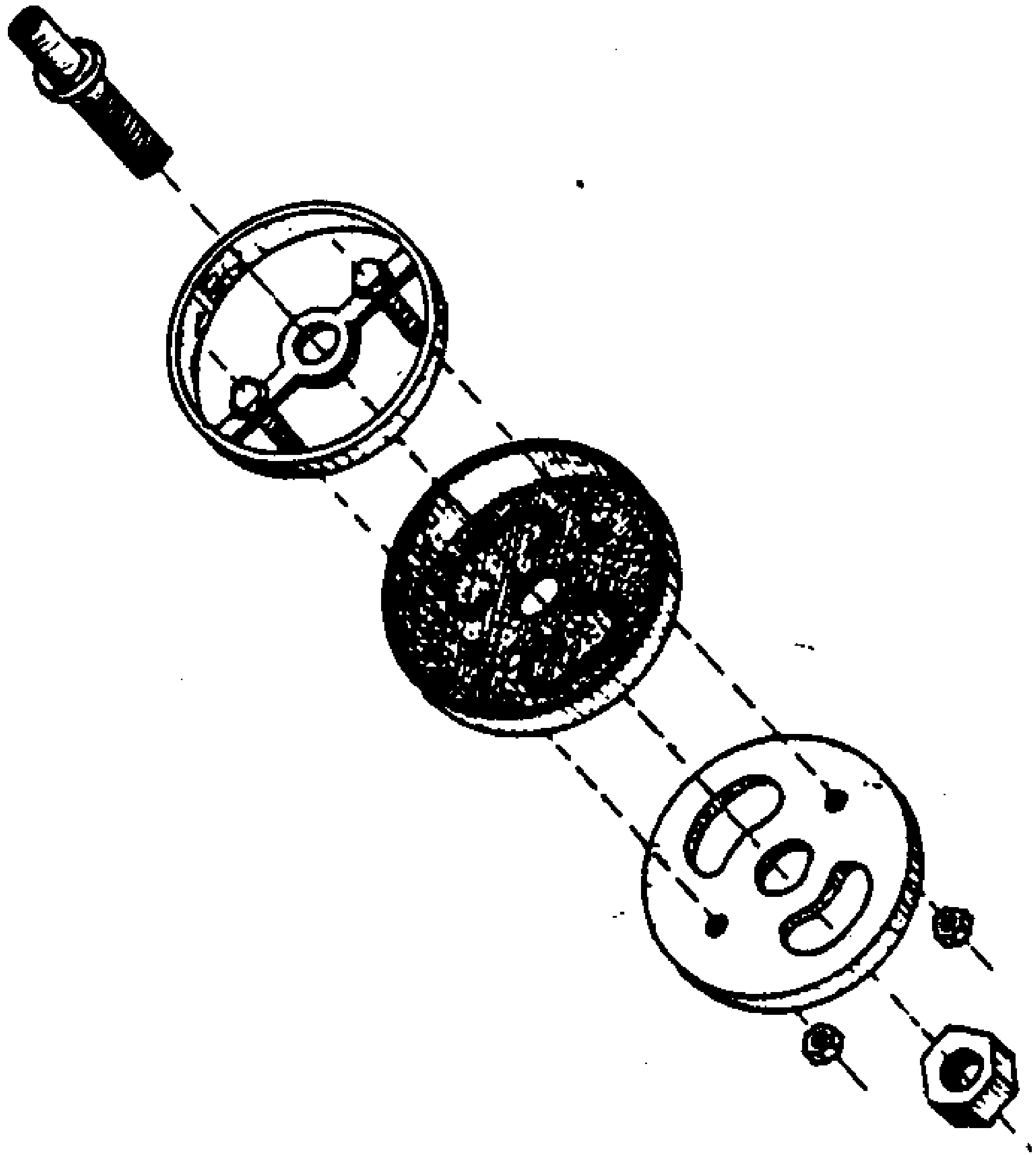


Figure 6. Double valve piston assembly

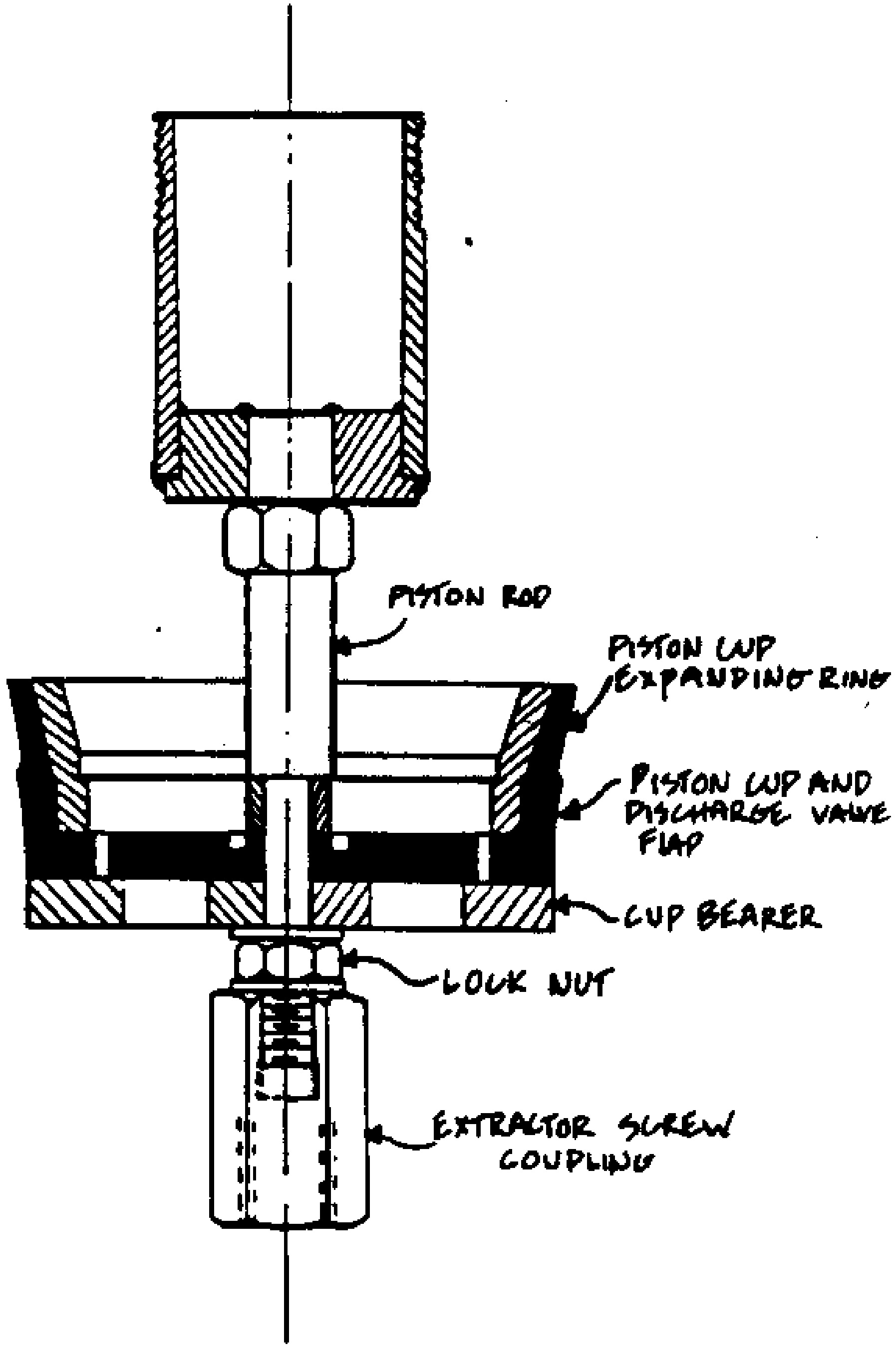


Figure 7. Conventional piston assembly

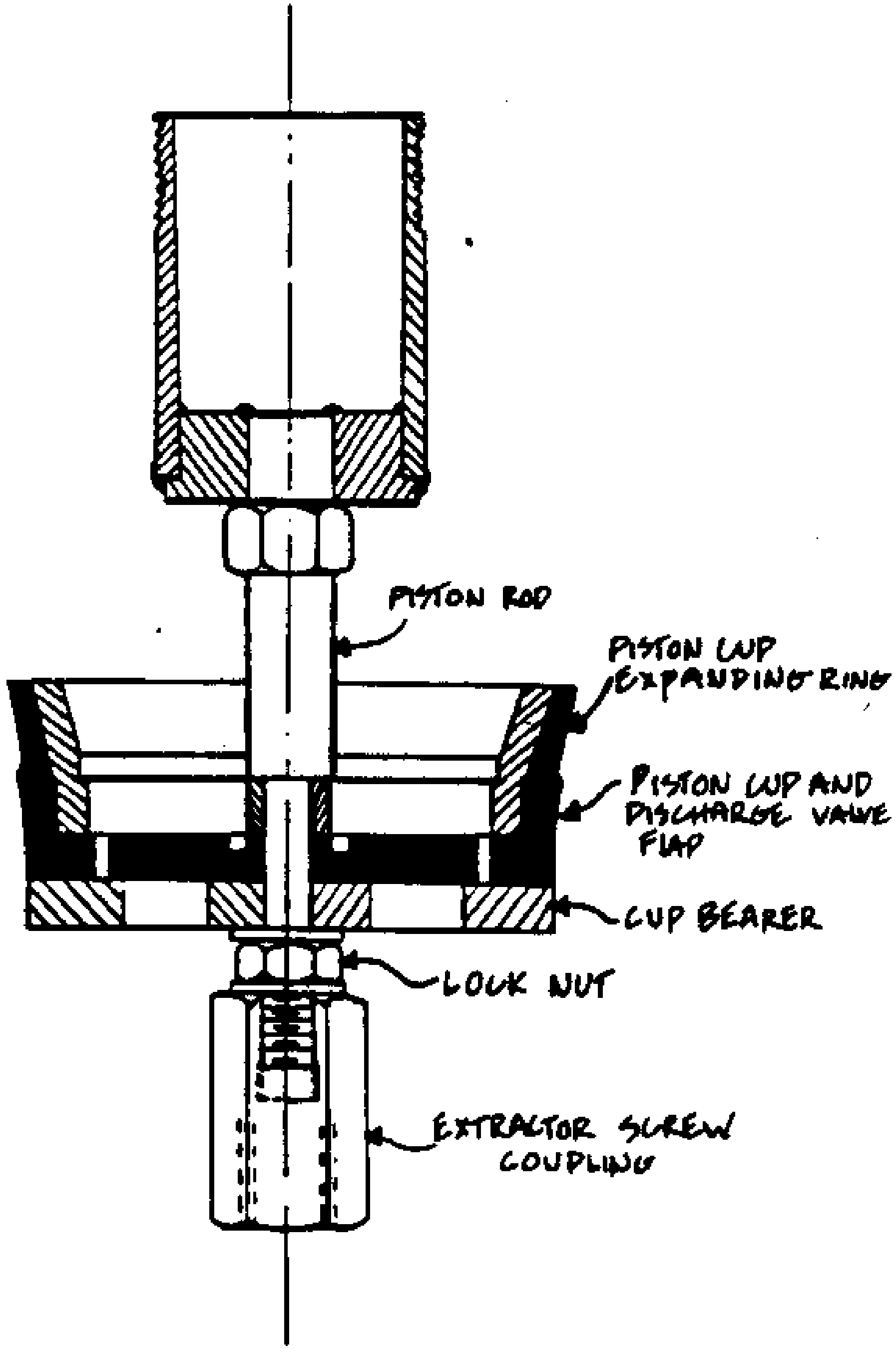


Figure 7. Conventional piston assembly

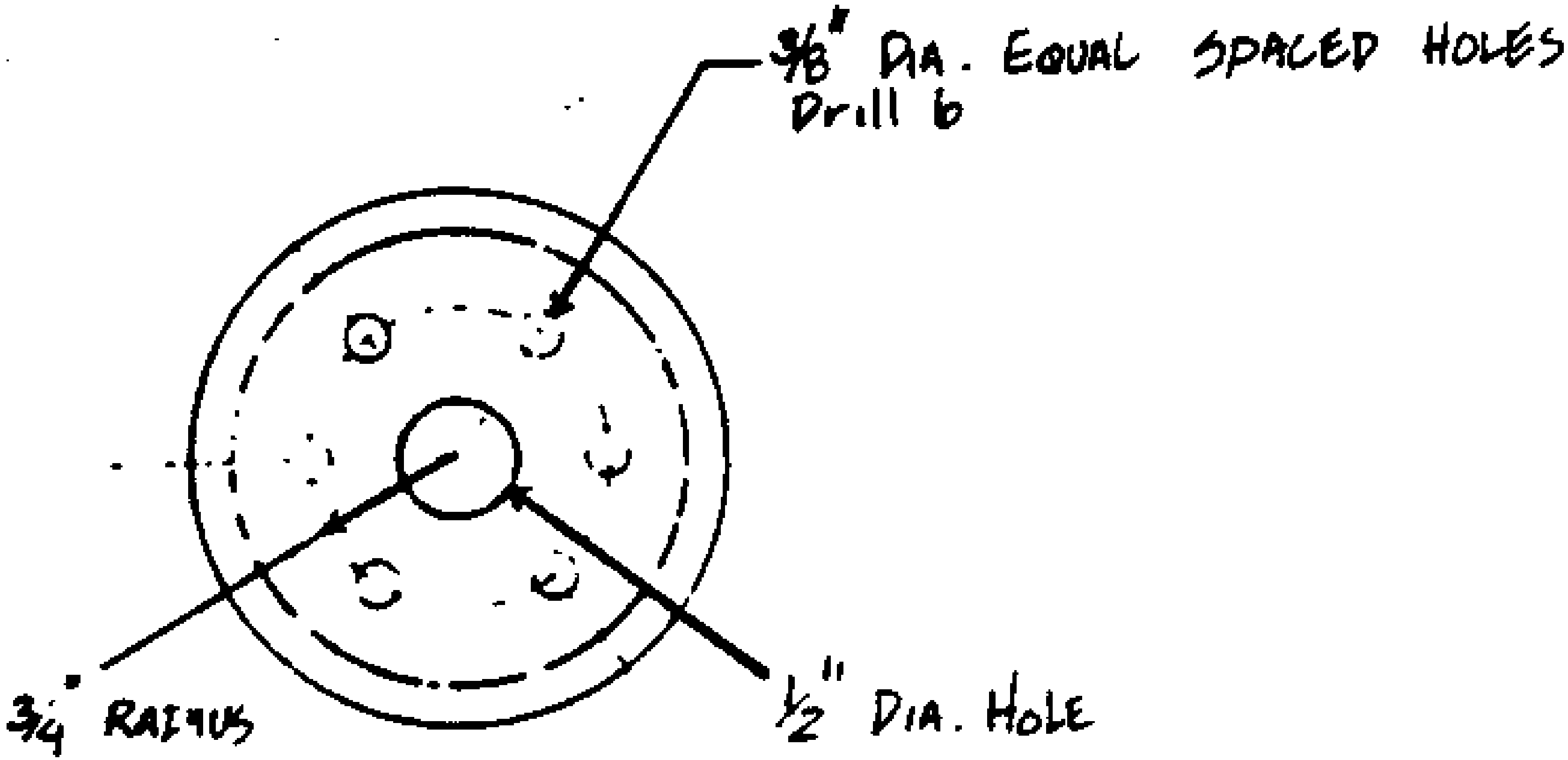


Figure 8. Piston block (bottom view)

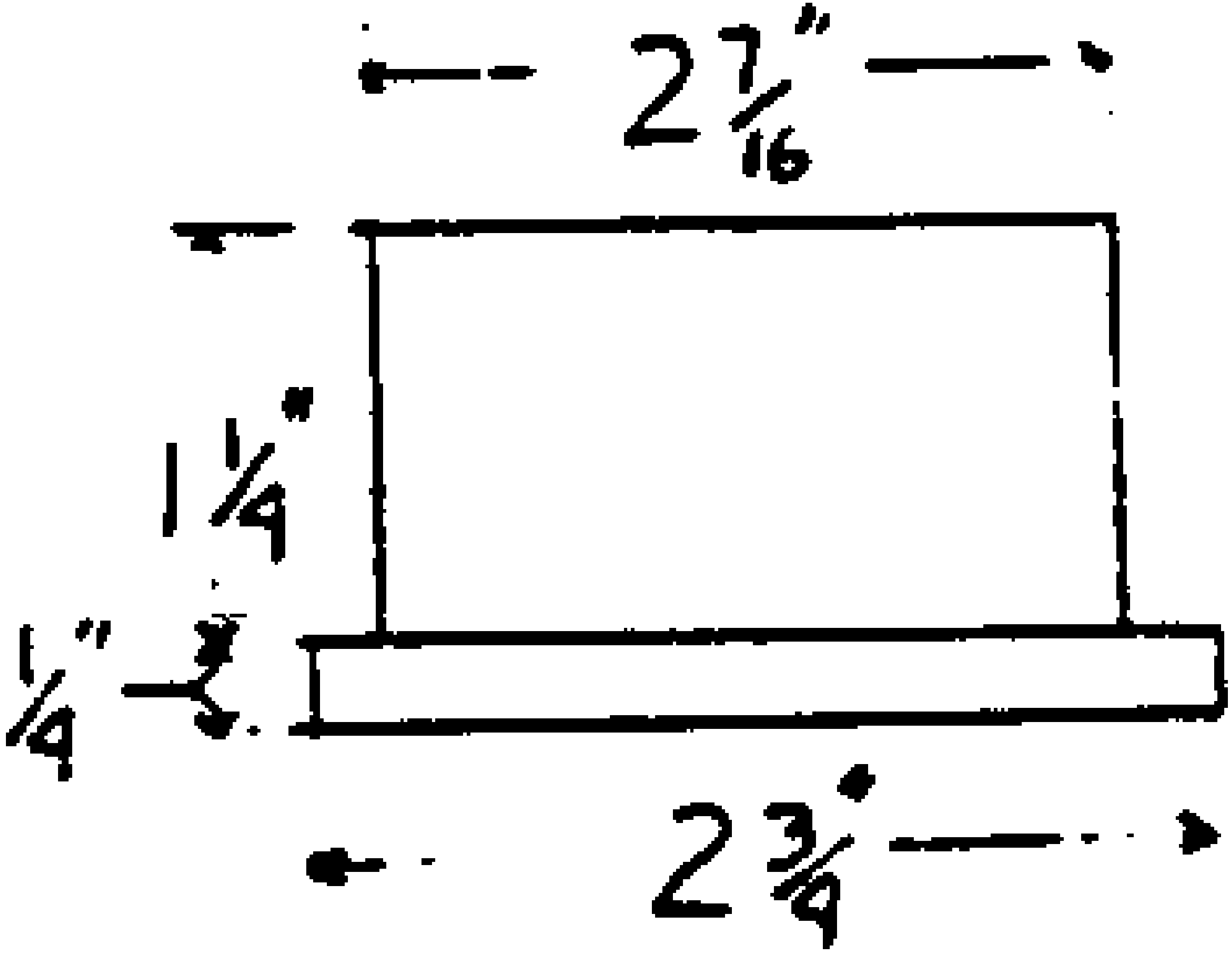


Figure 9.
Piston block (side view)

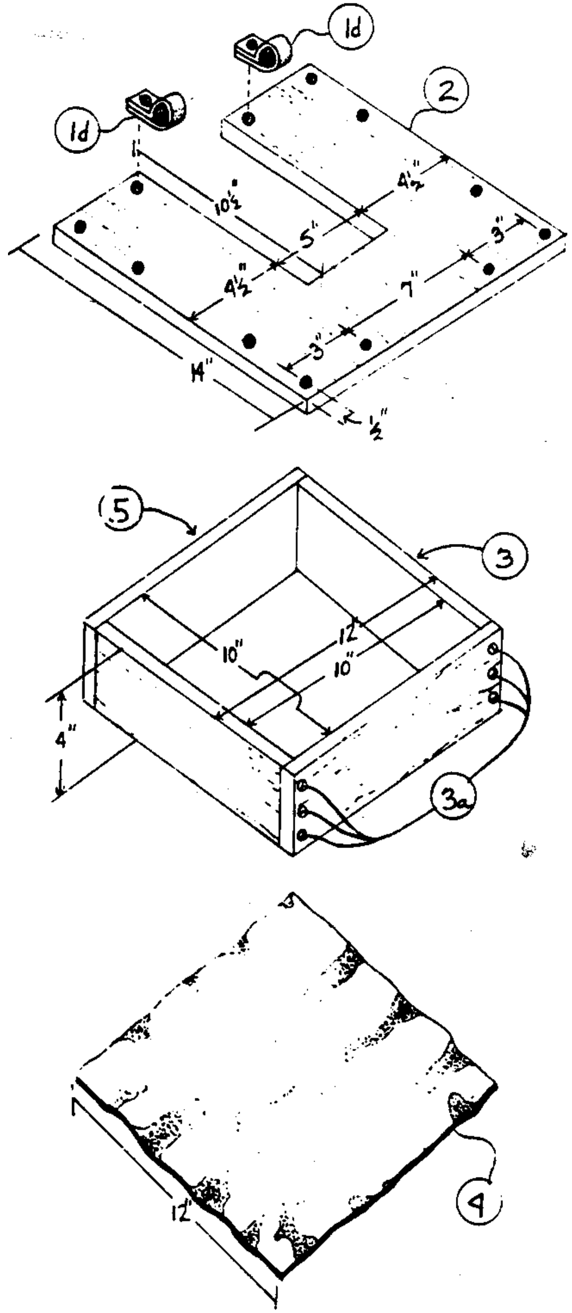


Figure 10.
Upper frame assembly

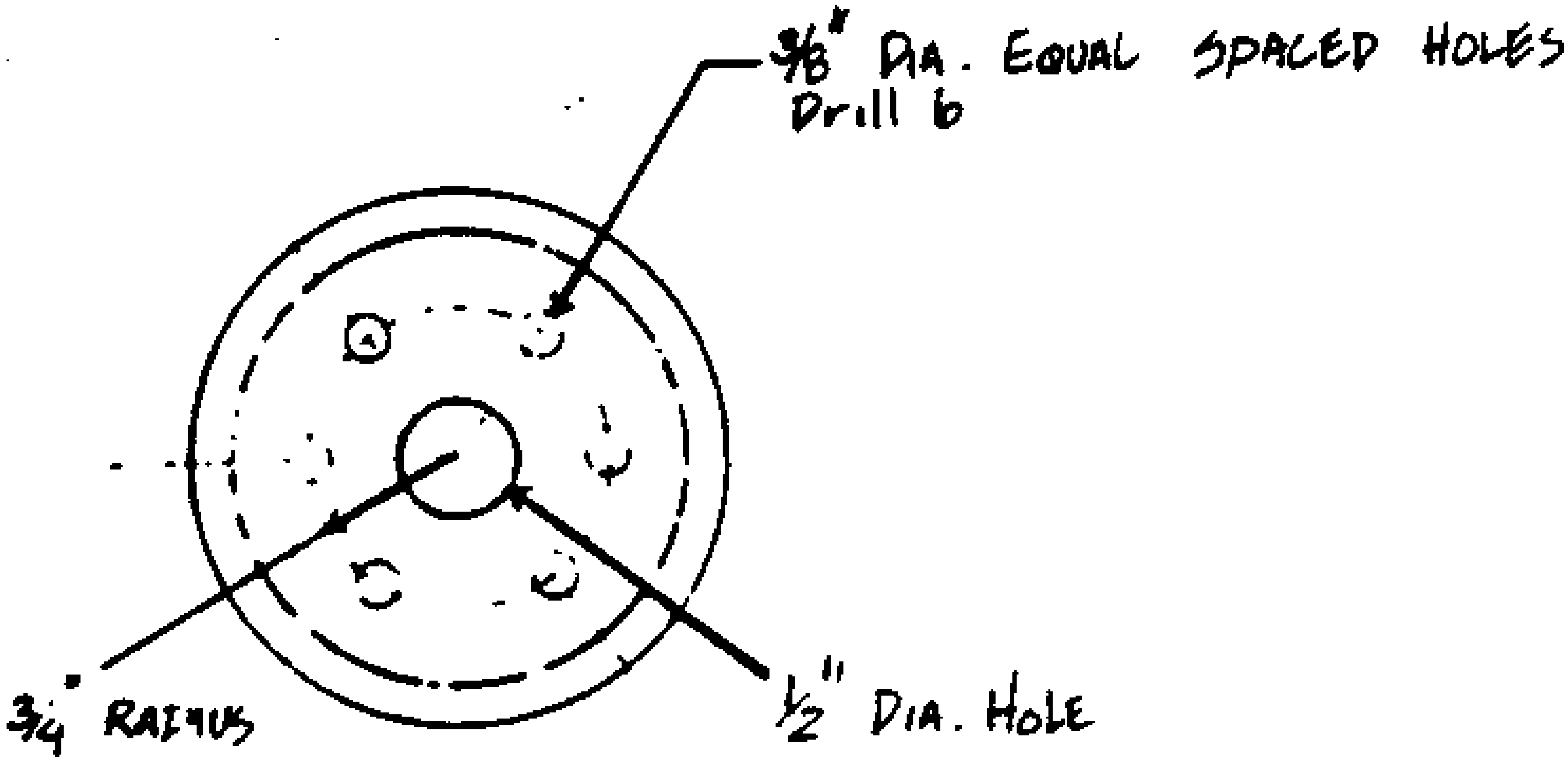
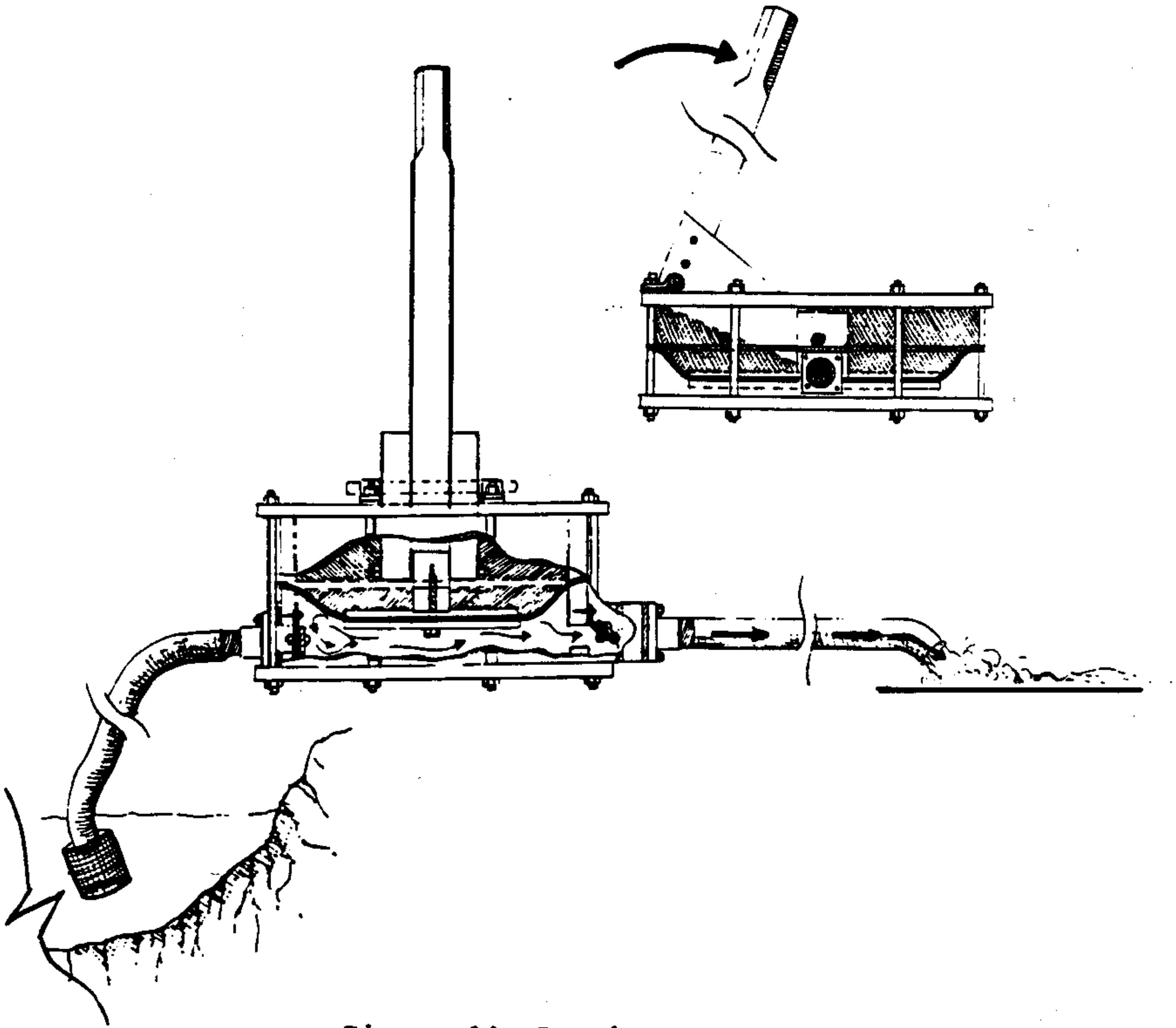


Figure 8. Piston block (bottom view)



Fiqure 14. Pumping water out

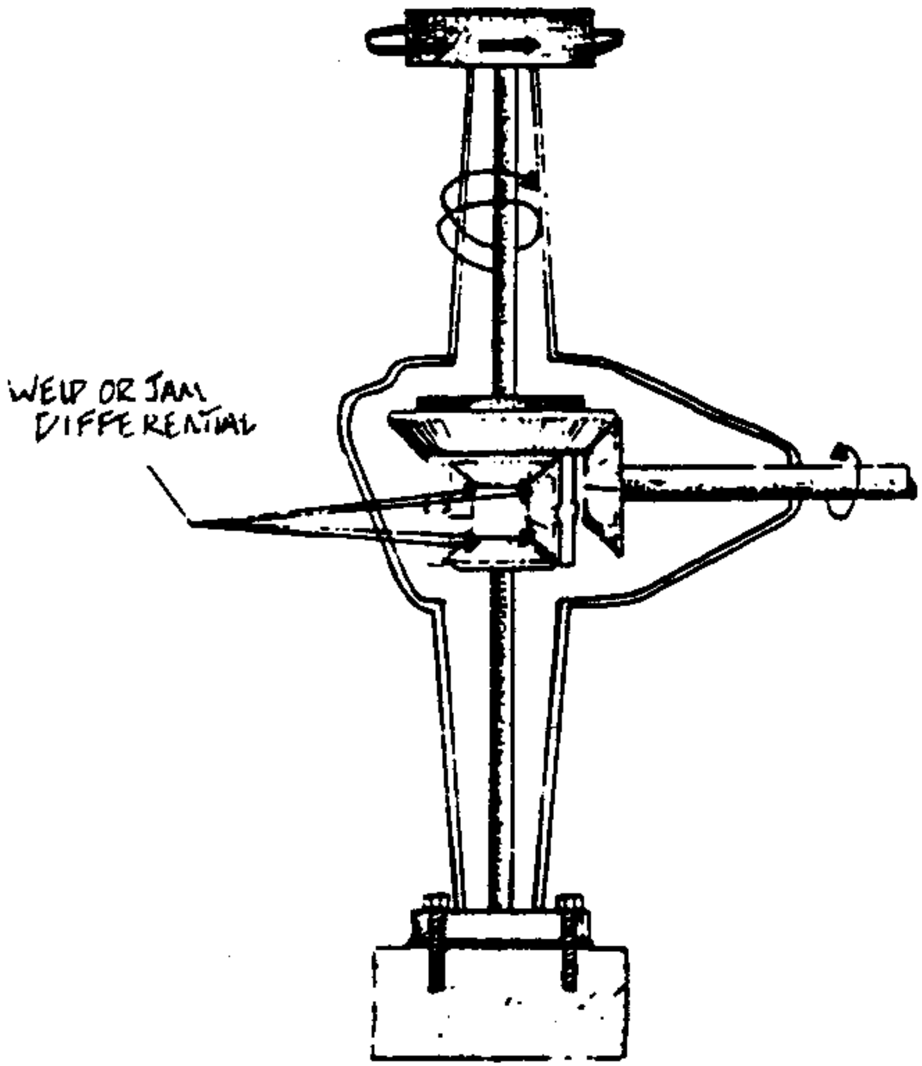


Figure 15.
Automobile differential
adapted for pumping

MAINTENANCE

Labor Account

	Name	Hours & Dates	Repair Done	Rate?	Pay?
1					
2					
3					
4					
5					
			Totals (By week or month)		

Materials Account

	Item	Cost	Reason Replaced	Date	Comments
1					
2					
3					
4					
5					
	Totals (By week or month)				

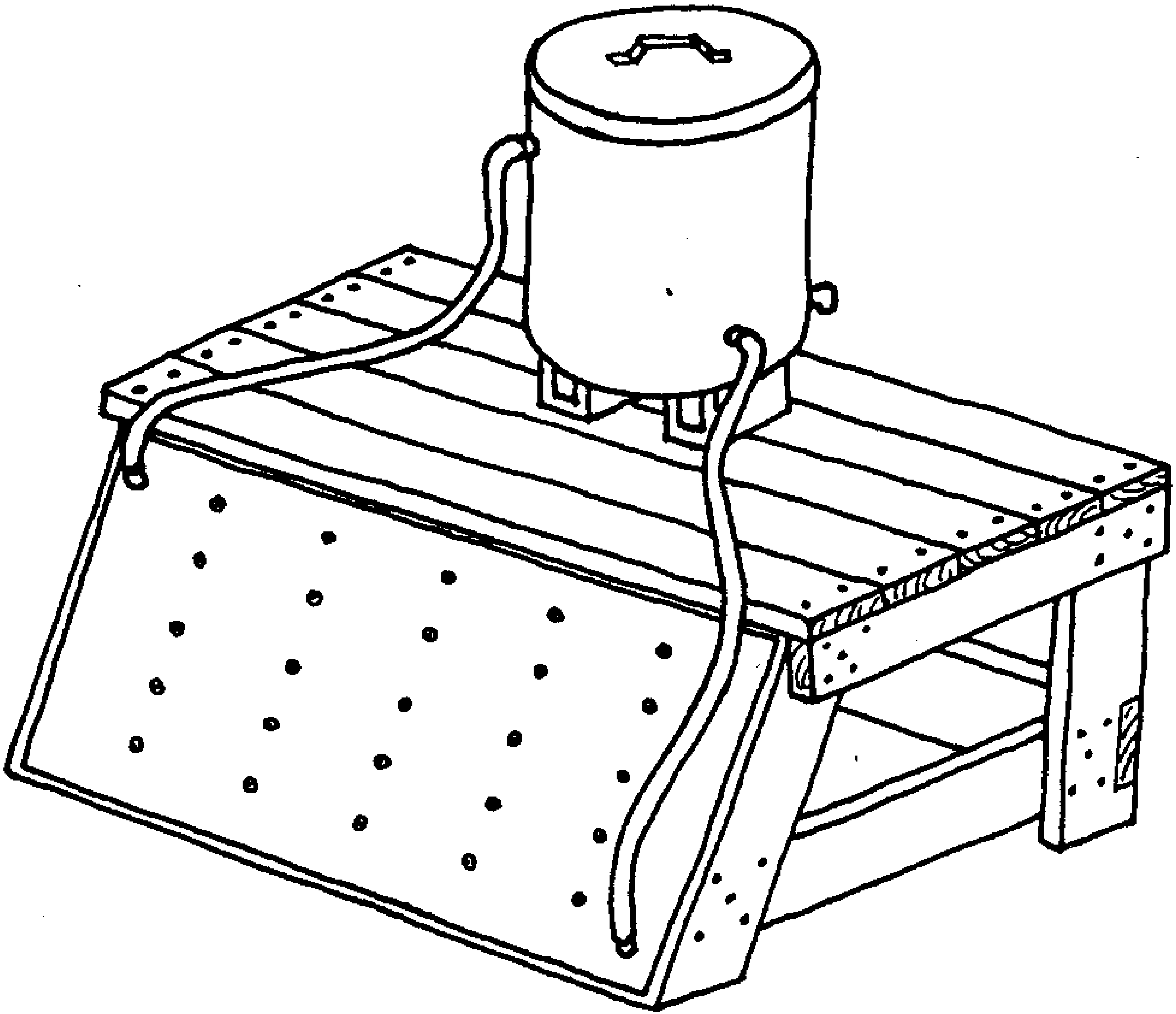


Figure 16B. Portable solar water heater

Materials Account

	Item	Cost Per Item	# Items	Total Costs
1				
2				
3				
4				
5				
			Total Costs	

Materials Account

	Item	Cost Per Item	# Items	Total Costs
1				
2				
3				
4				
5				
			Total Costs	

Table 3. Manure production and characteristics.
Approximate daily production per 1000 lb animal weight.

Parameter*		Dairy cow	Beef feeder	Swine feeder	Sheep feeder	Poultry		Horse
						Layer	Broiler	
Raw manure (RM)	Wt./day	82	60	65	40	53	71	45
Feces	% RM	69	71	55	50	—	—	80
Total solids (TS)	Wt./day	10.4	6.9	6.0	10.0	13.4	17.1	9.4
	% RM	12.7	11.6	9.2	25	25.2	25.2	20.5
Volatile solids (VS)	Wt./day	8.6	5.9	4.8	8.5	9.4	12.0	7.5
	% TS	82.5	85	80	85	70	70	80
BOD_5	Wt./day	1.7	1.6	2.0	0.9	3.5	—	—
	% TS	16.5	23	33	9.0	27	—	—
COD	Wt./day	9.1	6.6	5.7	11.8	12.0	—	—
	% TS	88	95	95	118	90	—	—
Nitrogen (Total, as N)	Wt./day	0.41	0.34	0.45	0.45	0.72	1.16	0.27
	% TS	3.9	4.9	7.5	4.5	5.4	6.8	2.9
Phosphorus (as P)	Wt./day	0.073	0.11	0.15	0.066	0.28	0.26	0.046
	% TS	0.7	1.6	2.5	0.66	2.1	1.5	0.49
Potassium (as K)	Wt./day	0.27	0.24	0.30	0.32	0.31	0.36	0.17
	% TS	2.6	3.6	4.9	3.2	2.3	2.1	1.8

*Raw manure: Feces and urine with no bedding.
Feces: Solids and liquids in feces as %RM. Urine as %RM = 100 - % feces.
Total solids: The sum of dissolved and undissolved constituents in water or wastewater.
Volatile solids: The quantity of solids in water, wastewater, or other liquids lost in ignition of the dry solids at 550° C; VS + ash = TS.
BOD_5: The oxygen used in the biochemical oxidation of organic matter in 5 days at 68°F. A standard test to assess wastewater strength.
COD: A measure of the oxygen consuming capacity of inorganic and organic matter in wastewater. An analytical measure not used in engineering design.
Source: American Society of Agricultural Engineers, data adapted from Committee S&E-412 report AW-D-1, Revised 6-14-73.

Table 2. Daily manure production.[a]

Animal	Size pounds	Total manure production lb/day	cu ft/day	gal/day	Water %	Density lb/cu ft	TS lb/day	VS lb/day	BOD_5 lb/day	Nutrient content N lb/day	P lb/day	K lb/day
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dairy cattle	150	12	0.19	1.5	87.3	62	1.6	1.3	0.26	0.06	0.010	0.04
	250	20	0.32	2.4	"	"	2.6	2.1	0.43	0.10	0.020	0.07
	500	41	0.66	5.0	"	"	5.2	4.3	0.86	0.20	0.036	0.14
	1000	82	1.32	9.9	"	"	10.4	8.6	1.70	0.41	0.073	0.27
	1400	115	1.85	13.9	"	"	14.6	12.0	2.38	0.57	0.102	0.38
Beef cattle	500	30	0.50	3.8	88.4	60	3.5	3.0	0.80	0.17	0.056	0.12
	750	45	0.75	5.6	"	"	5.2	4.4	1.2	0.26	0.084	0.19
	1000	60	1.0	7.5	"	"	6.9	6.0	1.6	0.34	0.11	0.24
	1250	75	1.2	9.4	"	"	8.7	7.4	2.0	0.43	0.14	0.31
cow[b]		63	1.05	7.9	"	"	7.3	6.2	1.7	0.36	0.12	0.26
Swine												
Nursery pig	35	2.3	0.038	0.27	90.8	60	0.20	0.17	0.07	0.016	0.0052	0.010
Growing pig	65	4.2	0.070	0.48	"	"	0.39	0.31	0.13	0.029	0.0098	0.020
Finishing pig	150	9.8	0.16	1.13	"	"	0.90	0.72	0.30	0.068	0.022	0.045
	200	13	0.22	1.5	"	"	1.2	0.96	0.39	0.090	0.030	0.059
Gestate sow	275[b]	8.9	0.15	1.1	"	"	0.82	0.66	0.27	0.062	0.021	0.040
Sow & litter	375[b]	33	0.54	4.0	"	"	3.0	2.4	1.0	0.23	0.076	0.15
Boar	350[b]	11	0.19	1.4	"	"	1.0	0.84	0.35	0.078	0.026	0.051
Sheep	100	4.0	0.062	0.46	75	65	1.0	0.85	0.09	0.045	0.0066	0.032
Poultry												
Layers	4	0.21	0.0035	0.027	74.8	60	0.053	0.037	0.014	0.0029	0.0011	0.0012
Broilers	2	0.14	0.0024	0.018	"	"	0.036	0.025	0.0023	0.0024	0.00054	0.00075
Horse	1000	45	0.75	5.63	79.5	60	9.4	7.5	–	0.27	0.046	0.17

[a]Data are derived from Table 3:

(1) $\text{lb/day} = \frac{\text{animal wt} \times \text{RM in lb/day per 100 lb}}{1000}$

(2) cu ft/day = lb/day ÷ density

(3) gal/day = 7.5 x cu ft/day

(4) Water % = 100 - % RM of TS from Table 3.

(5) density = best estimate, not ASAE data.

(6) TS = lb/day x TS ans % RM from Table 3.

(7)-(11) lb/day of element = TS x % TS of element.

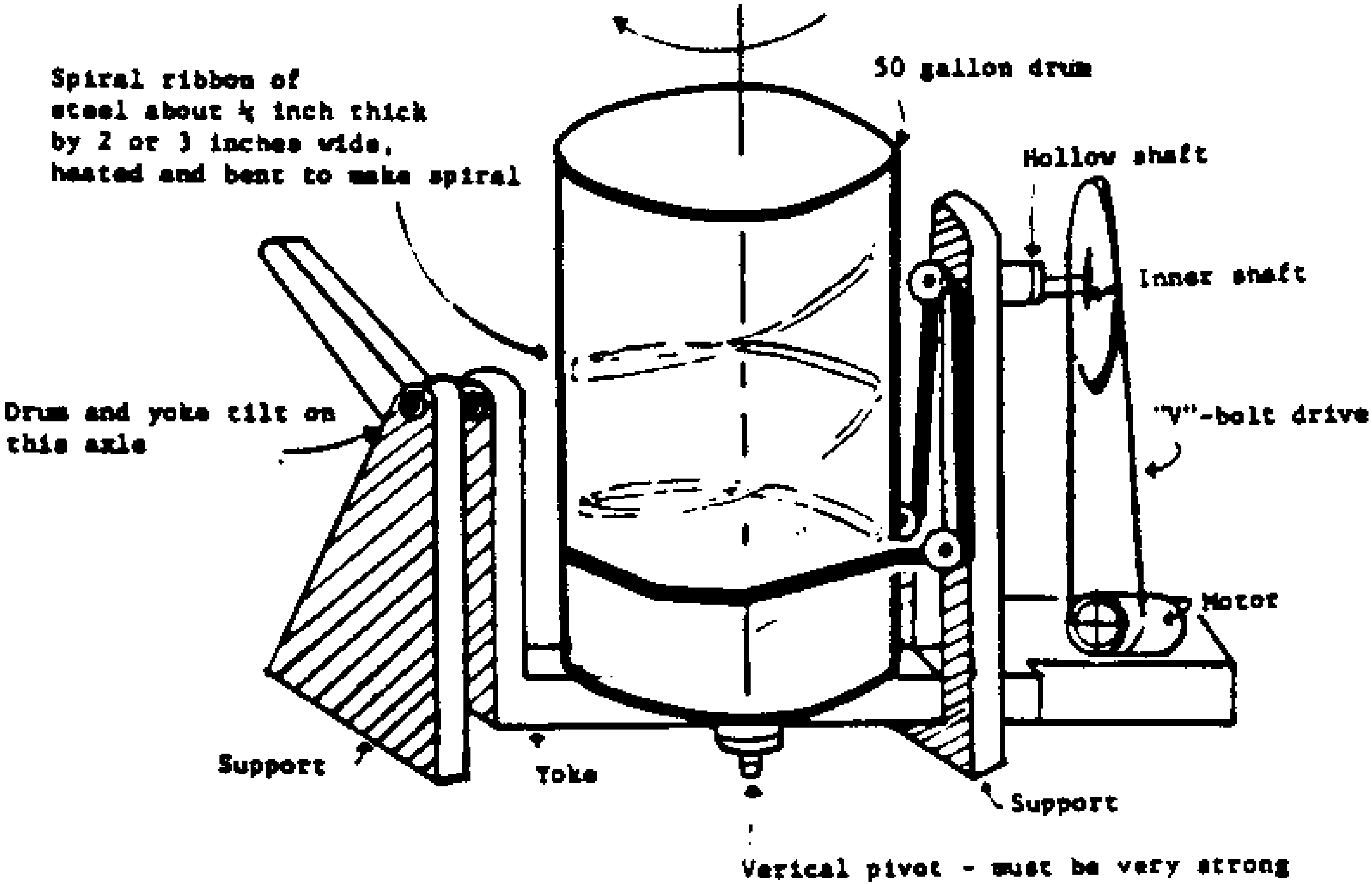
[b]Not ASAE data; assumptions:

cow = 1.05 cu ft/day

gestating sow = ½ of ASAE data for her weight because she's limit fed.

sow & litter = ASAE data for her weight + 8 pigs @ 1.0 lb/day.

boar = ½ of ASAE data for his weight because he's limit fed.



Works best when filled about 45%

Figure 1. Ribbon Mixer

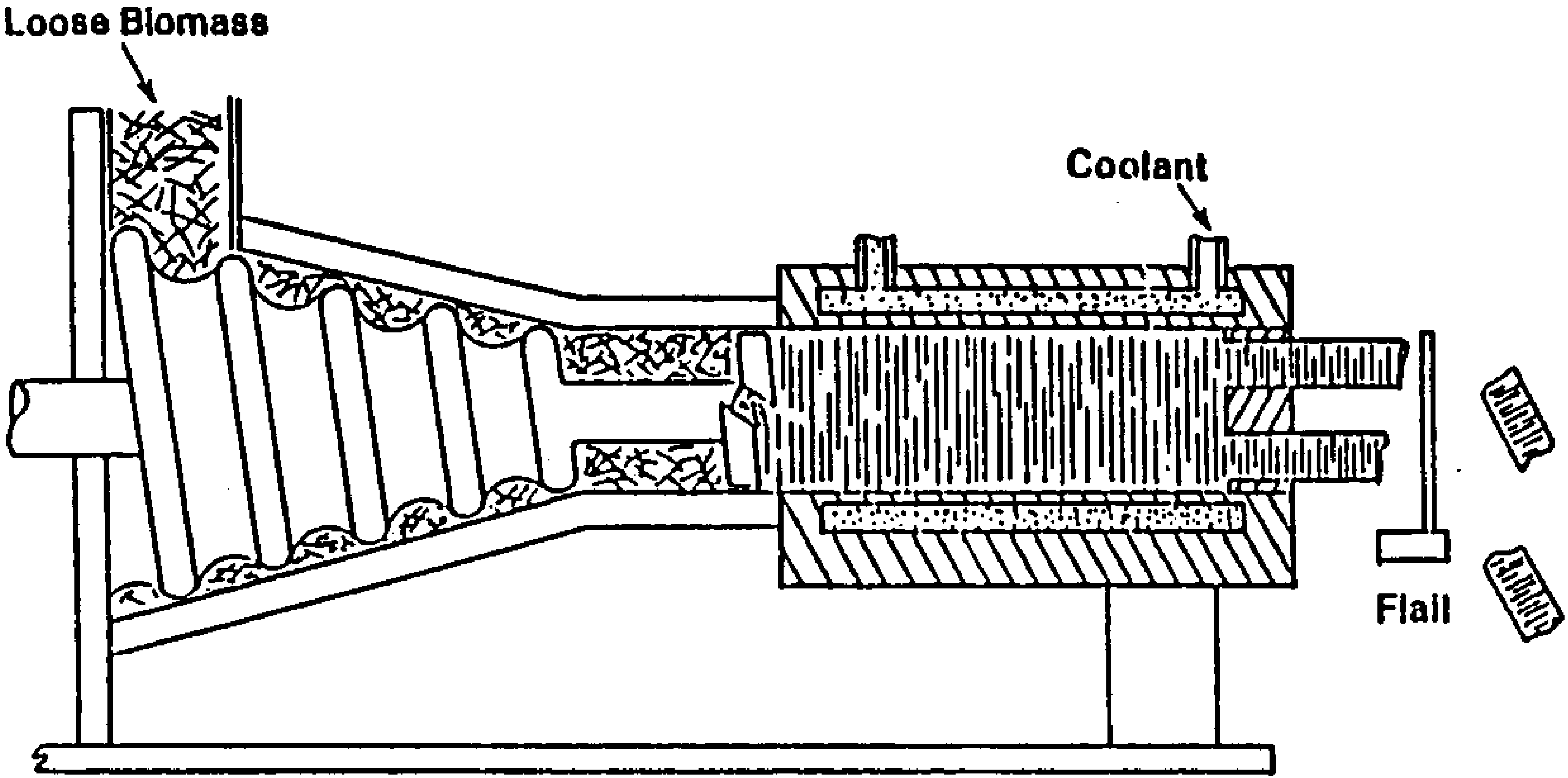


Figure 2. Screw Extruder

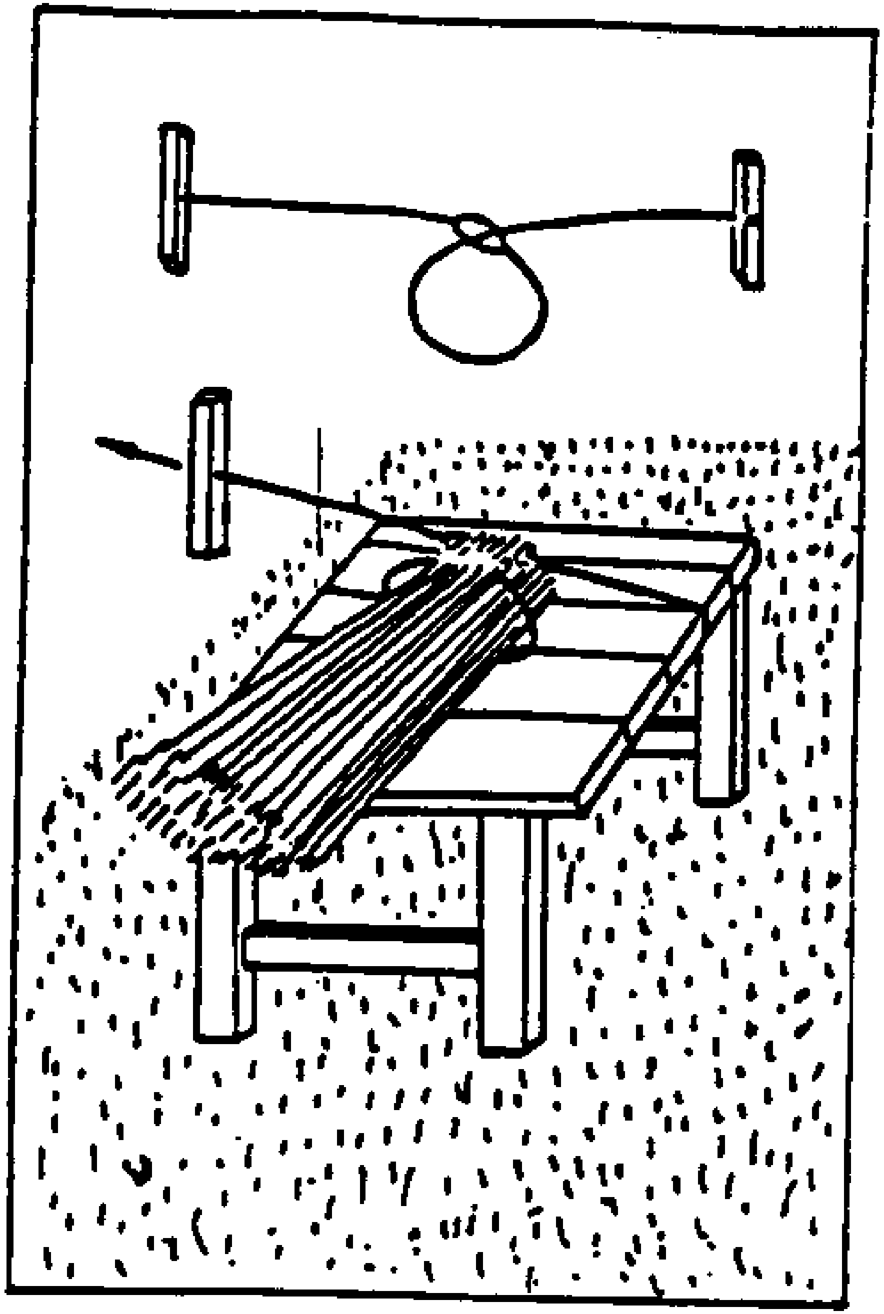
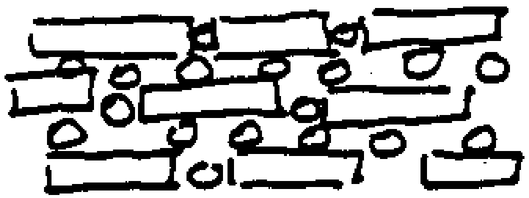


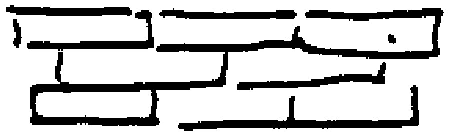
Figure 3. Bundling Table

Figure 7. Clay Shrinkage Phases.

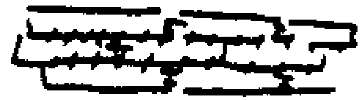
Note: shrinkage occurs twice: first, when clay is dried, and again, when it is fired.



Plastic



Dry



Fired

DRY BULB TEMPERATURE °C

WET BULB TEMPERATURE °C

WET BULB TEMPERATURE °C

DRY BULB TEMPERATURE °C

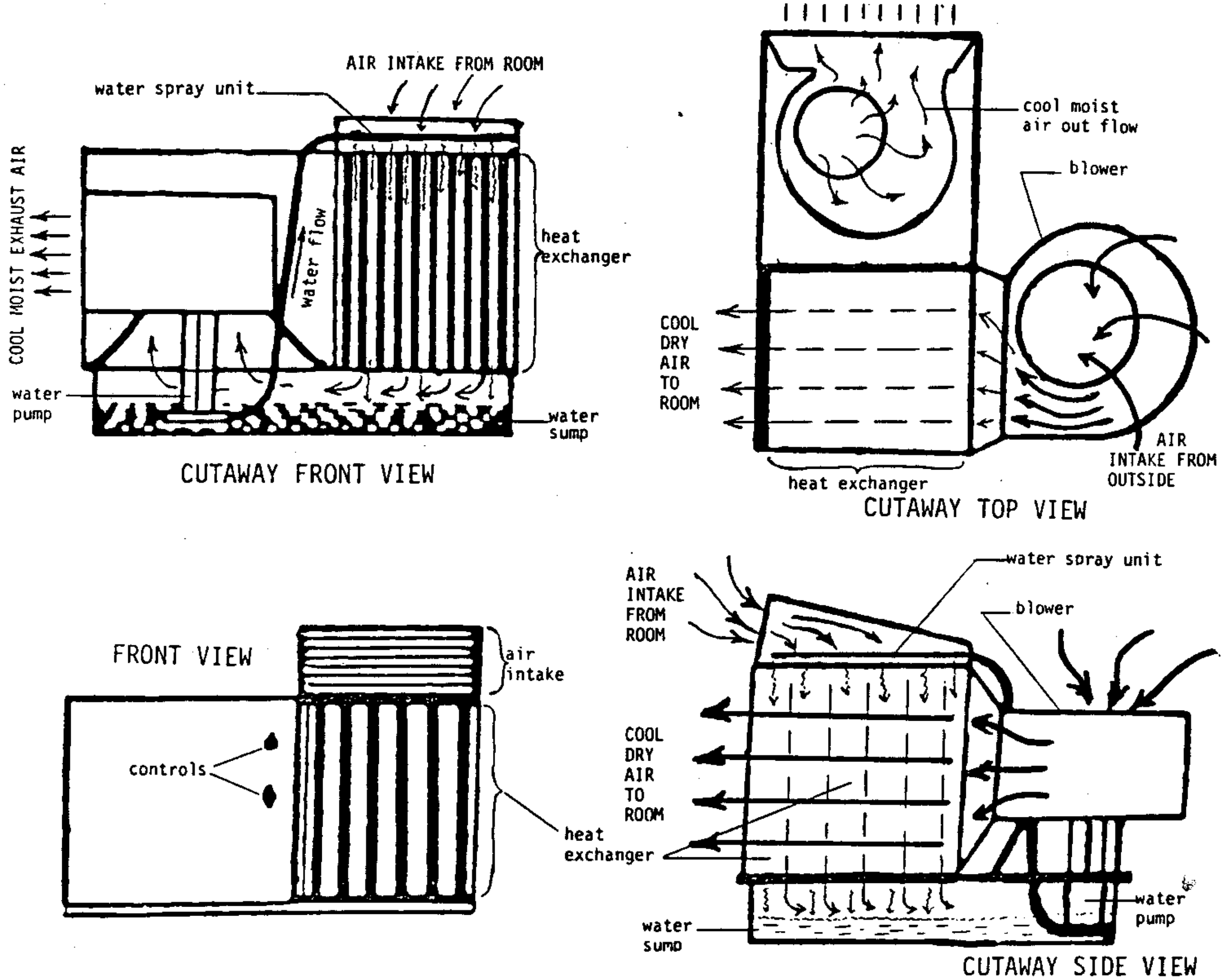


Figure 17. Four Views of an Indirect Evaporative Cooler

Source: Adapted from "Investigation and Development of Indirect Evaporative Cooler Using Plastic Heat Exchanger," by M. Singh and K. Naravankhendkar, Mechanical Engineering Bulletin, Volume 13, No. 2, June 1982: 61-65.

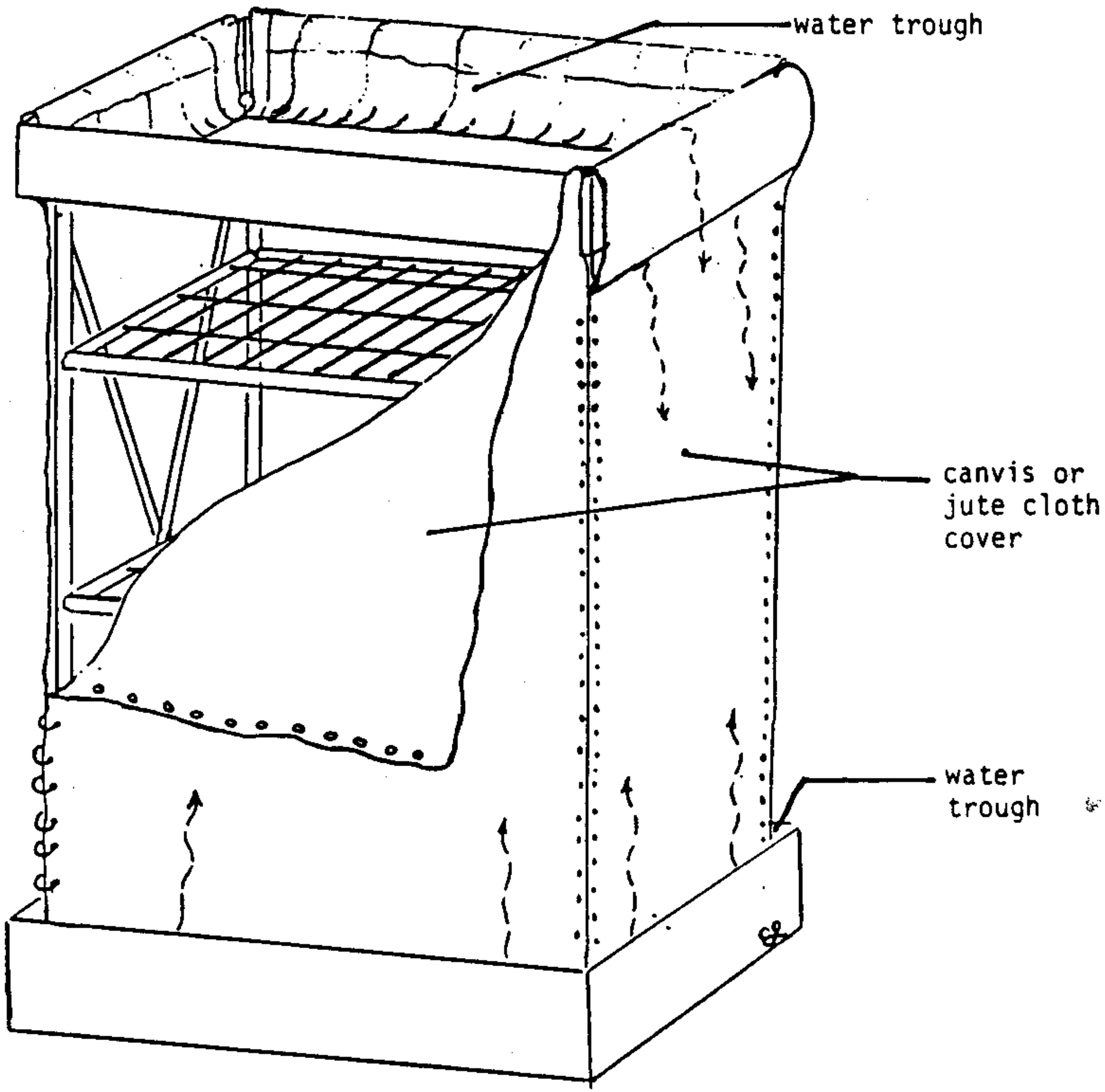


Figure 6. Type I Evaporative Cooler

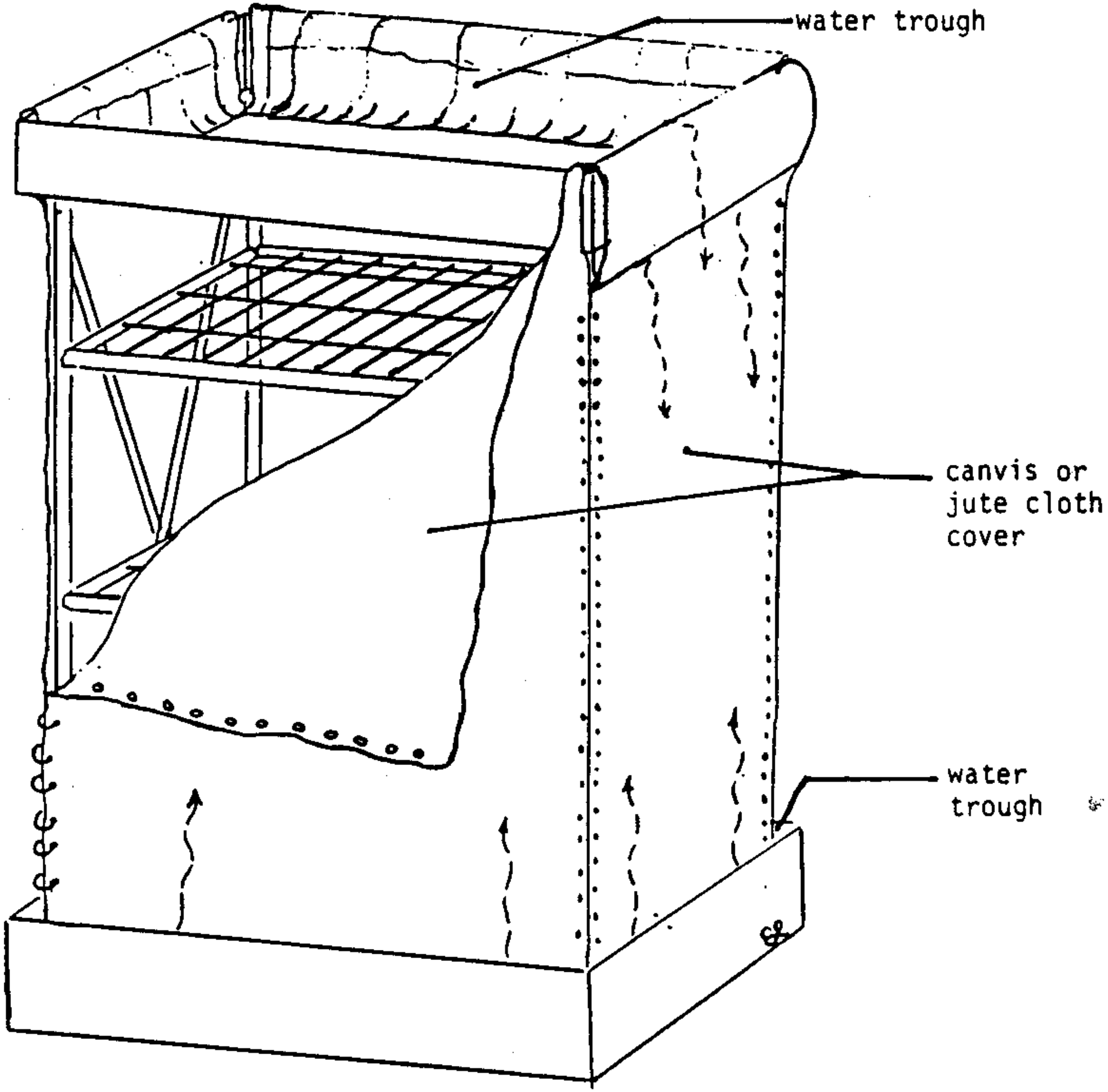
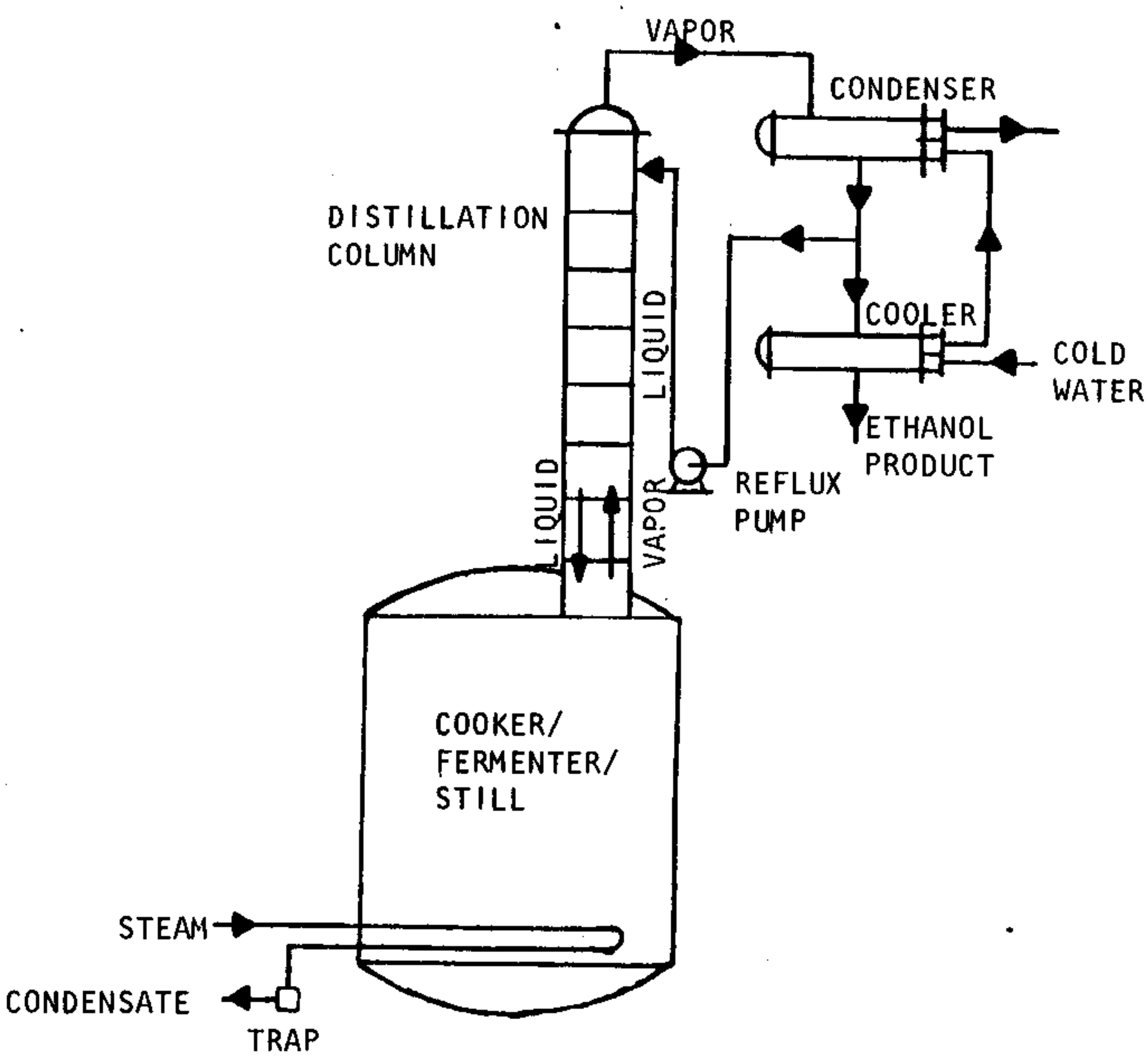


Figure 6. Type I Evaporative Cooler



BATCH DISTILLATION COLUMN WITH STILL
ALSO USED AS COOKER/FERMENTER TANK

Table 6. Projected Characteristics and Status of Some Energy Storage Systems

Type of Energy Storage System	Round-trip Efficiency (percent)	Energy Density kWh/cu.ft.	Capital Costs[a] C_p (Dollars/kW)	C_s (Dollars/kWh)	Stage of Development	Potential Application
Electrochemical:						
Lead-acid Batteries	60-75	1-2	80-100	20-40	Near state of the art	Distributed energy storage for daily peak shaving; standby and emergency generating capacity; vehicle propulsion; energy storage in solar energy systems.
Advanced Conventional Batteries	60-80	1-10	60-100	10-20	Laboratory prototypes	
Advanced Redox Batteries	60-75	0.5-2	100-200	5-10	Conceptual and laboratory studies	
Mechanical:						
Flywheels	85-90	0.5-1.5	30-50	50-75	Initial development	Distributed energy storage, power factor correction; emergency generating capacity.
Pumped Water, Conventional	65-70	0.001 (30M)[b]	60-90	6-12	Existing application	Central energy storage for peak shaving and load leveling.
Pumped Water, Underground	65-70	0.03 (1,000M)[b]	60-90	7-15	Engineering studies	
Compressed Air, Steel Tanks	80-85	0.1-0.05 (50 Atm)	70-100	100	Near state of the art	Central energy storage for peak shaving and load leveling; reserve generating capacity.
Compressed Air, Underground	70-85		70-100	3-20	Engineering studies	
Thermal:						
Steam, Steel Tanks	70-85	Up to 1 (50 Atm) (500°F)	60-80	15-25	Pilot installation	Central energy storage, integrated with base load.
Steam, Underground	65-80		60-80	2-5	Engineering studies	
Electromagnetic:						
Superconducting	90	0.5-1	30-50	35-400	Conceptual; key components under development	Central energy storage (very large scale only) integrated with other cryogenic devices on utility system.

Sources: Kalhammer, F.R., "Energy Storage: Incentives and Prospects for its Development," Symposium on Energy Storage, 168th National Meeting, American Chemical Society, Preprint Fuel Division, Vol. 19, No. 4 (Washington, D.C.: ACS, 1974), p. 56; "Energy Storage Systems," Scientific American, 241(6), 1979, p. 56.

[a] Under "Capital Costs," C_p represents capital costs proportional to power rating; C_s represents capital costs proportional to system's energy storage capacity.

[b] In meters water head.

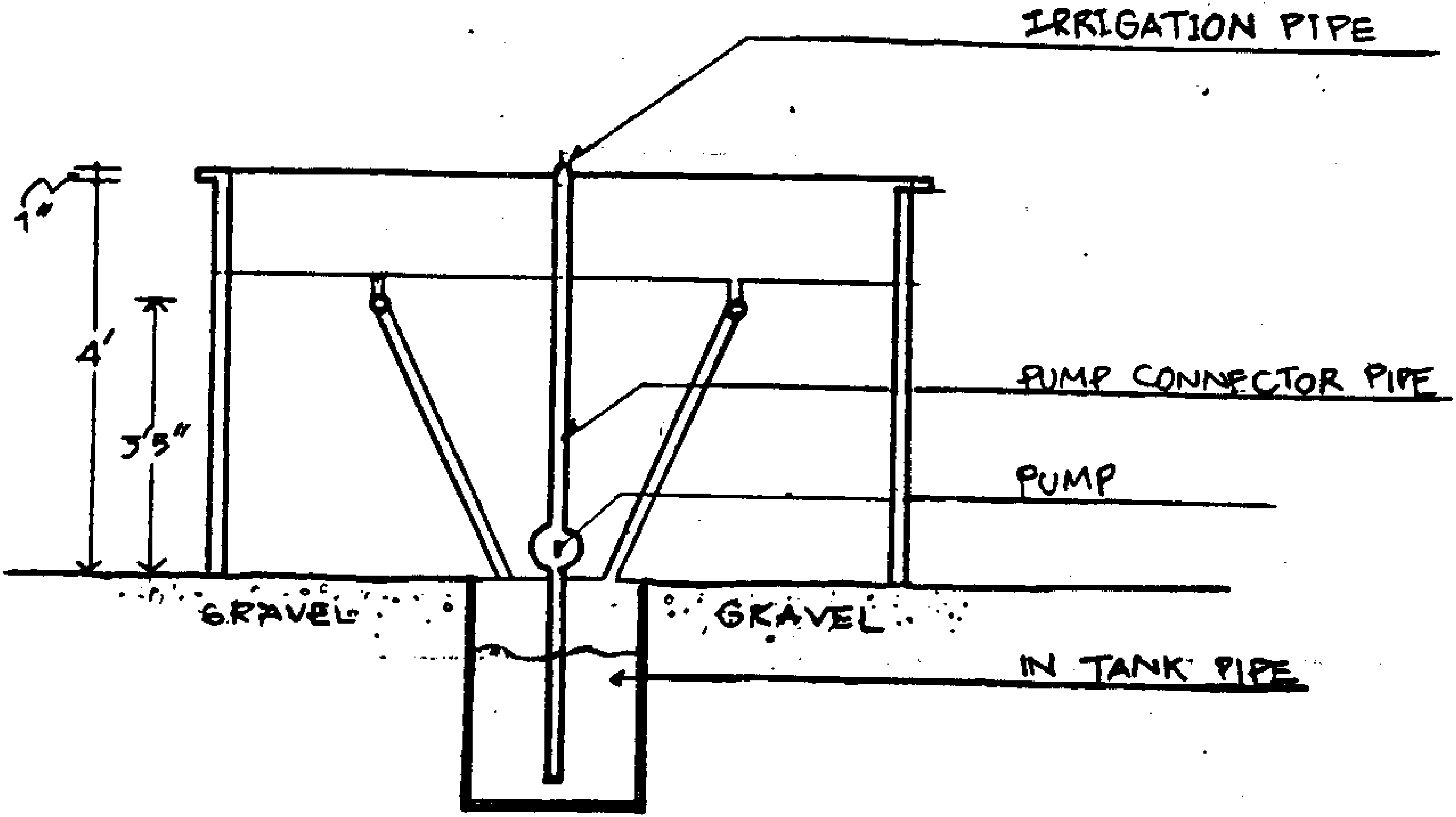


Figure 5. Bed End View

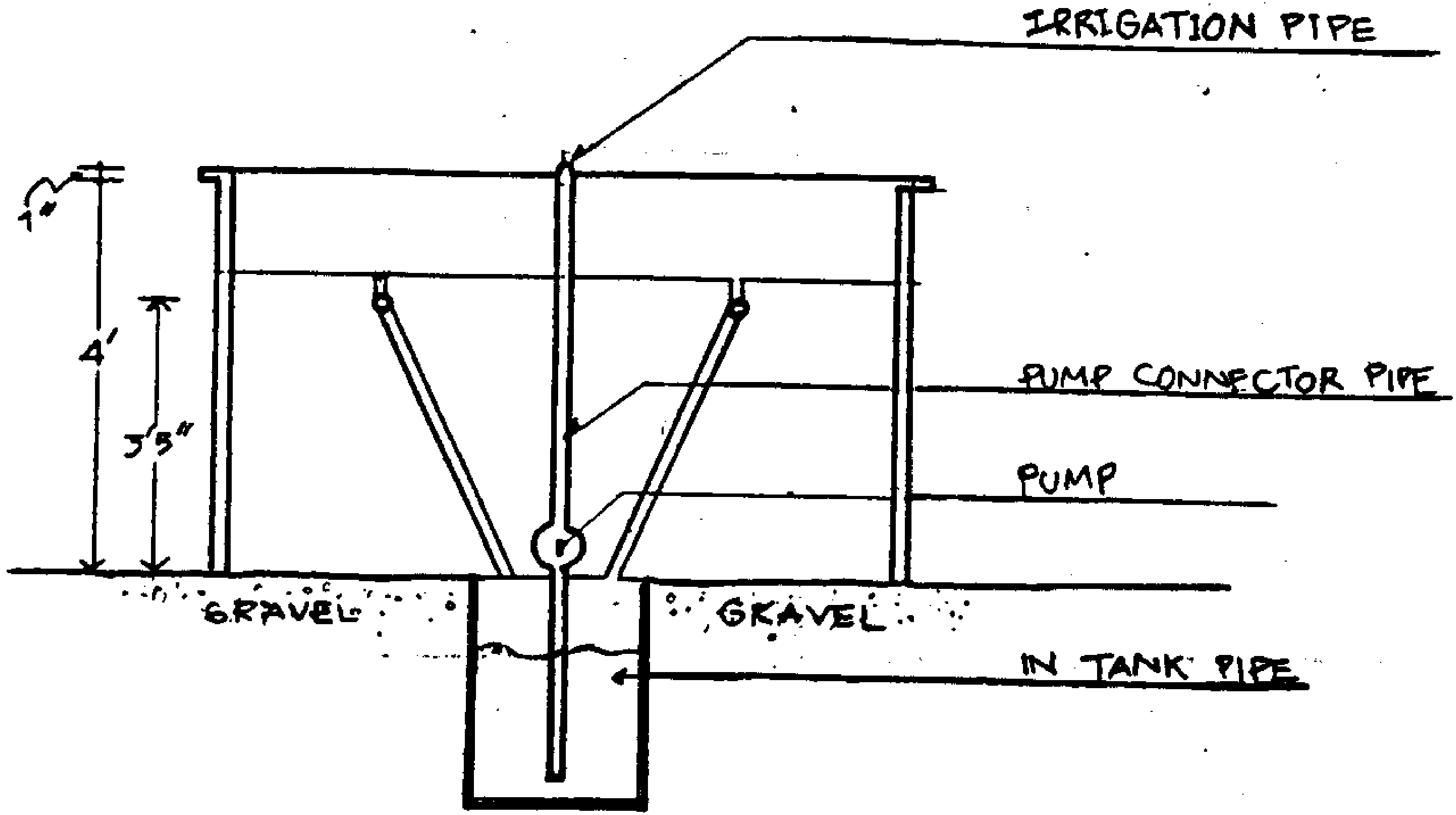


Figure 5. Bed End View

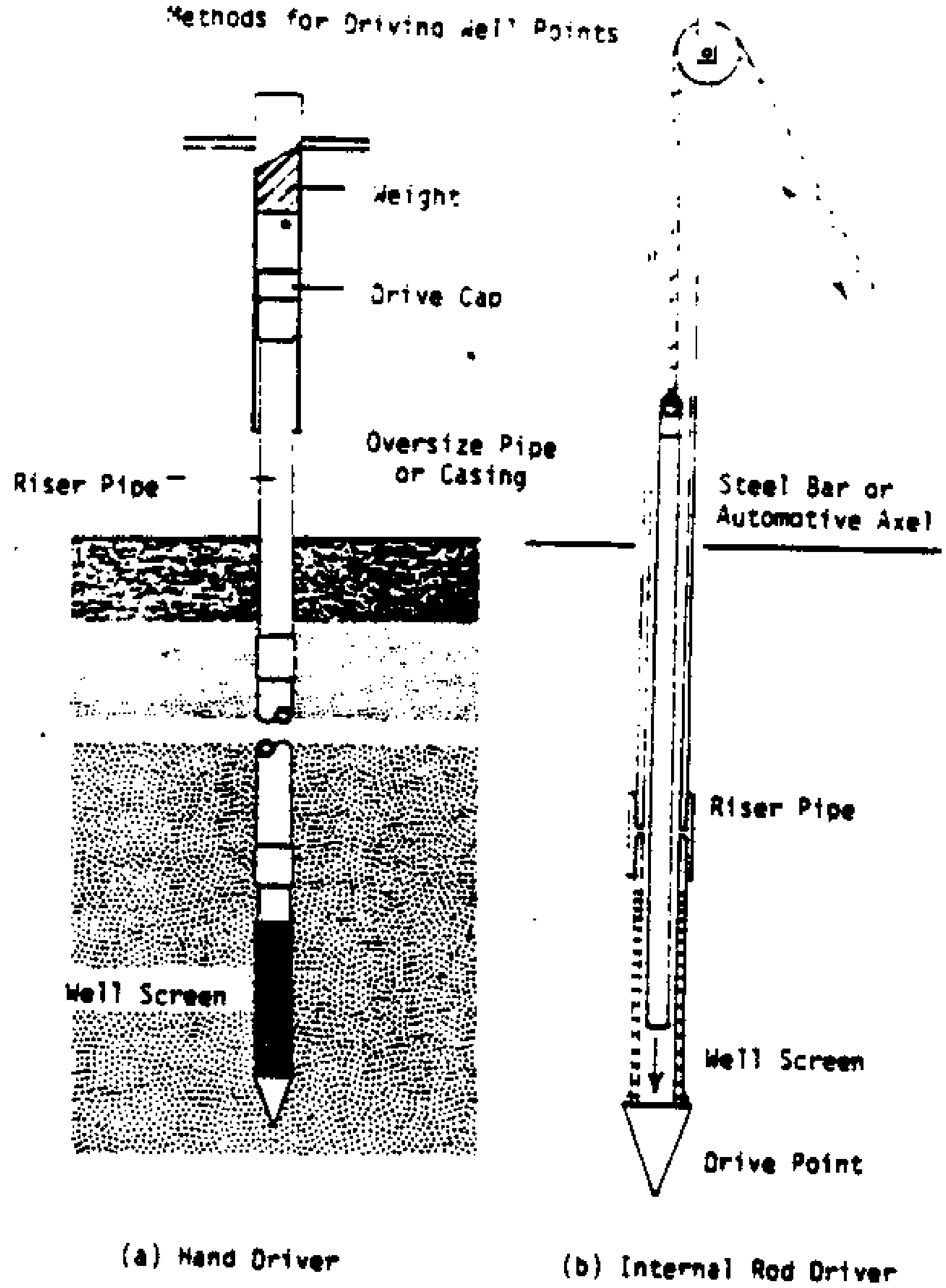


Fig. 10: Two types of drive head

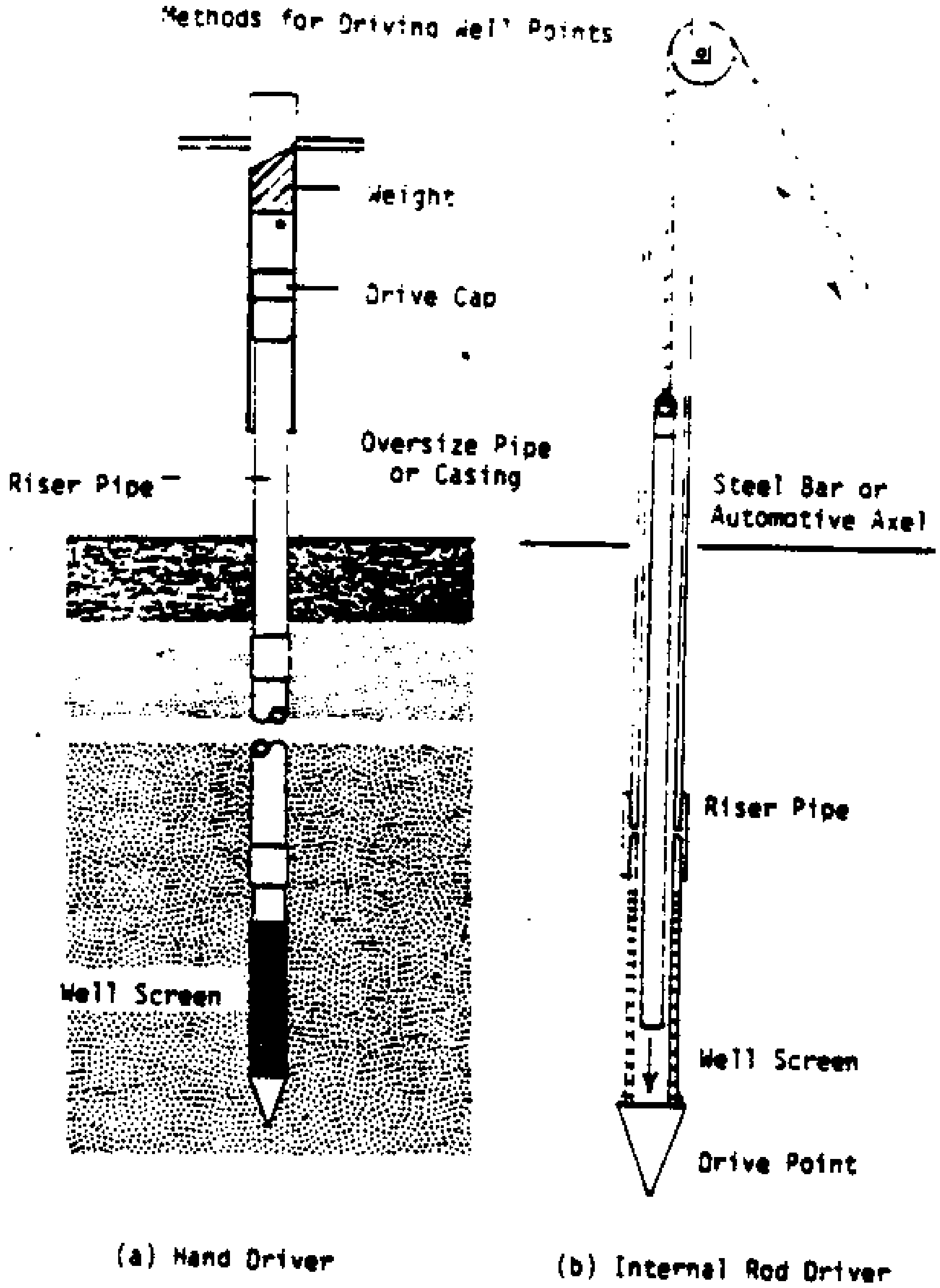
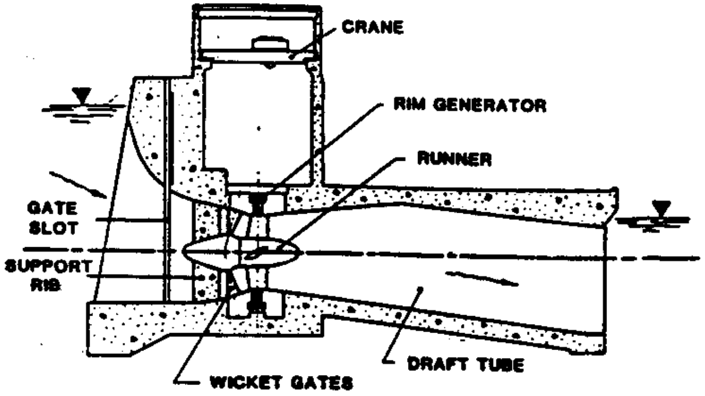
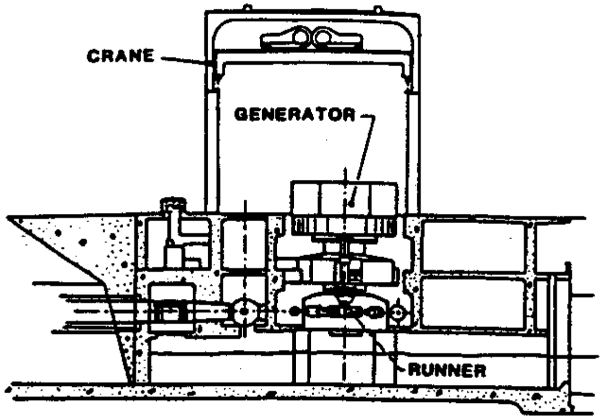


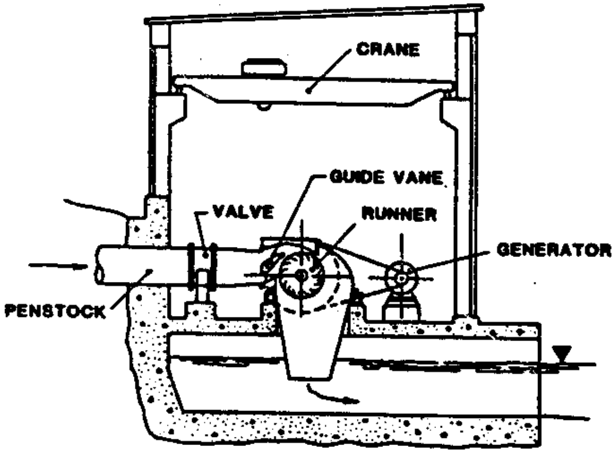
Fig. 10: Two types of drive head



RIM GENERATOR



IMPULSE TURBINE



CROSS - FLOW IMPULSE TURBINE

Figure 3 (Continued). Common Types of Hydraulic Turbines

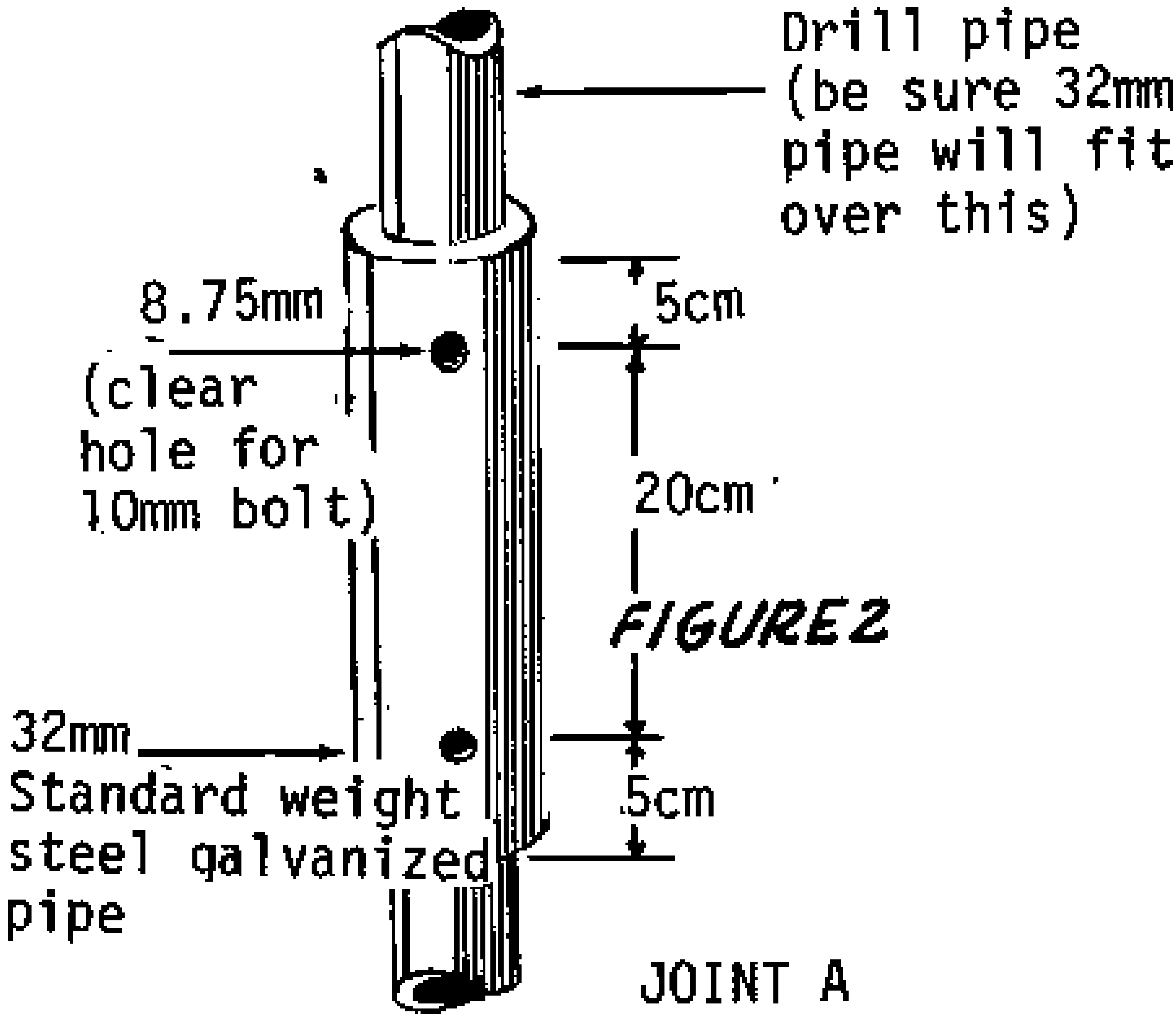


FIGURE 2

JOINT A

FIGURE 1.

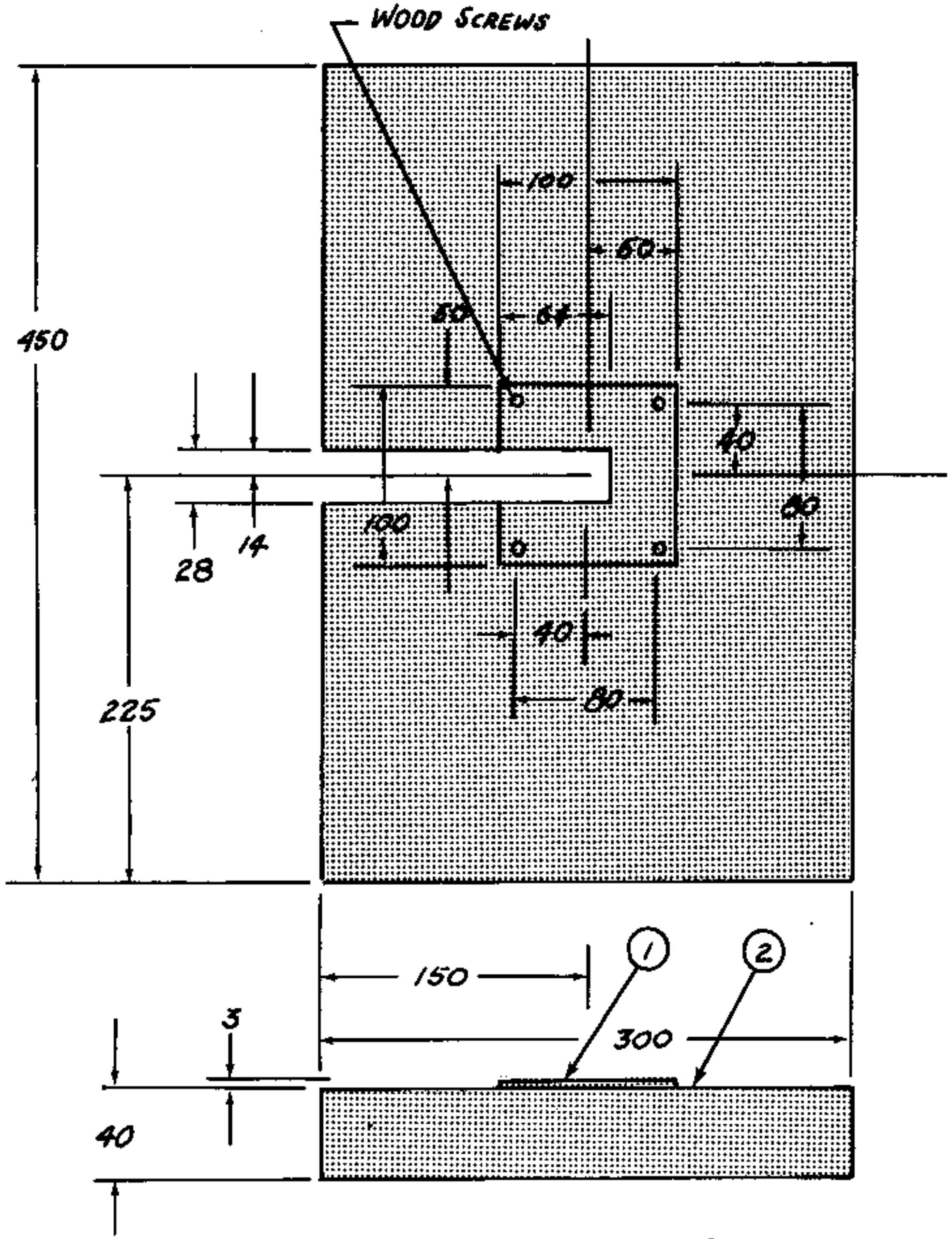
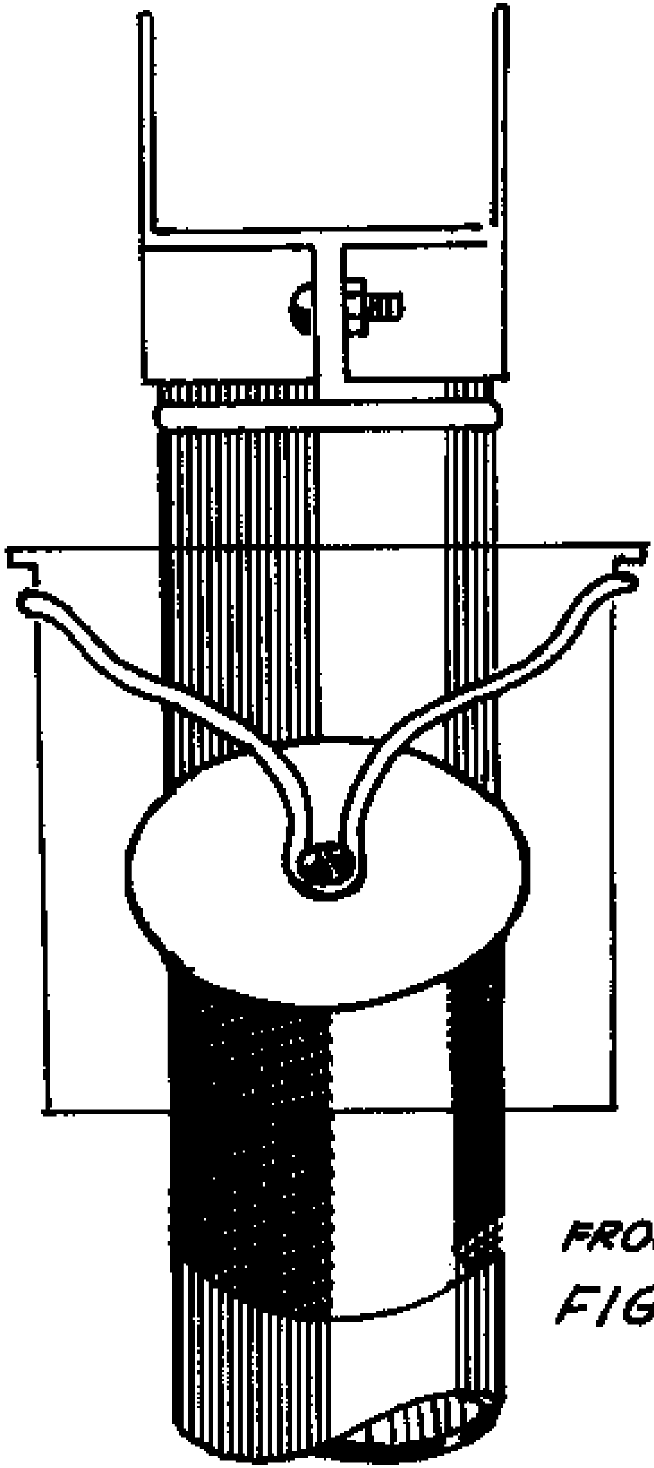


FIGURE 3 - AUGER SUPPORT

SCALE: 1/4 SIZE   MAT'L: ① MILD STEEL
② HARDWOOD



FRONT VIEW
FIGURE 3

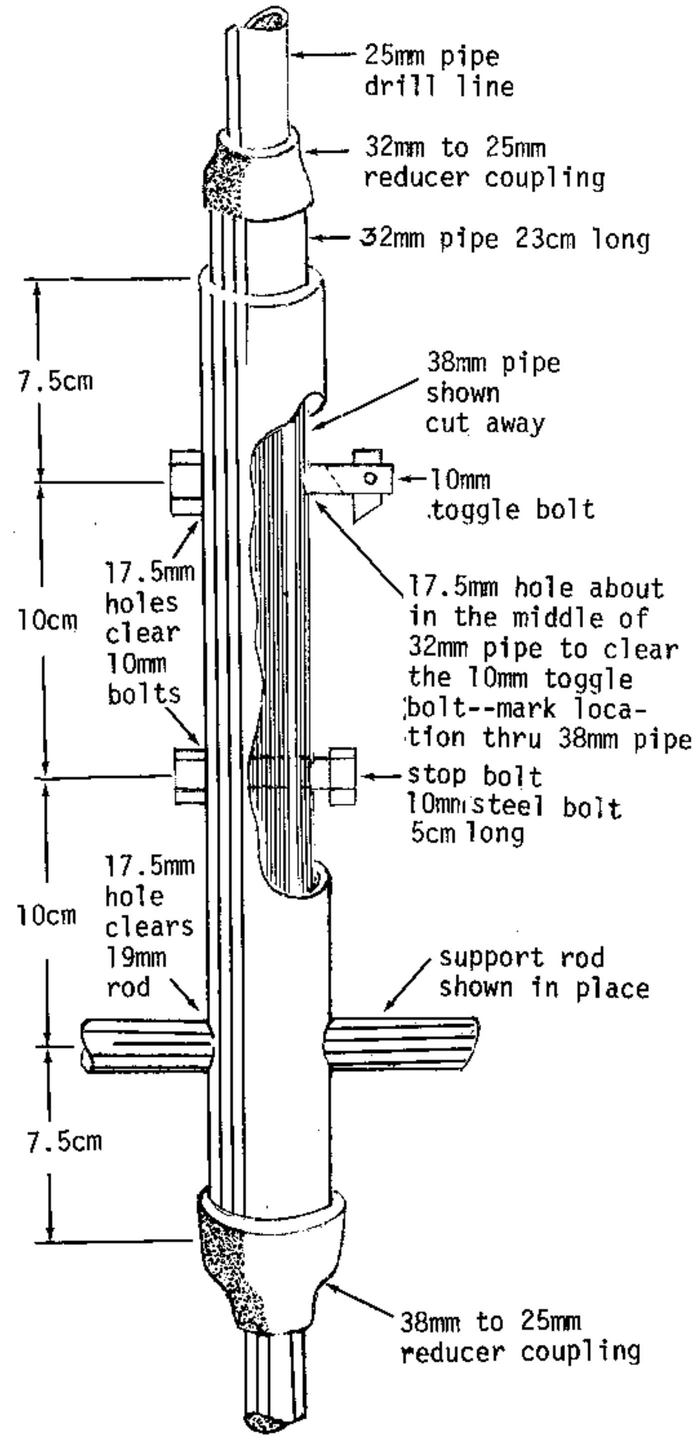

25mm pipe
drill line
32mm to 25mm
reducer coupling
32mm pipe 23cm long
7.5cm
38mm pipe
shown
cut away
10mm
toggle bolt
17.5mm
holes
clear
10mm
bolts
10cm
17.5mm hole about
in the middle of
32mm pipe to clear
the 10mm toggle
bolt--mark loca-
tion thru 38mm pipe
stop bolt
10mm steel bolt
5cm long
17.5mm
hole
clears
19mm
rod
10cm
support rod
shown in place
7.5cm
38mm to 25mm
reducer coupling

FIG.3 JOINT B

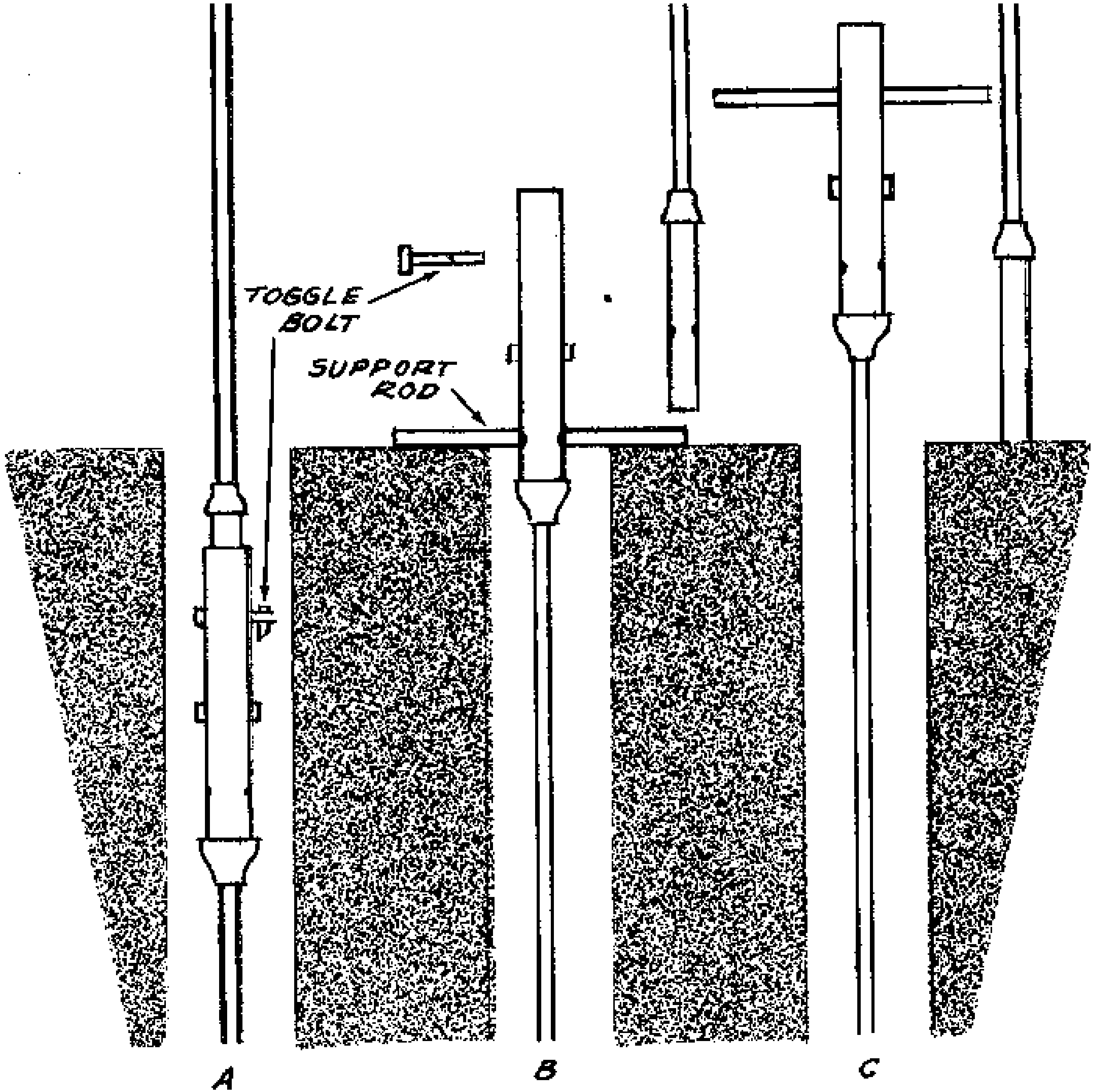


FIGURE 4 JOINT B IN OPERATION

FIGURE 5

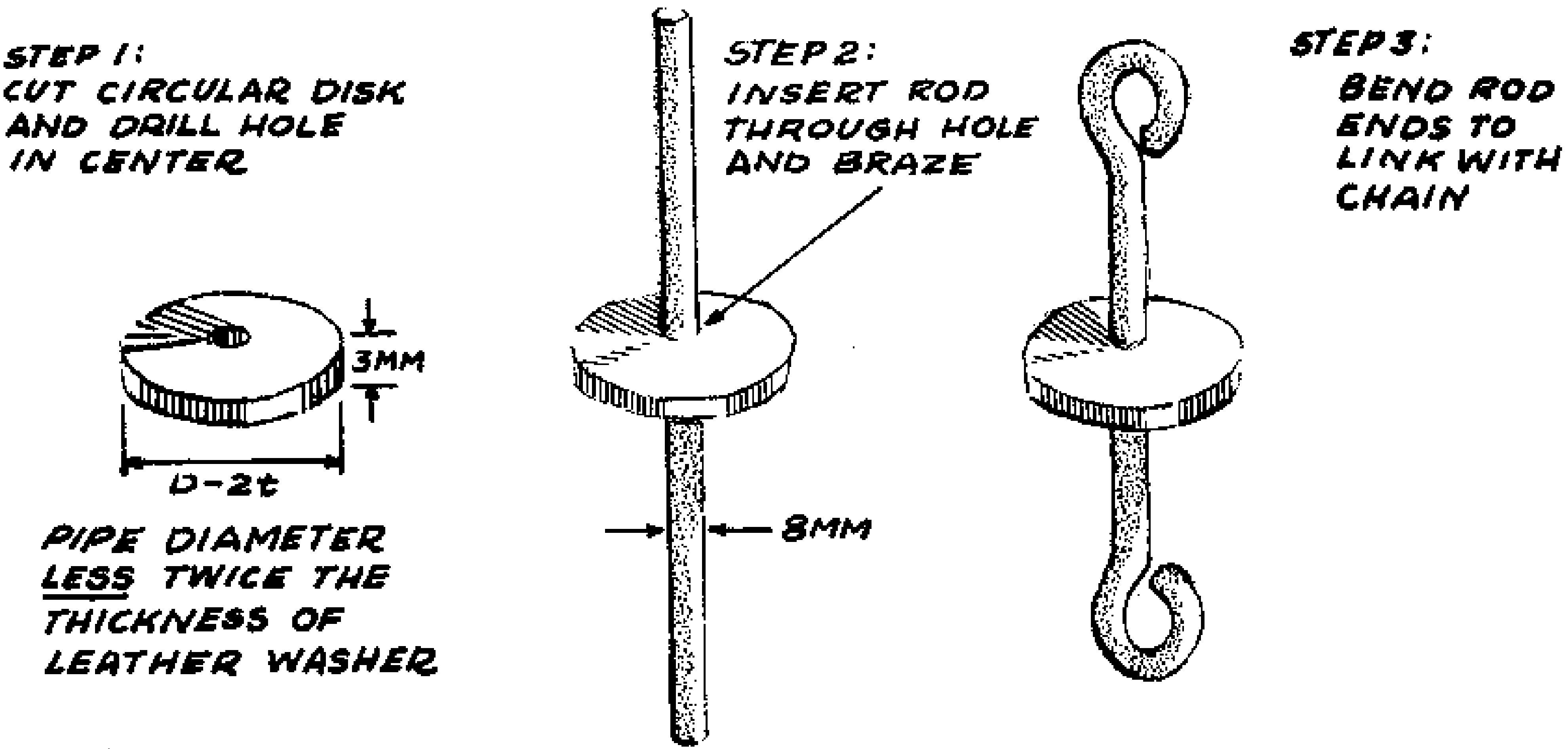

STEP 1:
CUT CIRCULAR DISK
AND DRILL HOLE
IN CENTER
3MM
D-2t
PIPE DIAMETER
LESS TWICE THE
THICKNESS OF
LEATHER WASHER
STEP 2:
INSERT ROD
THROUGH HOLE
AND BRAZE
8MM
STEP 3:
BEND ROD
ENDS TO
LINK WITH
CHAIN

FIGURE 6
RETAINING PLATE

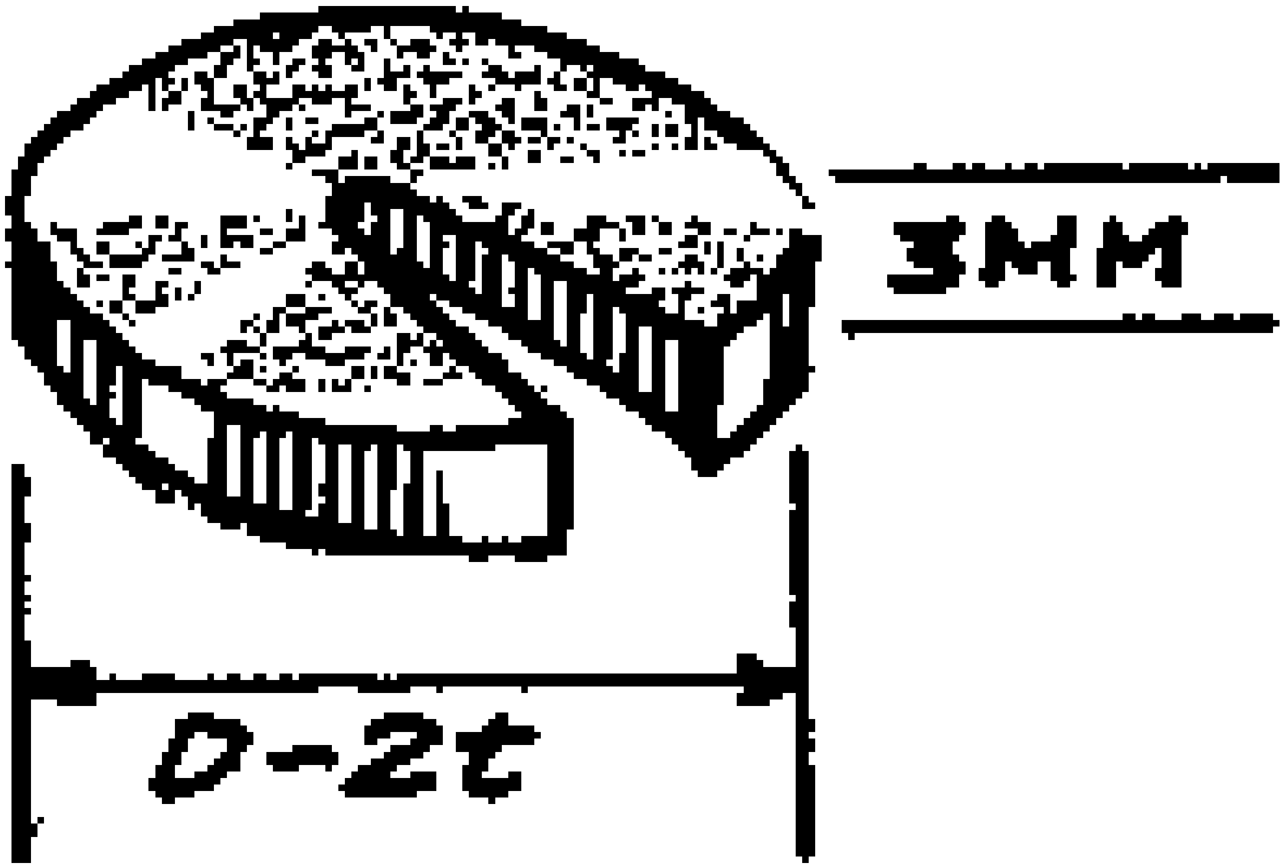
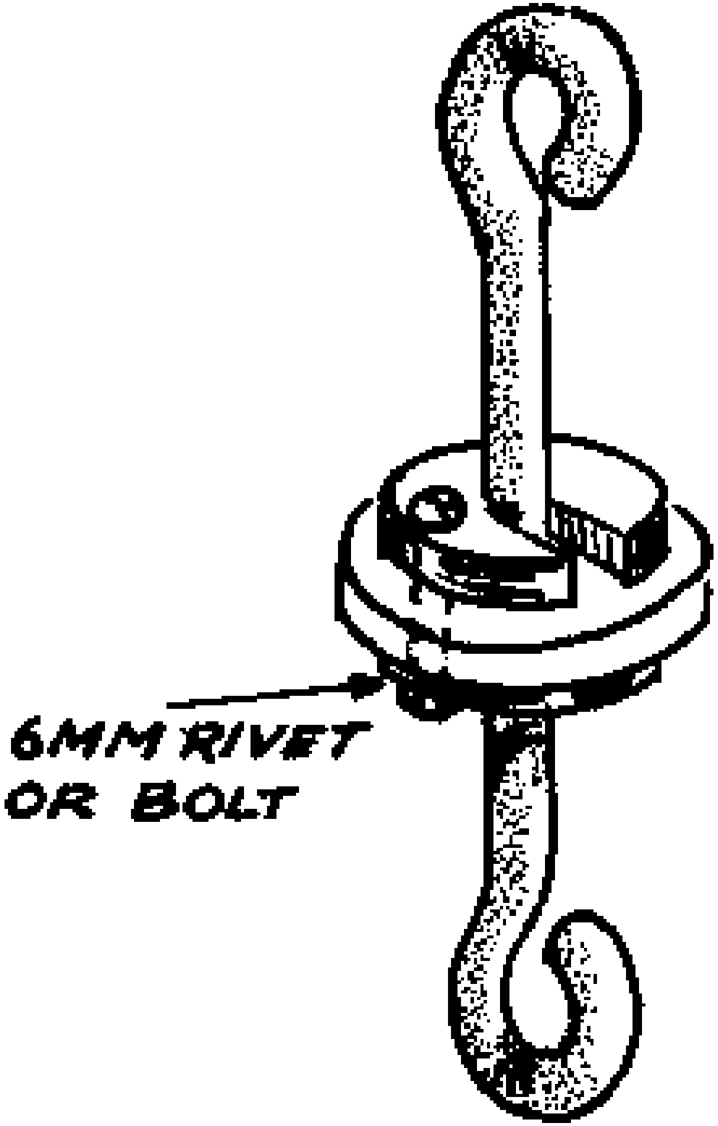
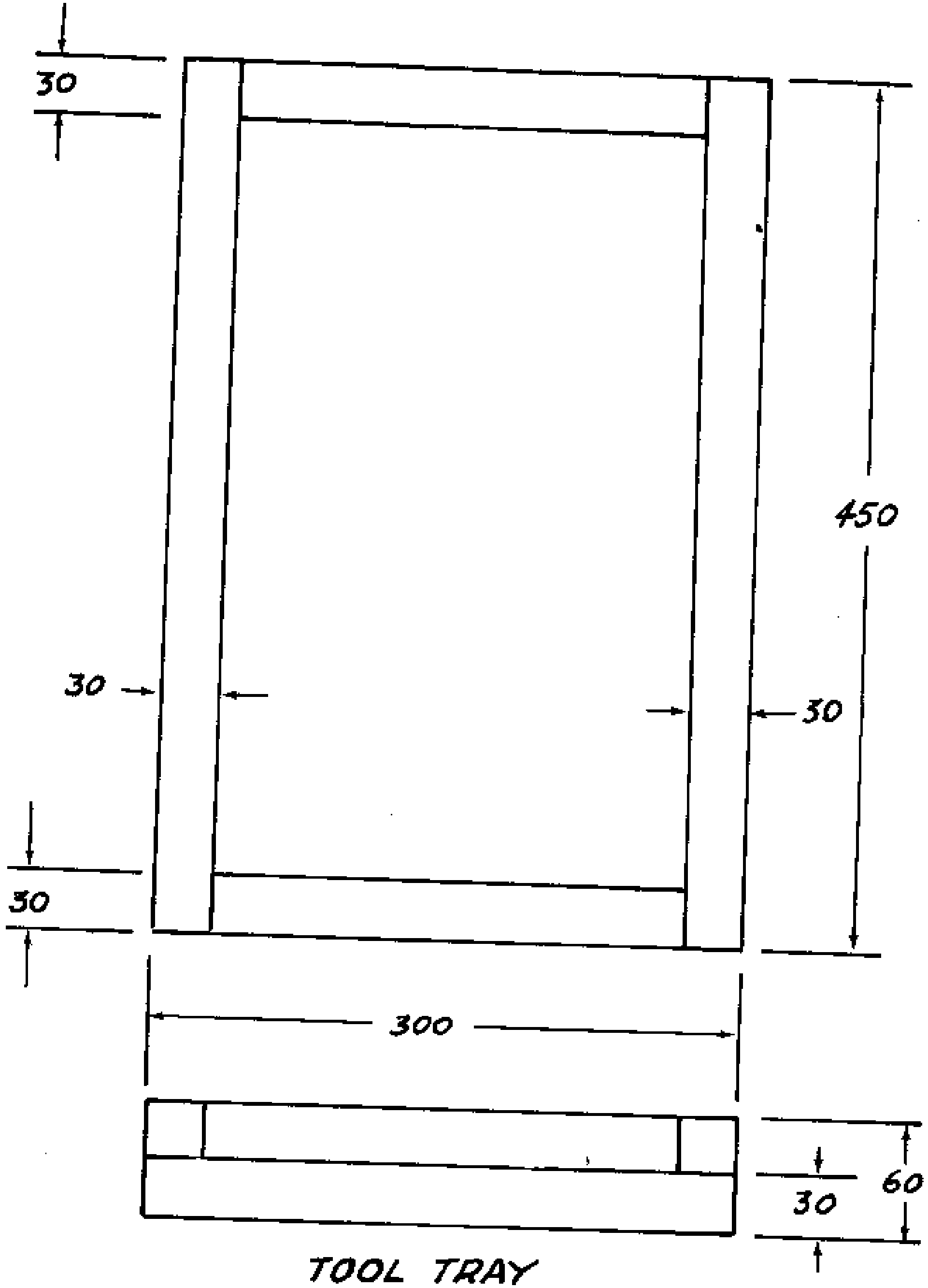


FIGURE 7
PISTON LINK
ASSEMBLED





TOOL TRAY

SCALE: 1/4 SIZE MAT'L: WOOD

FIGURE 6

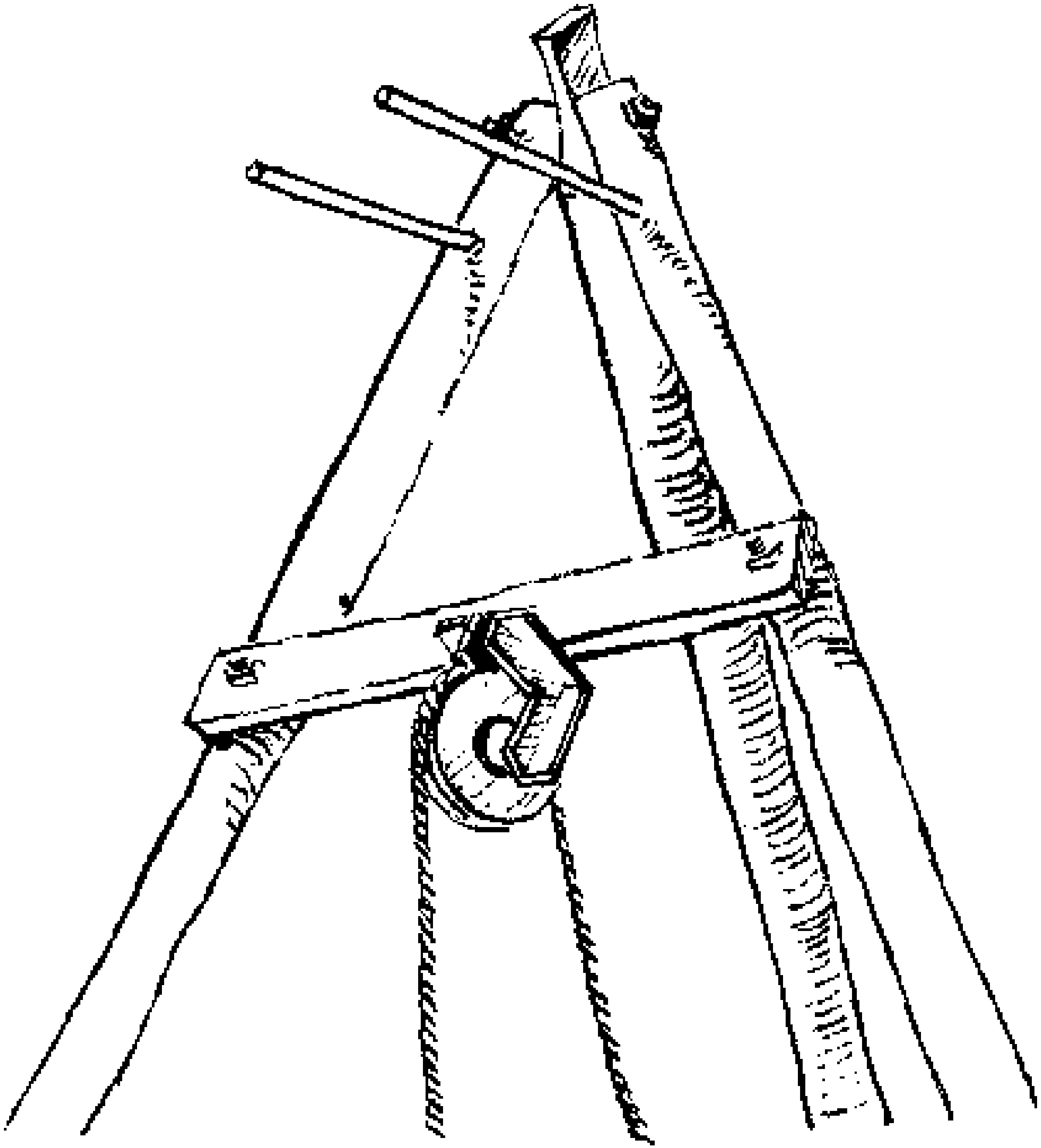


FIGURE 16

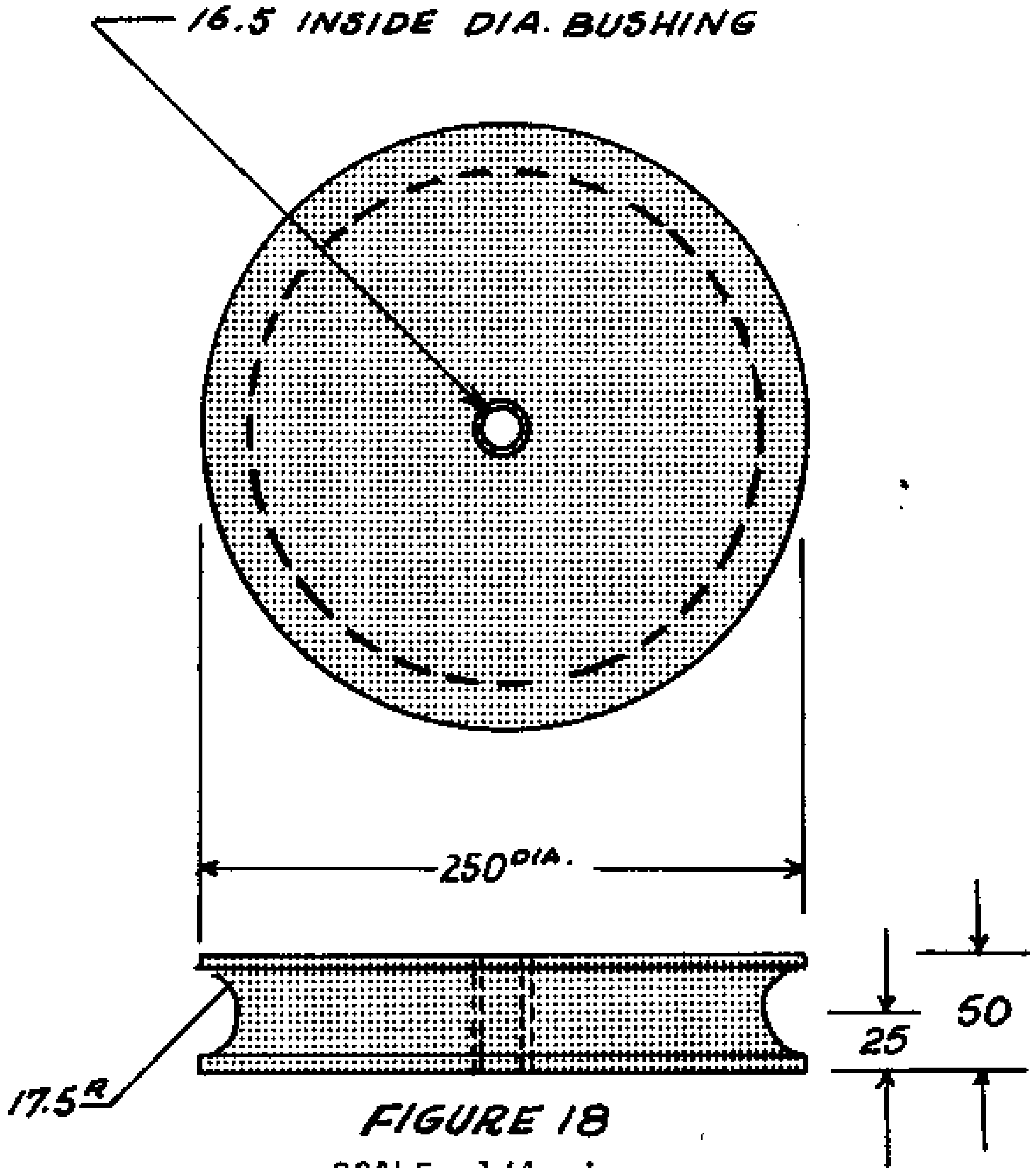


FIGURE 18

SCALE: 1/4 size
MAT'L: HARDWOOD

NOTE: Two pieces, this and its mirror image, make one pulley bracket. (See tripod drawing.) Attach to crossbar with 12DIA. Bolts.

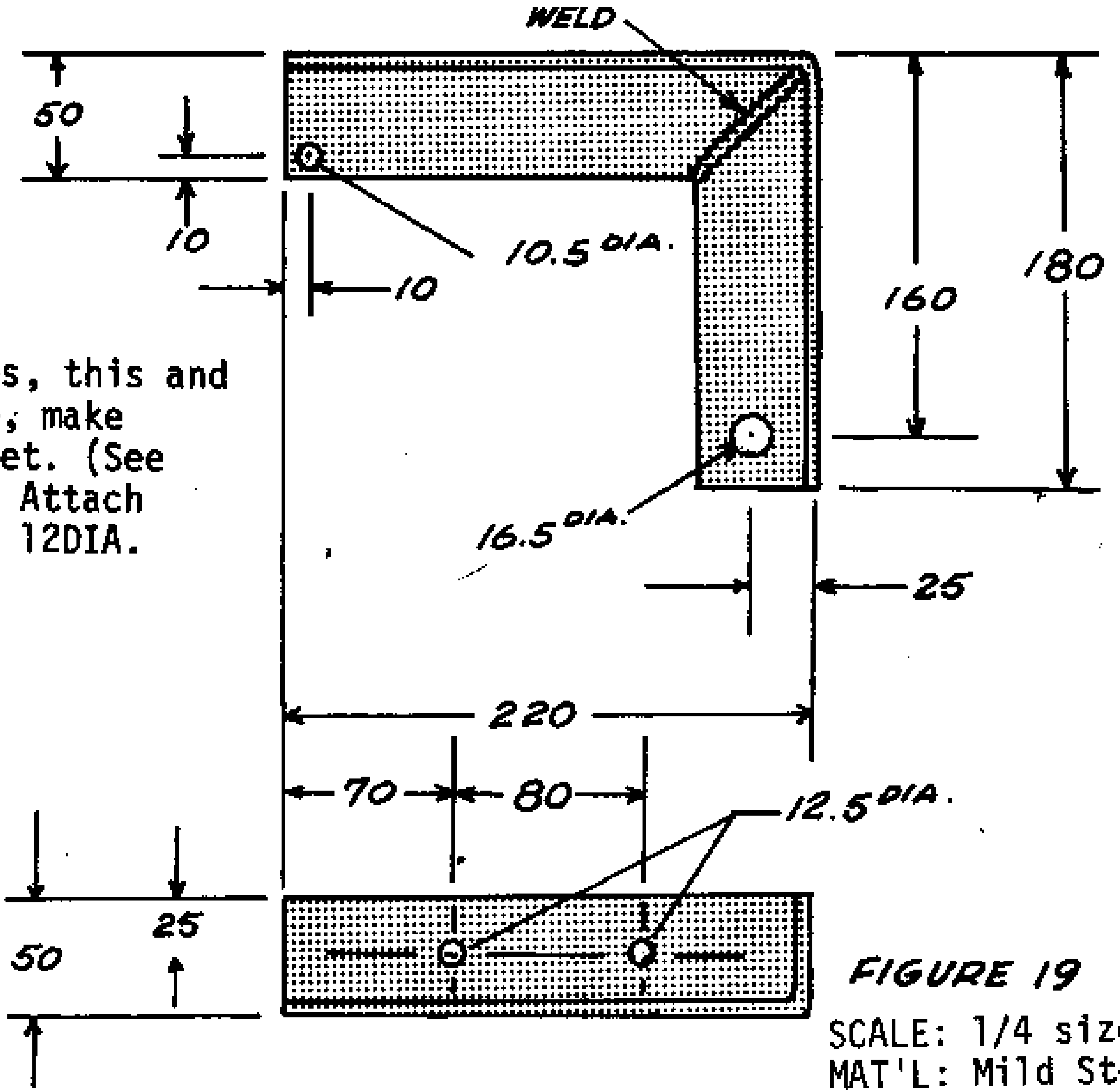


FIGURE 19

SCALE: 1/4 size
MAT'L: Mild Steel

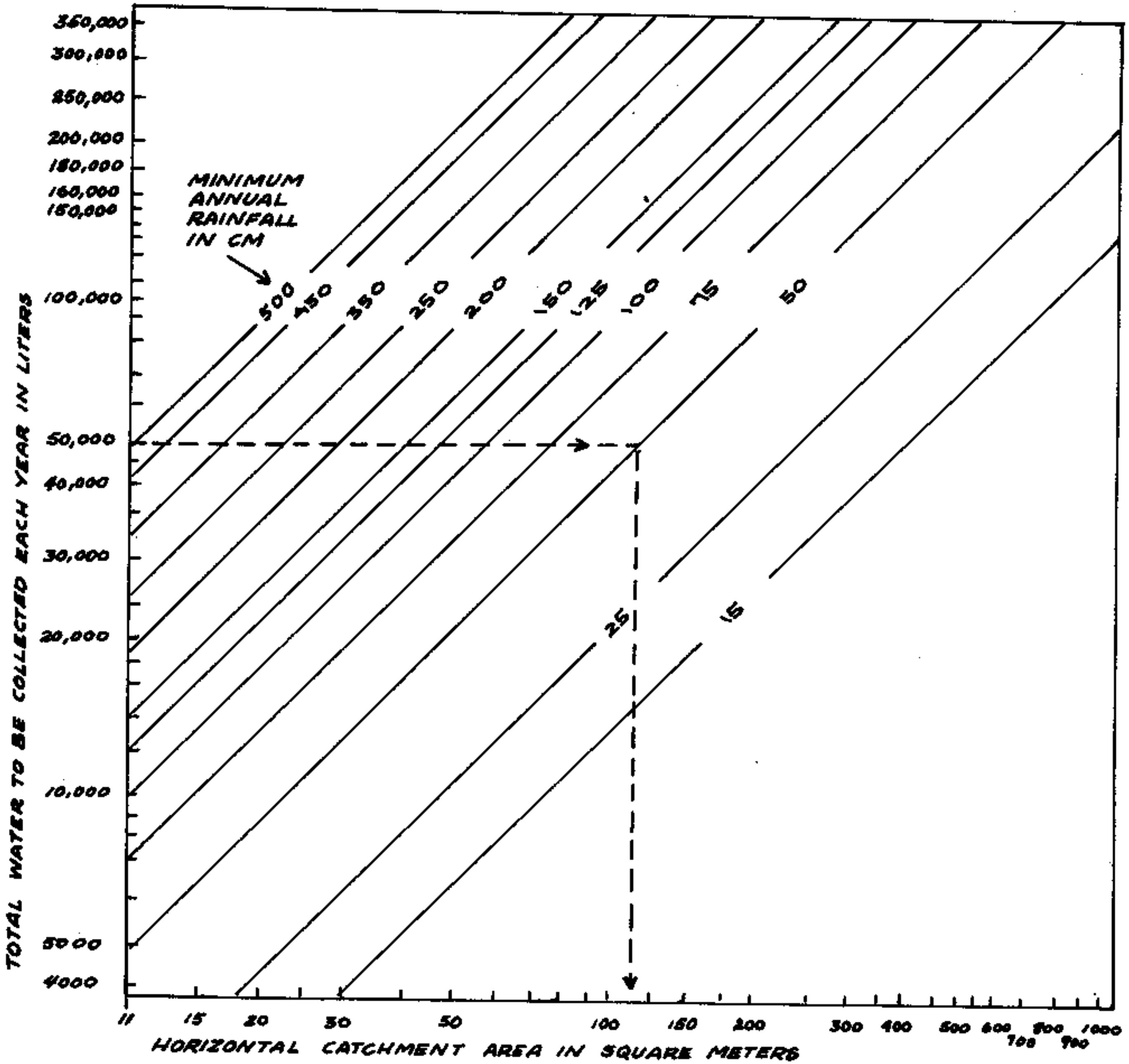

MINIMUM ANNUAL RAINFALL IN CM
500
450
350
250
200
150
125
100
75
50
25
15
350,000
300,000
250,000
200,000
180,000
160,000
150,000
100,000
50,000
40,000
30,000
20,000
10,000
5000
4000
TOTAL WATER TO BE COLLECTED EACH YEAR IN LITERS
11
15
20
30
50
100
150
200
300
400
500
600
700
800
900
1000
HORIZONTAL CATCHMENT AREA IN SQUARE METERS

FIGURE 2

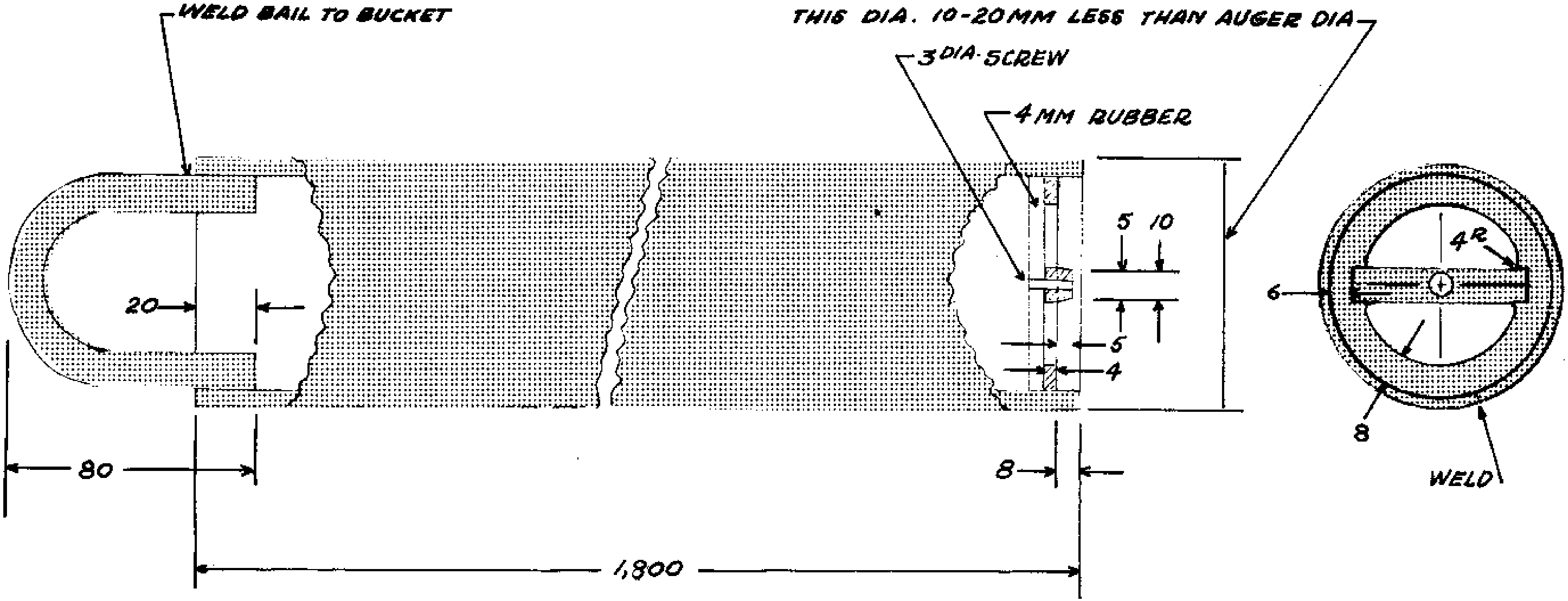


FIGURE 21

SCALE: ½ SIZE MAT'L: MILD STEEL

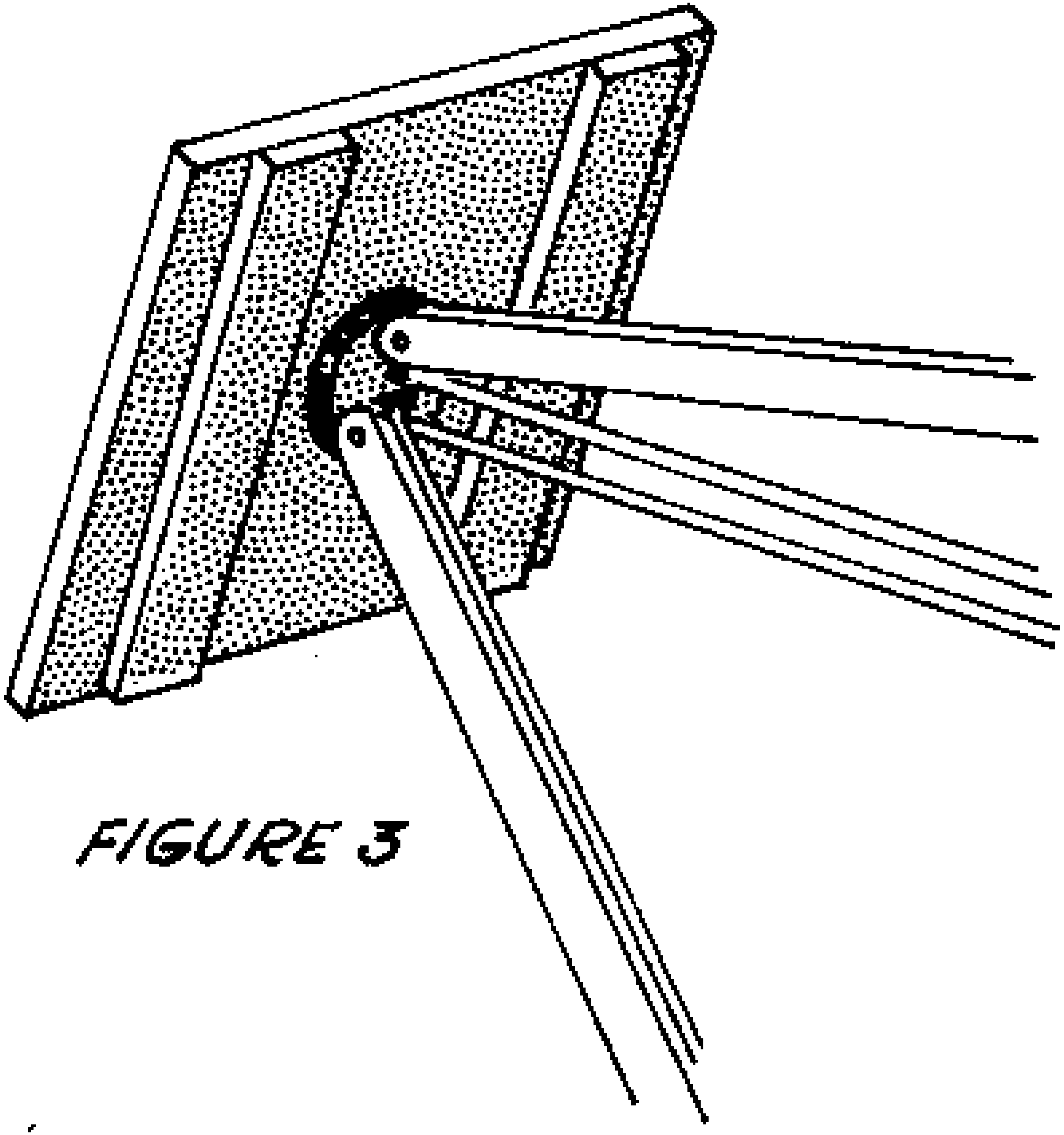


FIGURE 3

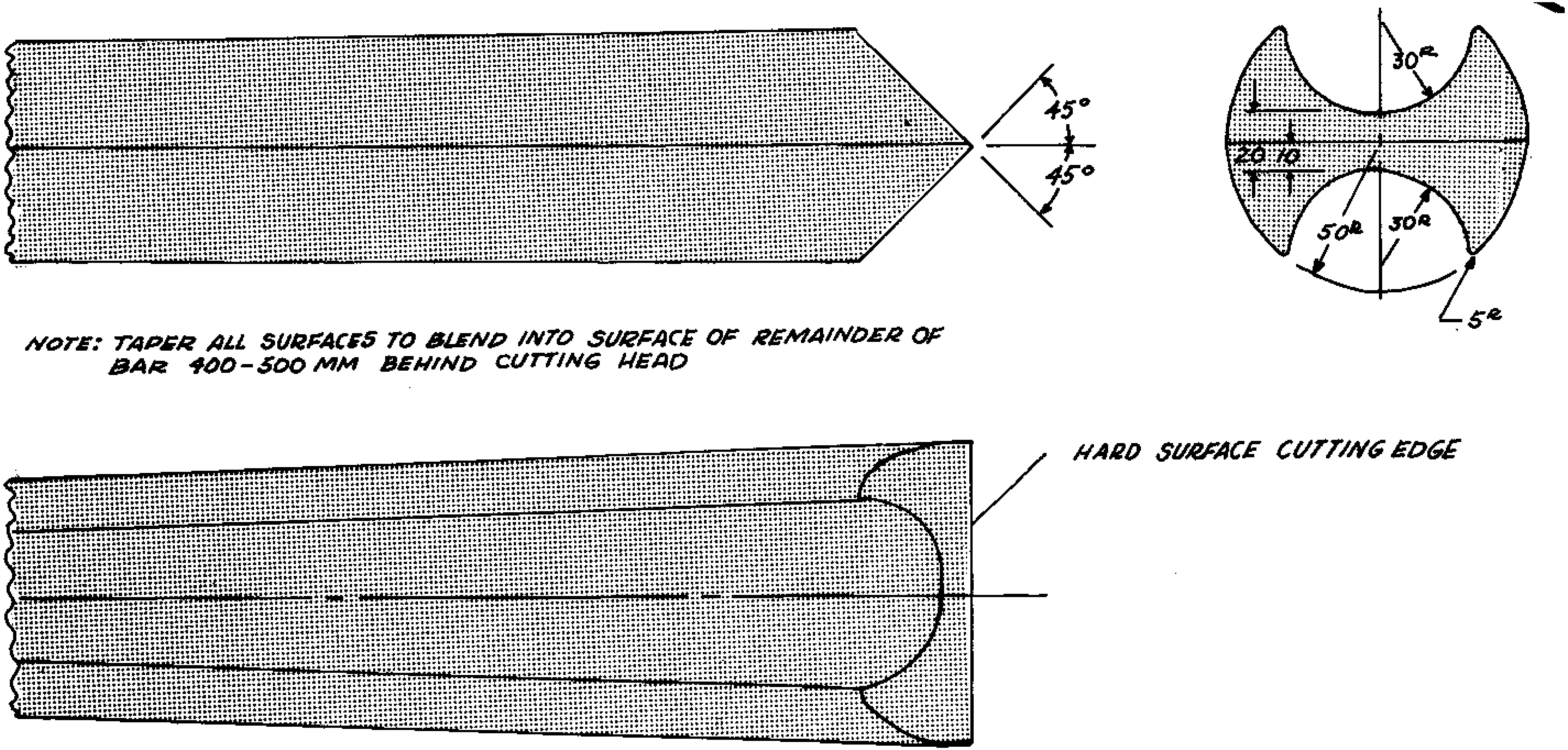


FIGURE 23

SCALE: ½ SIZE MAT'L: MILD STEEL

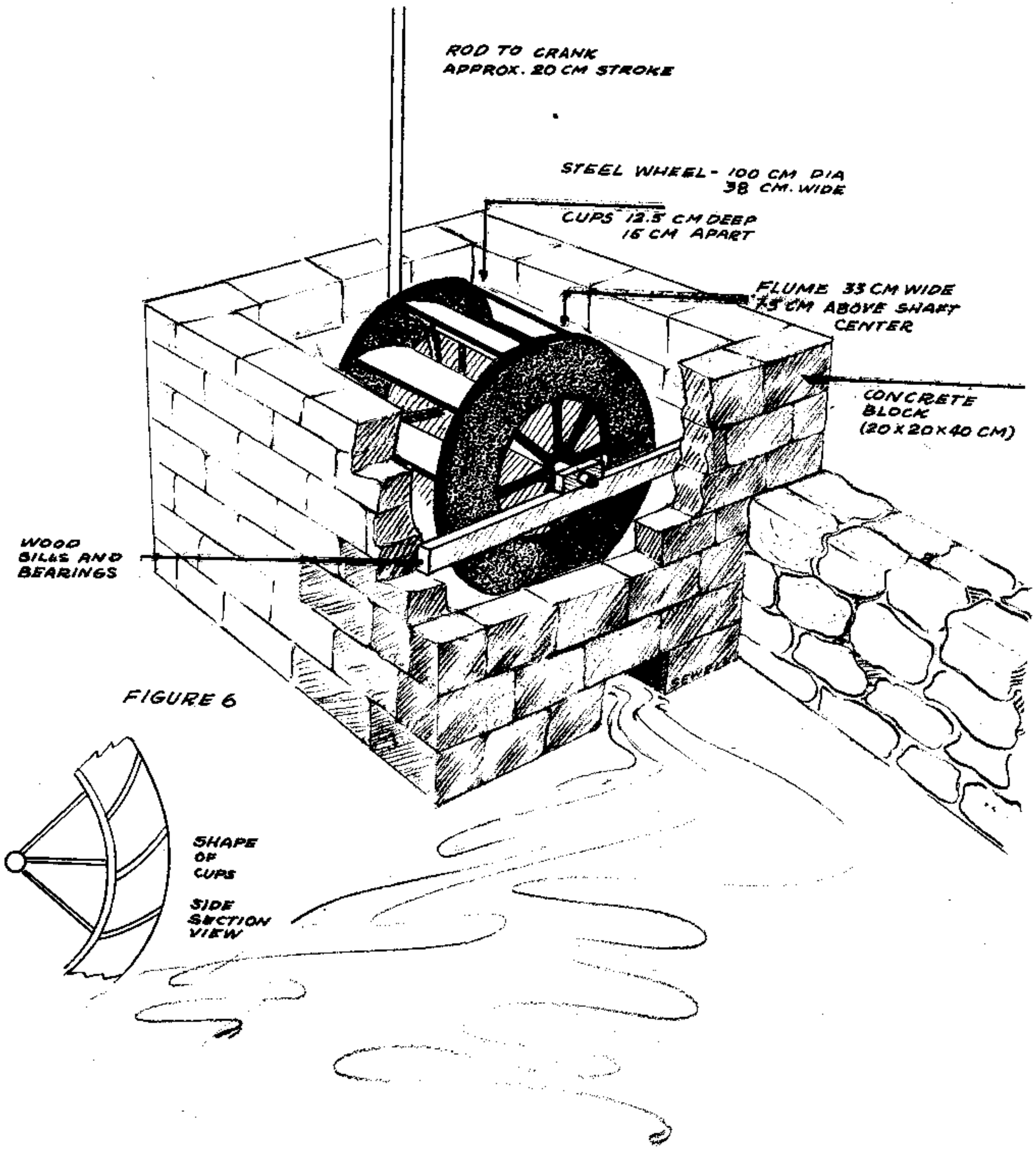
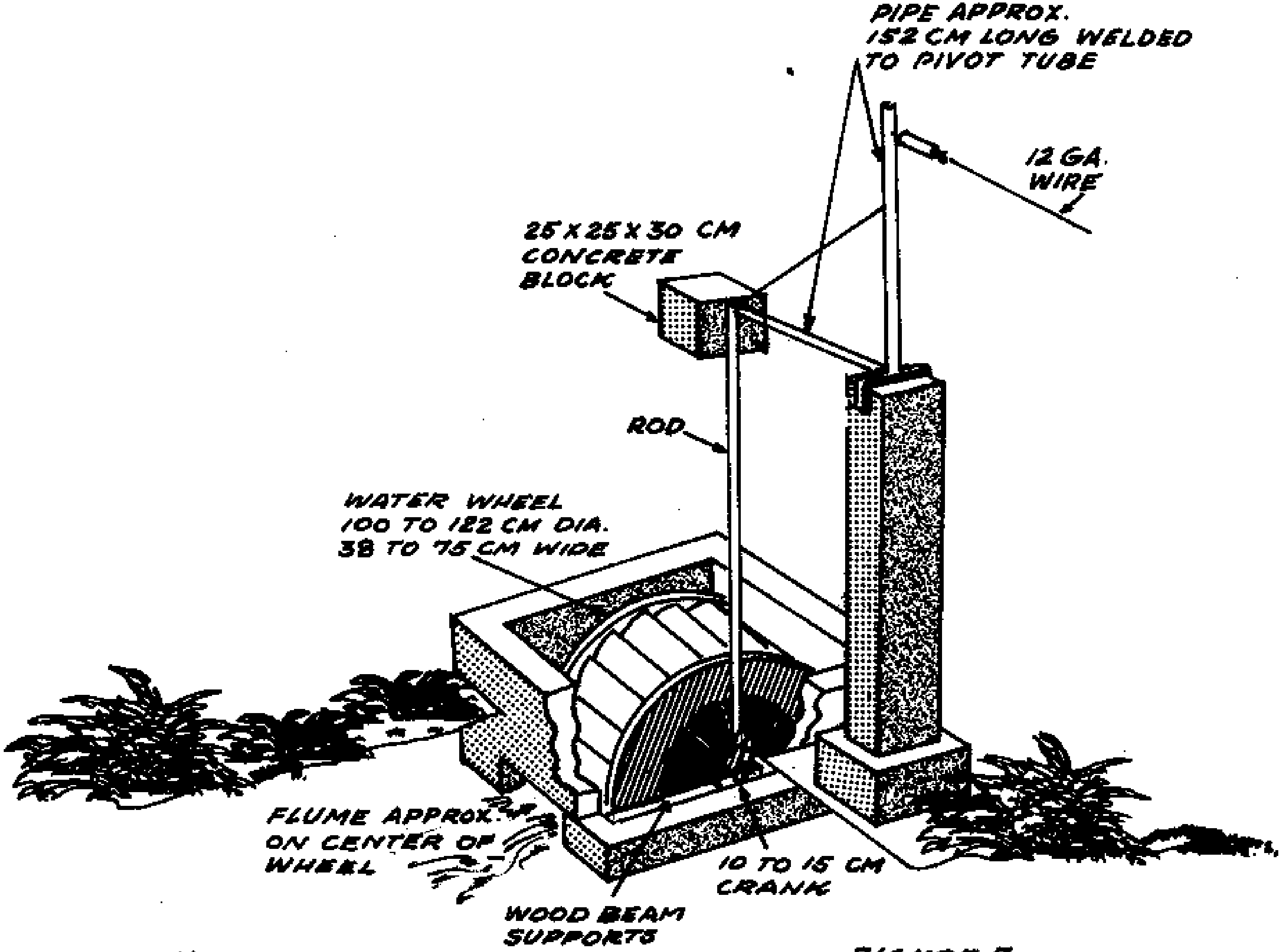

ROD TO CRANK
APPROX. 20 CM STROKE
STEEL WHEEL - 100 CM DIA
38 CM. WIDE
CUPS 12.5 CM DEEP
15 CM APART
FLUME 33 CM WIDE
75 CM ABOVE SHAFT
CENTER
CONCRETE
BLOCK
(20 X 20 X 40 CM)
WOOD
SILLS AND
BEARINGS
SHAPE
OF
CUPS
SIDE
SECTION
VIEW

FIGURE 6



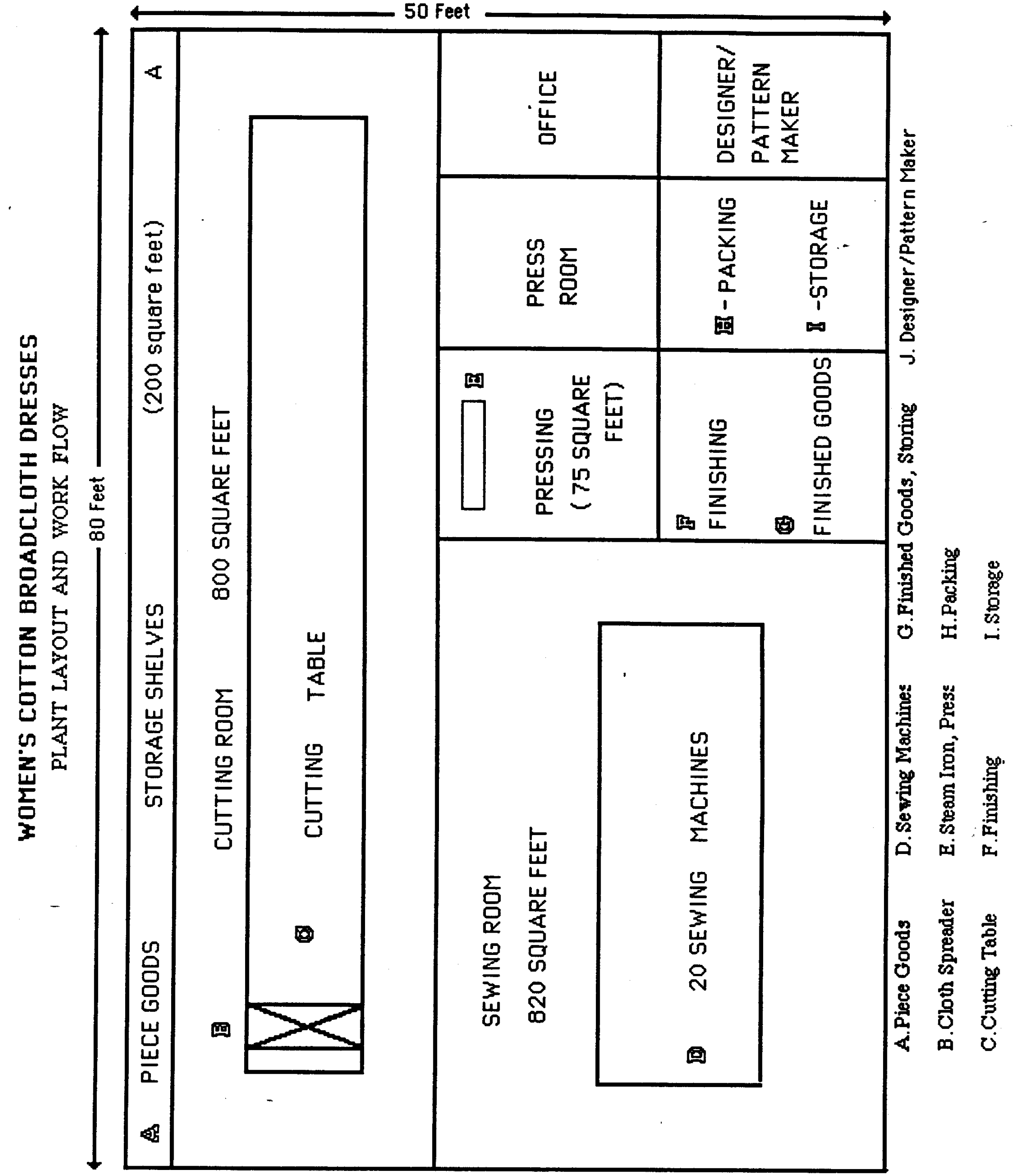
NOTE: CRANK CAN BE ADDED TO OTHER END OF SHAFT AT 90° ANGLE TO FIRST CRANK TO ATTACH MORE POWER TRANSMITTING WIRES

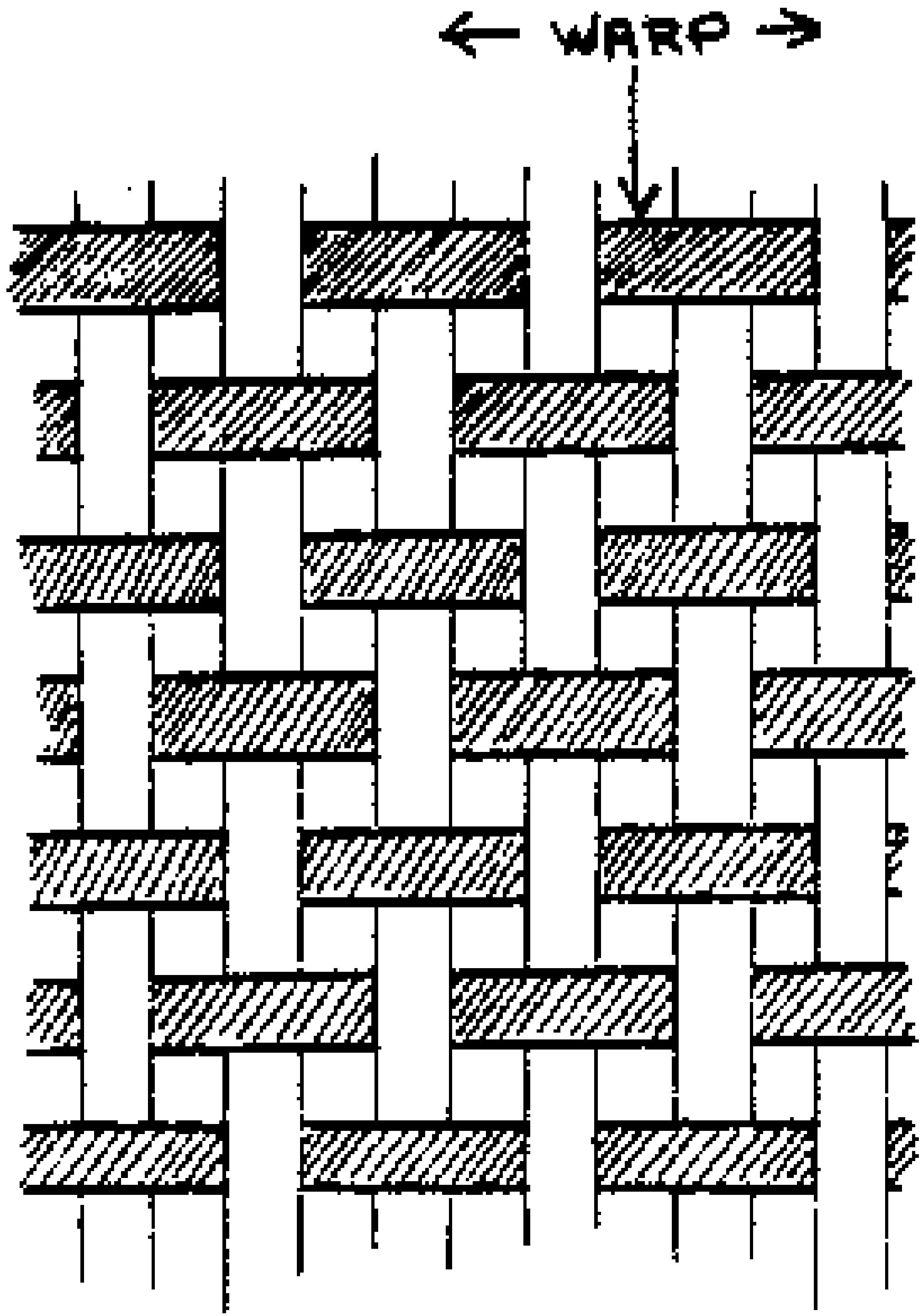
FIGURE 7

WOMEN'S BROADCLOTH DRESSES

Floor plan should have at least 4,000 square feet of room. Flow of work should go as indicated. The layout is flexible to provide an efficient work flow. It should be fairly simple to arrange machines and operations accordingly.

Note the importance of having space for a designer/pattern-maker.




WARP