Irrigation

SIPHON TUBES

The galvanized metal siphon tube described here can be used for irrigation (see Figure 1). It can be easily made and repaired by tinsmiths. A siphon can also be

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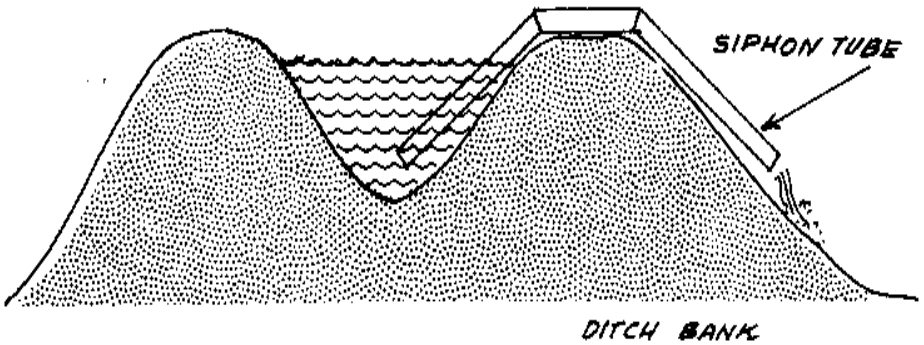

FIGURE 1

made from a piece of rubber hose or by bending a piece of plastic tubing. Construction details are given in Figure 2.

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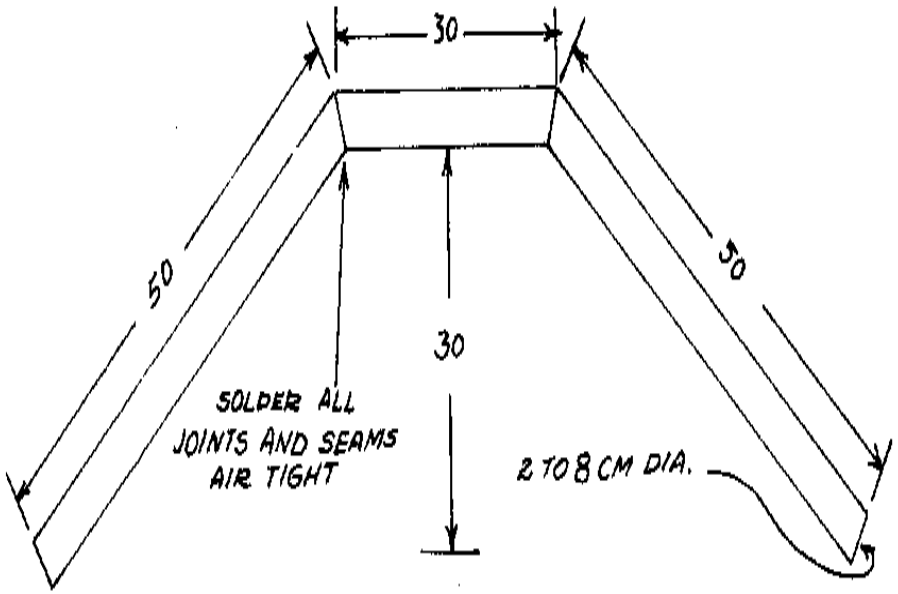

Source: FIGURE 2

Dale Fritz, VITA Volunteer, Schenectady, New York

The purpose of this siphon tube is to carry water out of a ditch without cutting

a hole in the ditch bank. In many soils a small hole cut in the ditch bank soon becomes a large hole because of erosion. Imported plastic siphons are often expensive, easily broken and usually impossible for local people to repair.

There are several good ways to start a siphon tube. The simplest way is to put the tube in the ditch until it fills with water. Holding one hand over the end of the tube, so that air cannot get in, lift the tube out and place it as shown in Figure 1. Be sure the other end of the tube does not come out of the water while placing the tube. When the tube is in place, remove your hand and the water will begin to flow. The end of the tube outside the ditch must be lower than the level of the water in the ditch.

USING TILE FOR IRRIGATION AND DRAINAGE

An irrigation or drainage system made with the concrete tiles described here can help to keep a garden in production during both wet and dry seasons. It will make good use of irrigation water and, during the wet season, will drain off surplus water.

The entries that follow explain how to make a concrete-tile machine and how to use the machine.

In regions of heavy rainfall, the tile drainage can be combined with good surface drainage by making raised beds in gardens, shoveling out 30cm (1') wide pathways that will be 15cm (6") lower than the beds. Put the beds over the tile lines and make them 1 meter (3') wide. Use the pathways also as drainage ways and

connect them with a good outlet to lower ground.

**This system of under-ground irrigation (and drainage) can serve under fruit trees
or gardens. It can also be used around the foundations of buildings where drainage is a problem.**

**Concrete irrigation tiles, whether for irrigation or drainage or both are laid 30cm
(12") deep in lines 1.2m (4') apart (the latter measurement depending on the texture of the soil: more distance between lines for clay soils and less for sandy
soils). The garden should be almost level, with good surface drainage. Upright "elbows" at the ends of the lines give access to the tile at either end (see Figure 1).**

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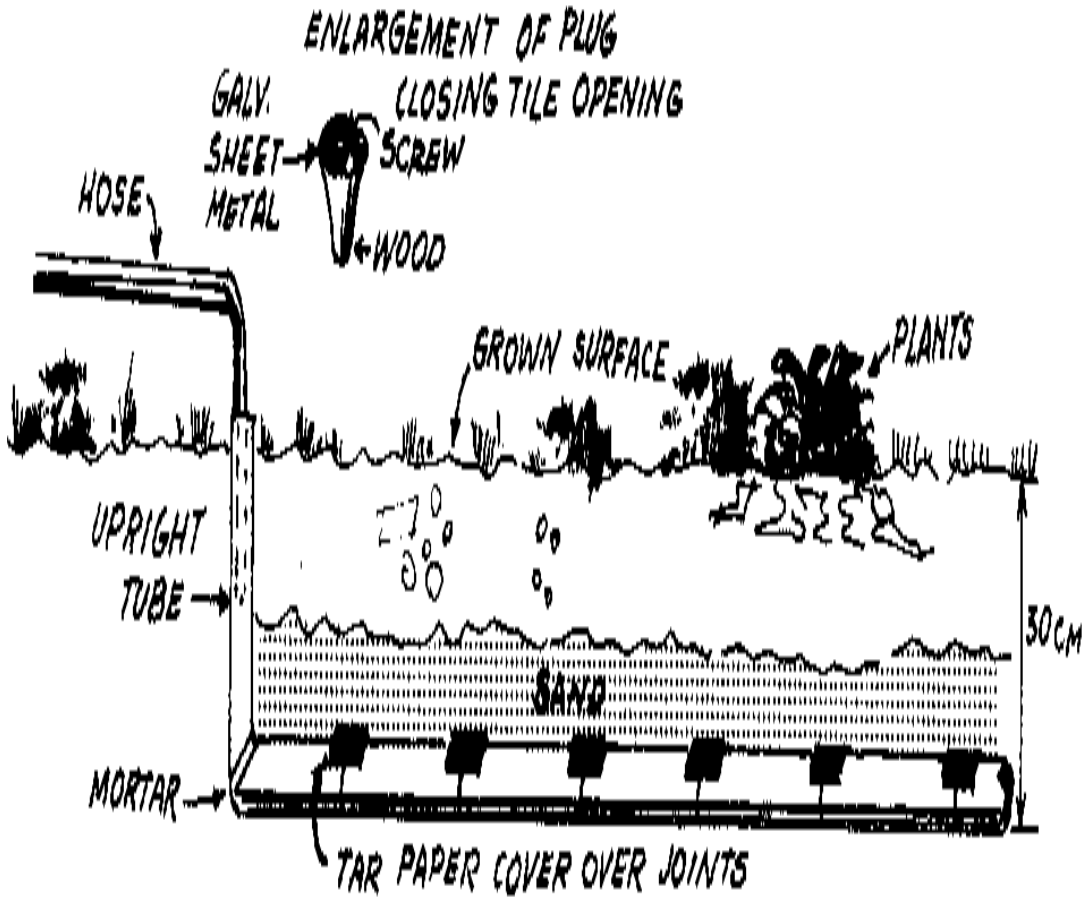

FIGURE I

A garden hose can deliver the water from its source to the upright ends of the tile lines. While tile lines must be level, they do not have to be straight; they

can follow a contour line or double back to make a more convenient system of installation with four or more lines connected to make one unit (Figure 2).

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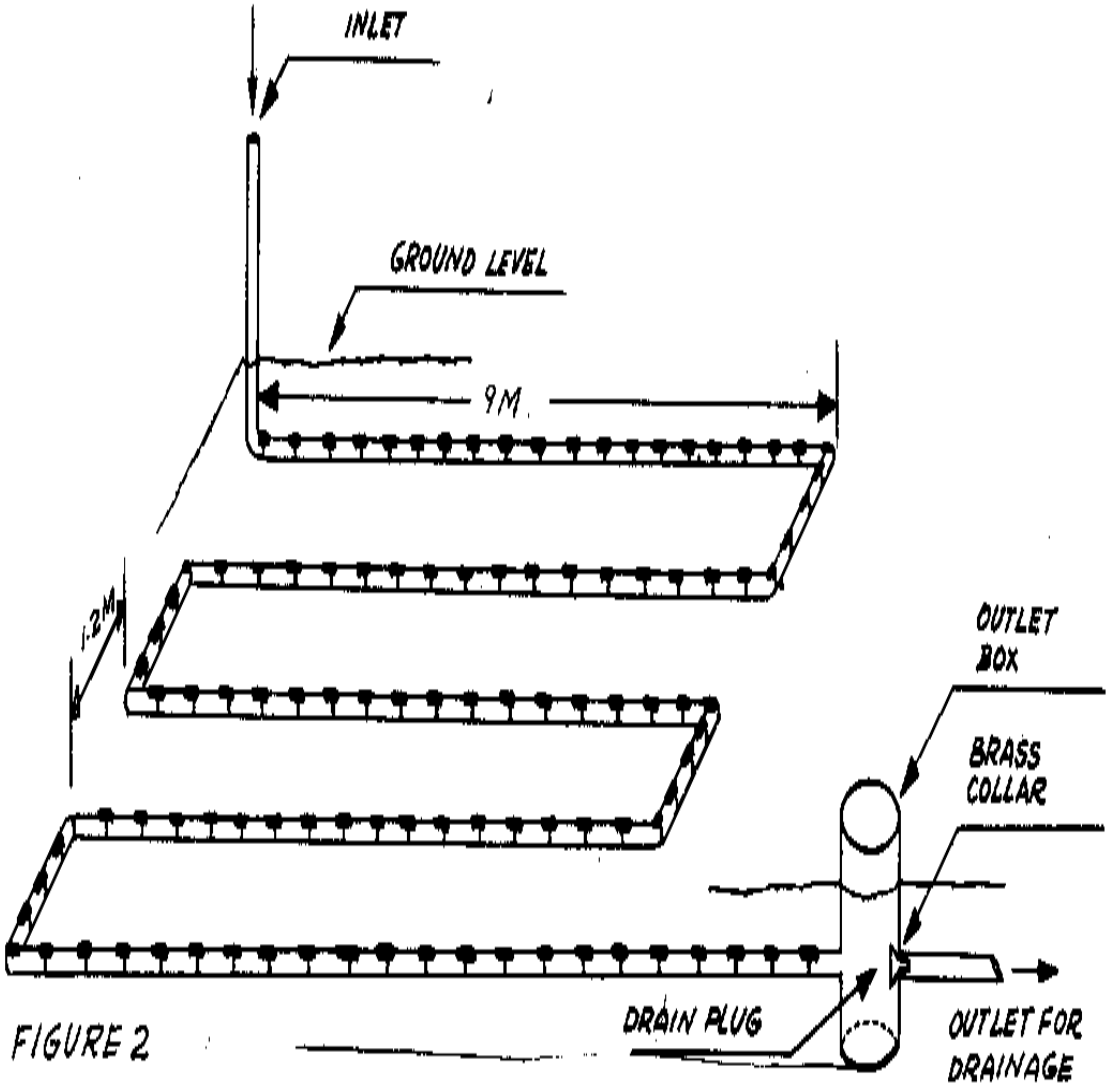

FIGURE 2

In dry seasons, the tiles supply water to the plant roots. In wet seasons, the water escapes through the sand and gravel around the tile and follows the concrete tube formed by the tiles to a drainage outlet (see Figure 2). While passing downward through the soil to the tile, the water draws air into the soil and supplies oxygen to the helpful bacteria and to the plant roots.

Tools and Materials

Concrete tile Wood for plugs
Cement for mortar, concrete Optional - Brass outlet box collar
Sand for mortar and tile covering Shovels, concrete-mixing tools
Gravel or crushed stone for concrete

To install the tiles:

o Grade the garden plot to within 5cm to 7cm (2" to 3") of level and make trenches 30cm "12") deep, according to the design in Figure 2. This will give an even distribution of the water. Check the bottom of the tile ditches to be sure they are level. Only the drainage outlet will have a drop.

o Lay the tile end to end in the bottom of the trench. Use an "elbow" (made of two tiles cut to 45-degree angle) to make a place for putting the hose at one end, and use other elbows to turn corners.

o Put a piece of tar paper or used linoleum over each joint (Figure 3) to keep

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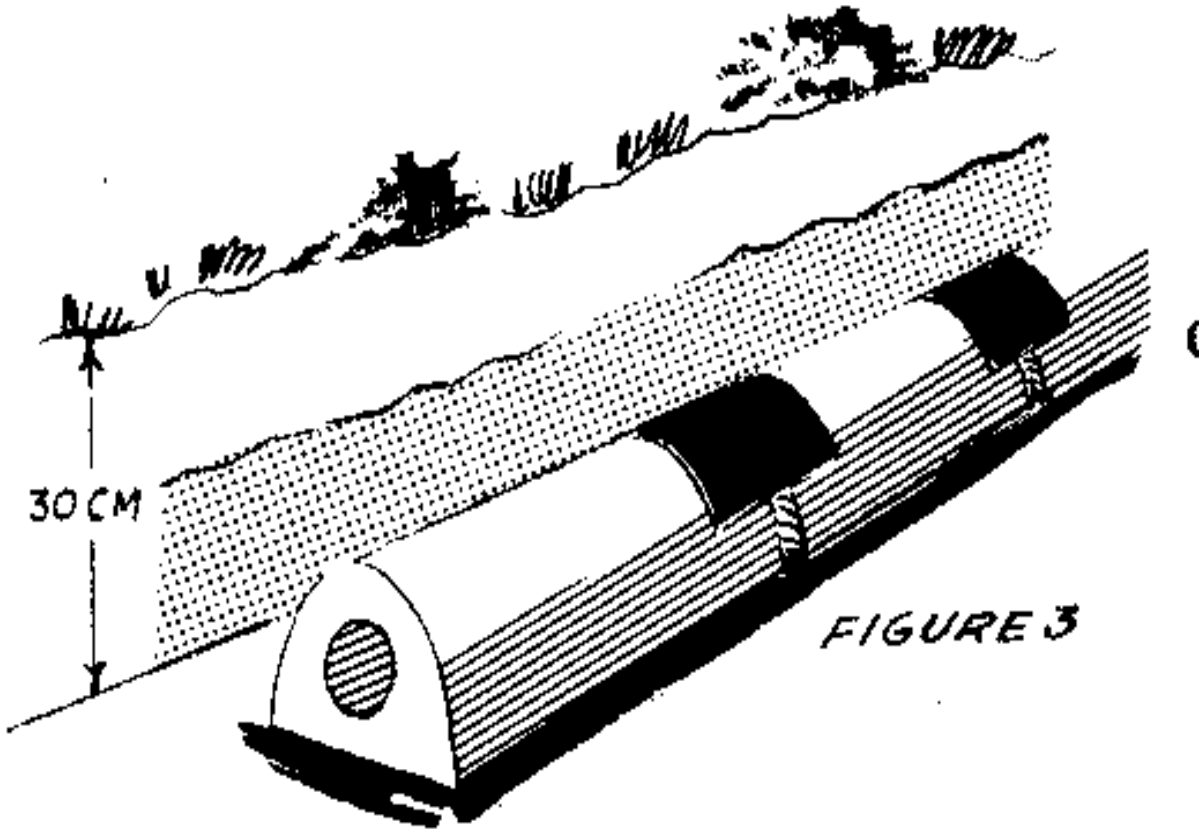

FIGURE 3

TAR PAPER OR LINOLEUM IS PLACED OVER EACH TILE JOINT TO KEEP DIRT OUT OF THE LINE.

the dirt out of the line. A piece 5cm x 12.5cm (2" x 5") is large enough. .

o Cover the tile with sand to give the water an opportunity to soak out into the soil or (in the case of drainage), to seep into the tile. The bottom 12.5cm (5") of the trench are filled with sand or gravel (around the tile) and the top 17.5cm (7") are filled with soil.

o Near the outlet, make an upright concrete box with two holes near the bottom to let drainage water run through and on out to an outlet. The box should be large enough so that one can reach into it to install a plug in the drain side of the box when the system is used for irrigation. A brass or aluminum collar installed in the concrete will make it easier to close this hole completely and thus avoid a loss of water.

o Put covers over both ends to keep out small animals (see Figure 1).

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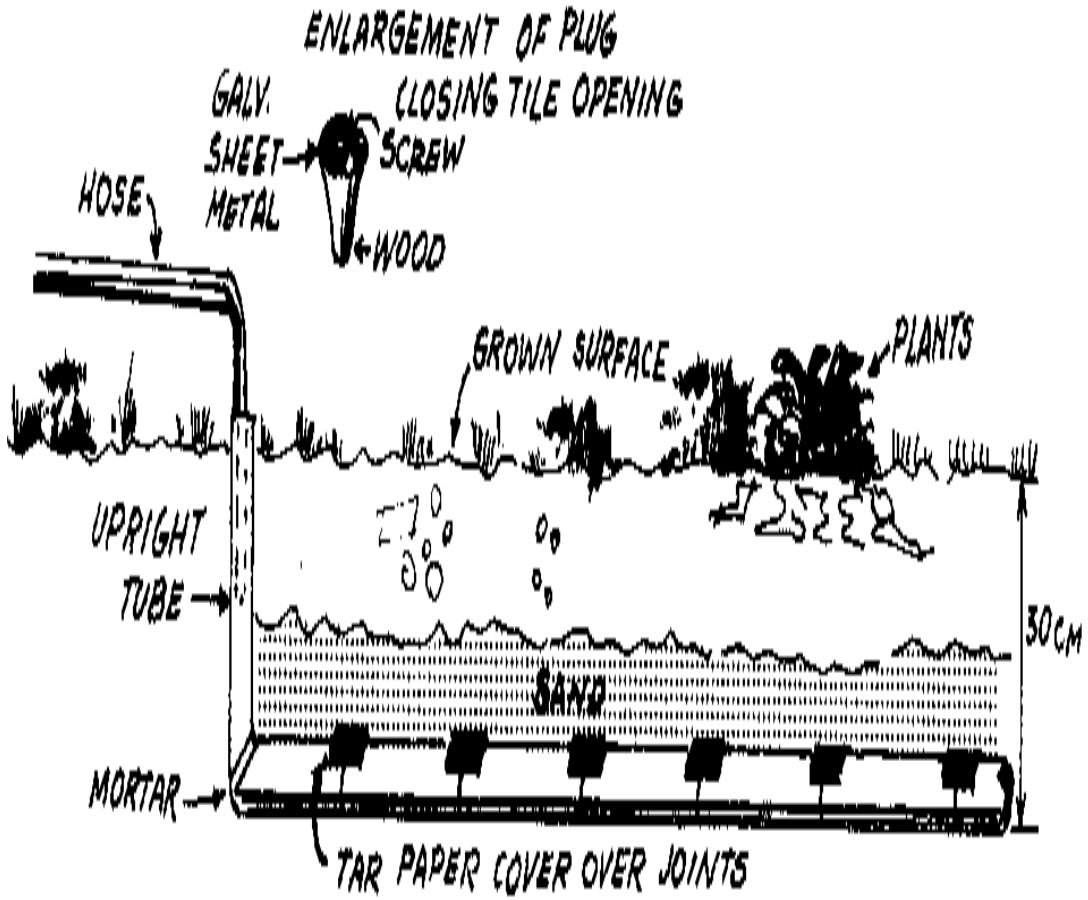

FIGURE I

o Do not water more frequently than once or twice a week, so that plant roots will not enter the tile line to obstruct it.

o Be careful not to damage the tile with tillage equipment.

o For irrigation, the tile system is used with its drain plug securely closed (see Figure 2). Water is run into the line once or twice a week, by means of a hose, until the soil becomes moist. For drainage, simply pull the plug.

Making a Concrete Tile Machine

This all-steel tile-making machine (Figure 1) can be made of scrap metal in any

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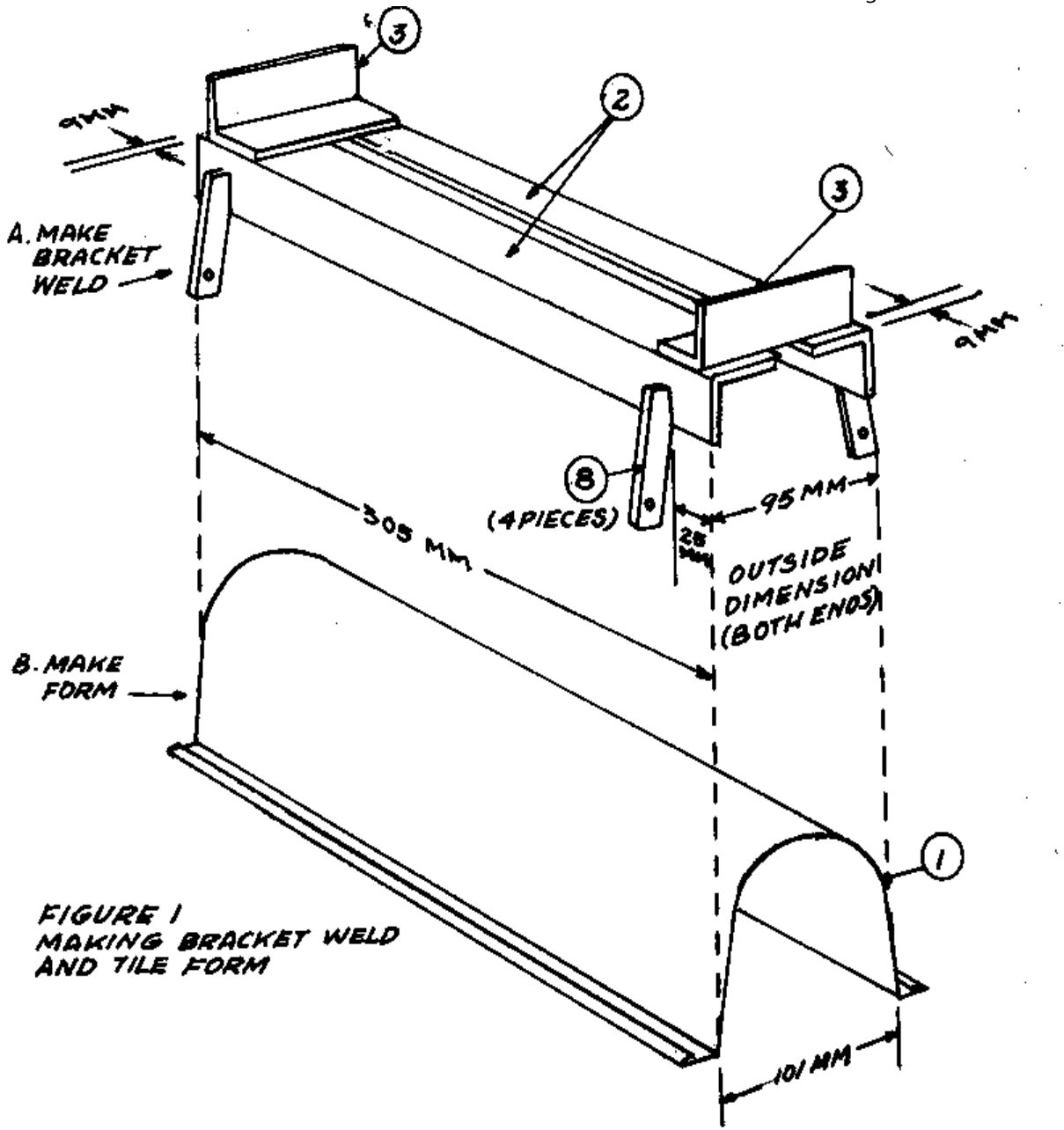

FIGURE I
MAKING BRACKET WELD AND TILE FORM

shop with welding equipment. The machine makes 80 to 100 tiles to a sack of cement. One worker can make about 300

tiles in an 8-hour day. Construction of the machine is a good welding project for students.

A tile-making machine made from wood is illustrated in Figure 15. The

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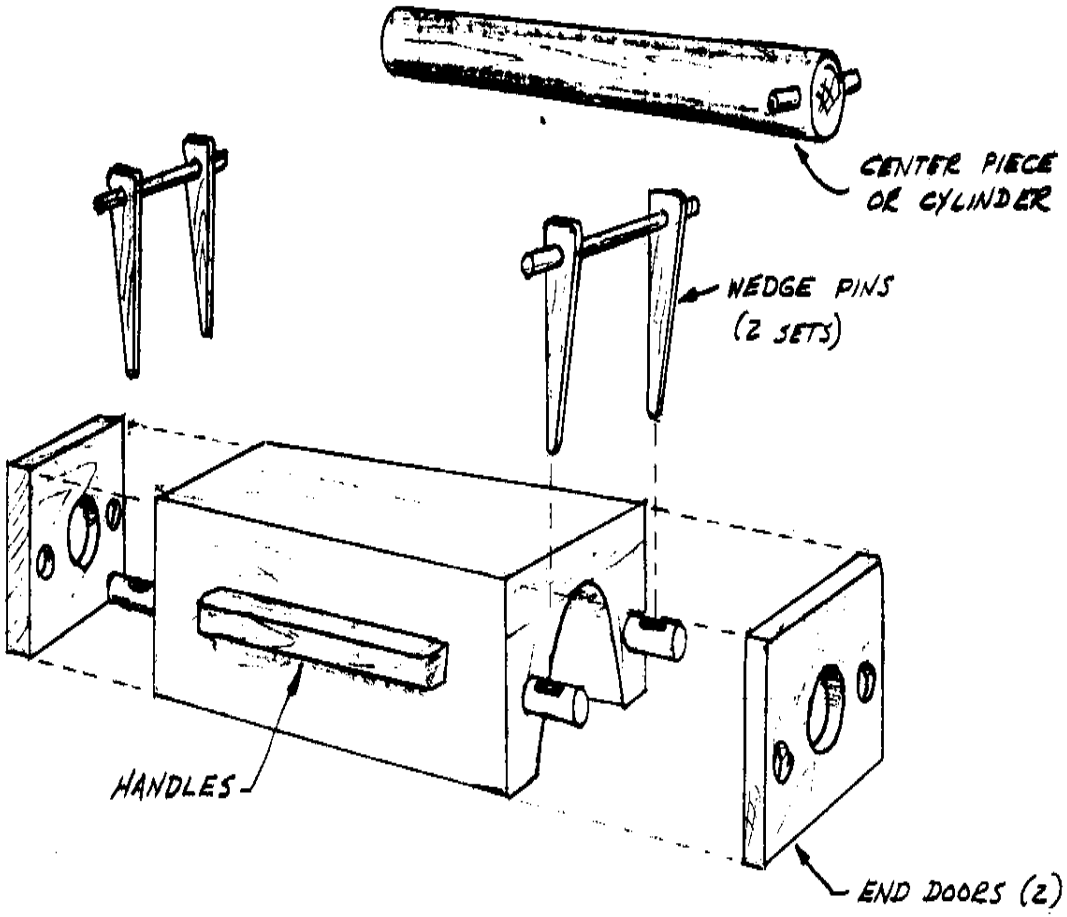

FIGURE 15 ALL-WOOD CEMENT-TILE MACHINE (DIMENSIONS OF TILE SAME AS ALL-METAL MACHINE). BLOCK IS STRONGER IF MADE FROM 3 PIECES JOINED LENGTHWISE.

tiles made with this machine are the same size as those

made with the all-metal machine.

All the drawings of the form and its several parts in this entry show the form in its upside-down, or emptying position.

The machine can be made of used or new materials. To make the form, it is desirable to have both electric and acetylene welding equipment, although either will serve. The thicker parts are assembled by arc welding and the thinner parts have to be put through other parts before welding, as will be explained below. We shall refer to each individual part by its number, which appears on the sketches.

The assemblies made of parts No. 10, 11, and 12 (Figures 8 and 14) are simply a

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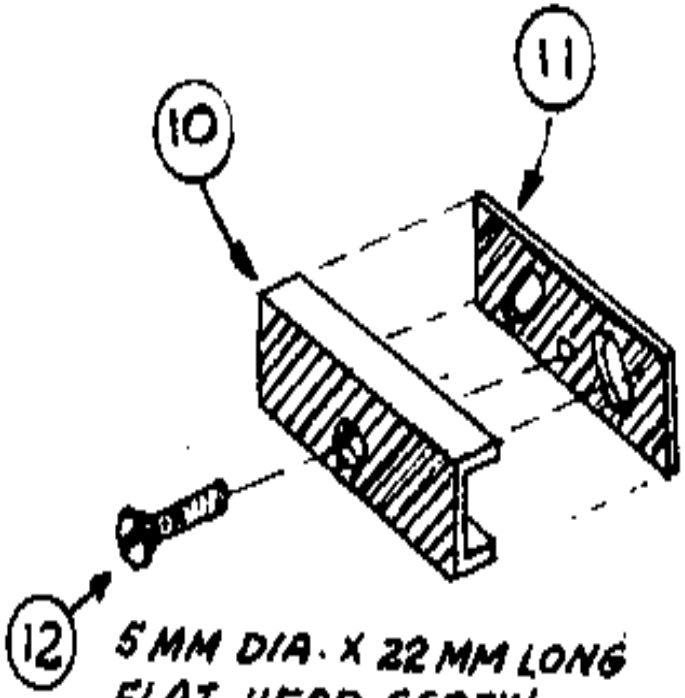

FIGURE 8

convenient means of taking hold of the levers to open the end doors. These levers are made of part No. 5 and 13 as described below and shown in Figures 9, 10, and 11.

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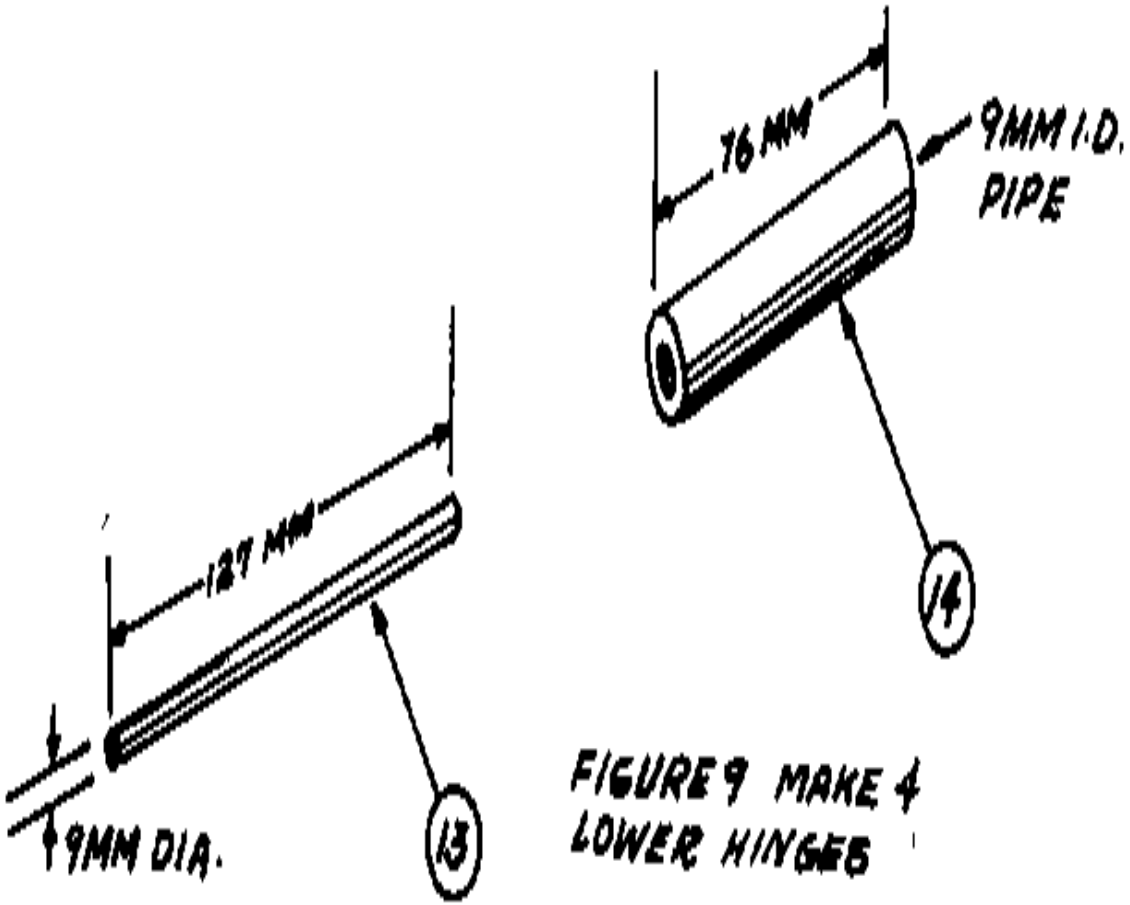

FIGURE 9 MAKE 4 LOWER HINGES

tension being made sufficient to hold the doors closed against the force of tamping.

The hole in the end door is shown as 3mm (1/8") larger than the diameter of the pipe that shapes the interior surface of the concrete tubes. This 3mm (1/8") is an allowance of clearance necessary to keep the sand particles from making the pipe difficult to remove after the mortar is tamped around it. Greater clearance would hurt the uniformity of the tile. The finished tile should have a uniform 13mm (1/2") wall and part No. 1 must be shaped and so related to the pipe that the thickness of the tile wall will be correct (see Figure 6).

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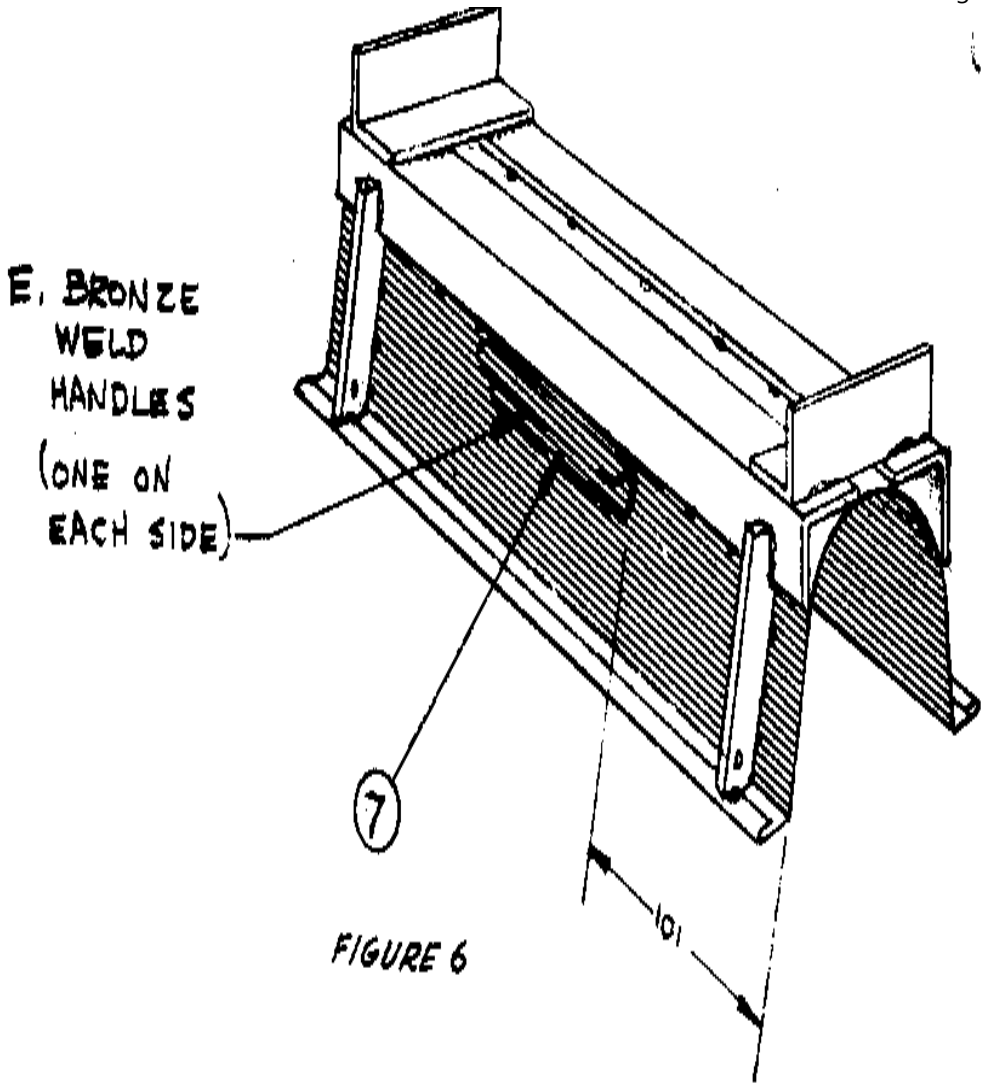

FIGURE 6

Parts No. 7 are bronze welded to the sides of No. 1 (see Figure 6). These parts, like other parts that touch the hands, should be dressed to a smoothness

**sufficient
to avoid injury to the operator. The outside of the form should be well painted but the inside cannot be painted, as paint would cause the mortar to stick
to the inside. When the form is not in use, the inside should be kept oiled.**

**The pipe may need to be dressed lightly in the lathe to make it easier to remove from the form after the mortar is tamped around it. In turning, it is advisable to
make the end opposite the handle end 0.5mm (1/64") smaller, as this will facilitate
its removal in the emptying process. This lathe work should be done after the end
of the pipe opposite the handle end has been welded shut with a disc of galvanized
sheet metal. If this end is not closed, cement will enter the pipe and thus be spilled into the inside of the tile to become an obstruction there.**

Part No. 19 is a wire of 3mm (3/32") diameter steel welding rod with the shape shown in Figure 2, but one of the eyes has to be formed after the part has been

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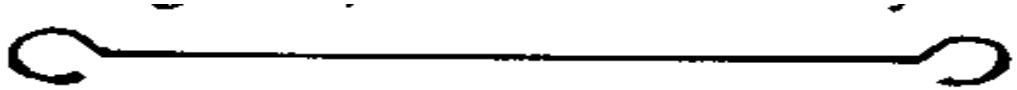

FIGURE 2
SHAPE OF PART NO. 19

**threaded through the hole in part
No. 8 (see Figures 1 and 8).**

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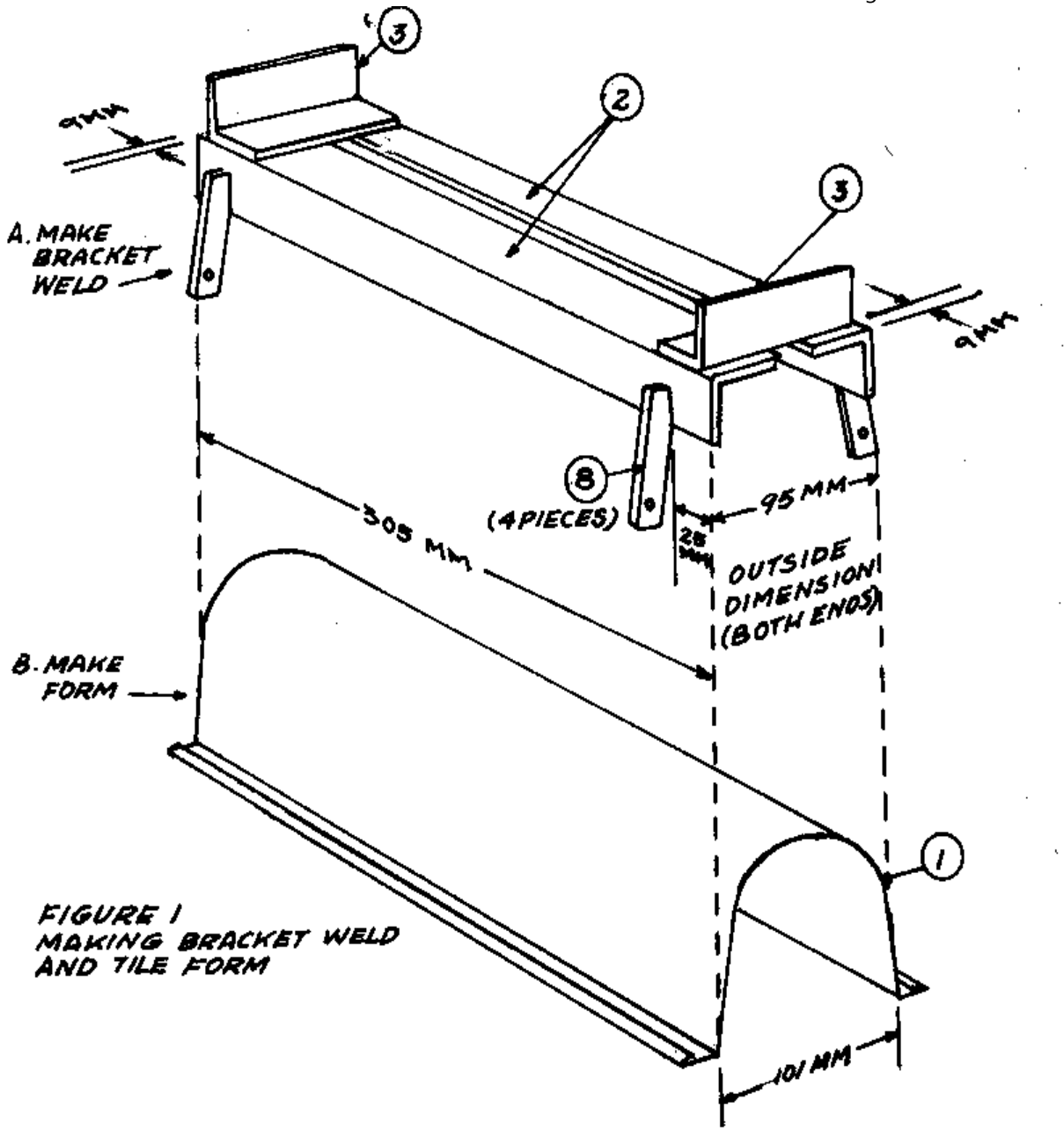

FIGURE I
MAKING BRACKET WELD AND TILE FORM

The following paragraphs are listed by part numbers:

1. The inside walls of the form are made of 16-gauge galvanized iron. Part No. 1 as shown in Figure 1 is made from a sheet cut to a true rectangle, 26.6cm x 30.5cm (10 1/2" x 12"). This is bent to shape by putting a 6mm (1/4") fold on each of the 30.5cm (12") sides; bending 19mm (3/4") more of same sides to a right angle; and then shaping the sheet according to the curve shown in Figure 3. This lining is then

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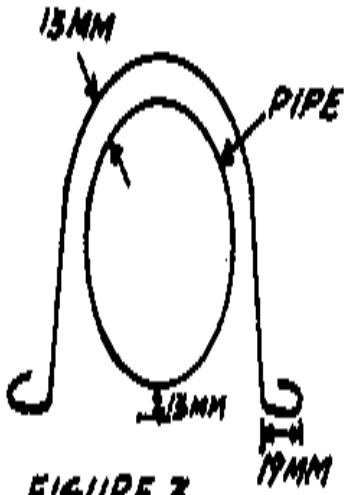

FIGURE 3
SHAPING PART NO. 1

fitted into the cradle made of parts No. 2 and 3. Parts No. 6 will be the end doors, which are also made of 16-gauge sheet iron. The inside

**of the form should not be painted,
as this interferes with its operation.**

2. For part No. 2, two pieces of angle iron, 38mm x 38mm x 3mm x 30.5cm (1 1/2" x 1 1/2" x 1/8" x 12") are needed.

3. Angle iron, 38mm x 38mm x 5mm (1 1/2" x 1 1/2" x 3/16"), 95mm (3 3/4") long. Two are needed. Parts No. 2 and 3 are welded together to form the cradle. Parts No. 8 are welded in place on parts No. 2 and corrections are made for shape before No. 1 is tack welded into the cradle thus formed. The design above gives some idea of final relationship to be kept between the sheet metal lining of the form and the metal pipe. Notice that the tile wall will be uniformly 13mm (1/2") thick (see Figures 4 and 8).

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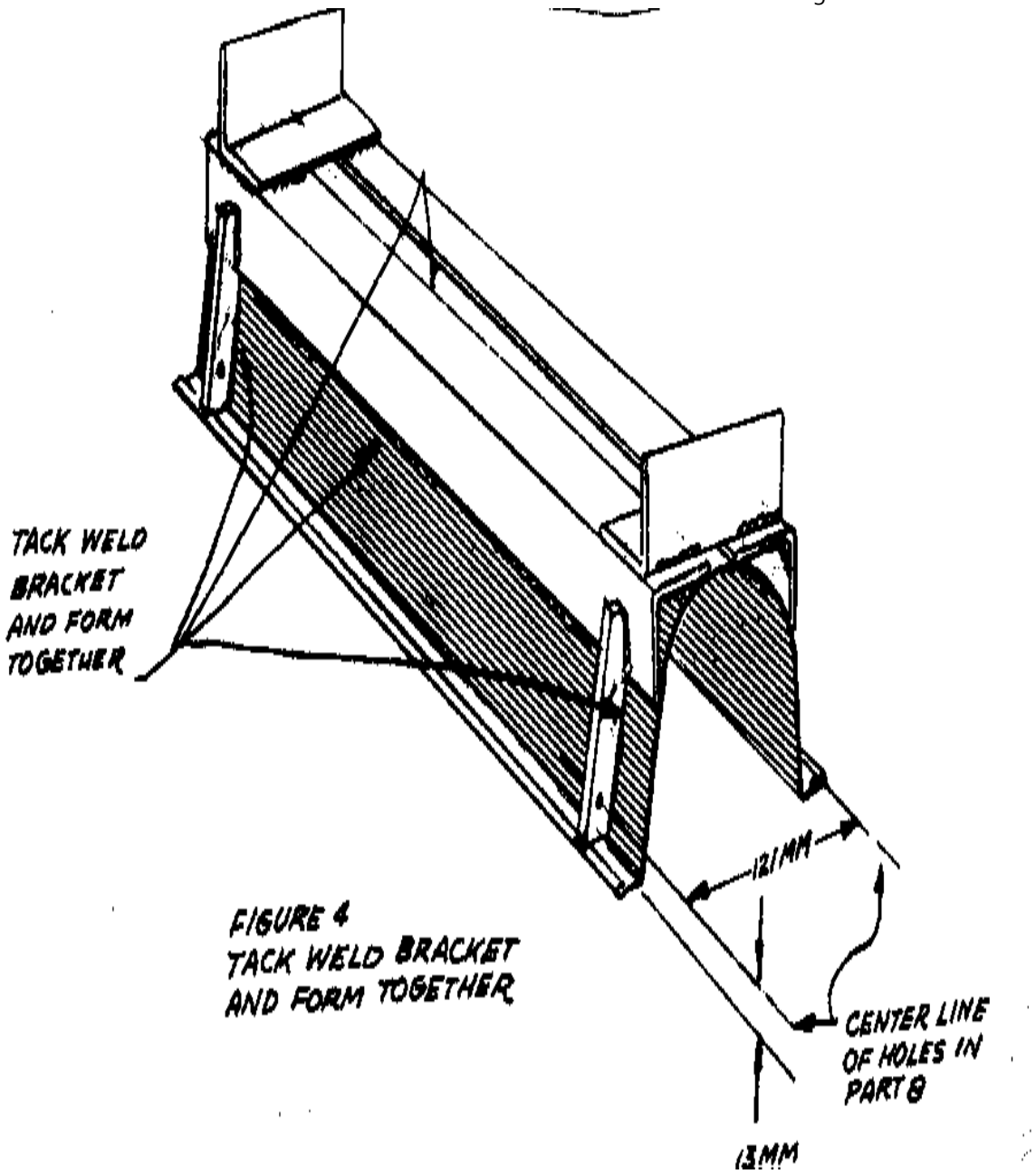

FIGURE 4
TACK WELD BRACKET
AND FORM TOGETHER

4. Mild steel rods, 10mm x 15.2cm (3/8" x 6") (see Figure 13). Two are needed.

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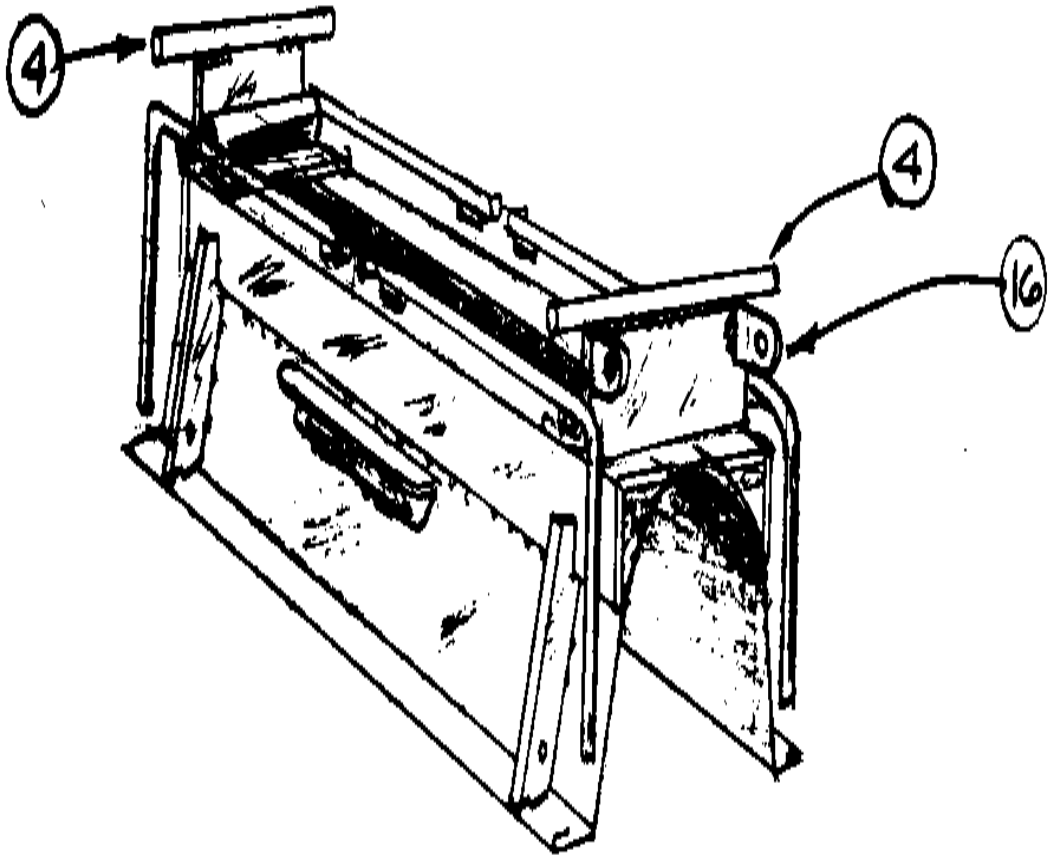

FIGURE 13 WELD ON HINGE PIECES (16) ON BOTH ENDS USING DOORS (6) AS GUIDES. ALSO WELD ON TWO RODS (4).

These are welded in place to make the form stand a little taller so the

levers will not touch the work bench while the mortar is being tamped into the form. They also provide a wider base.

5. Mild steel rods, 10mm x 22.9cm (3/8" x 9") (see Figure 10). Four are needed.

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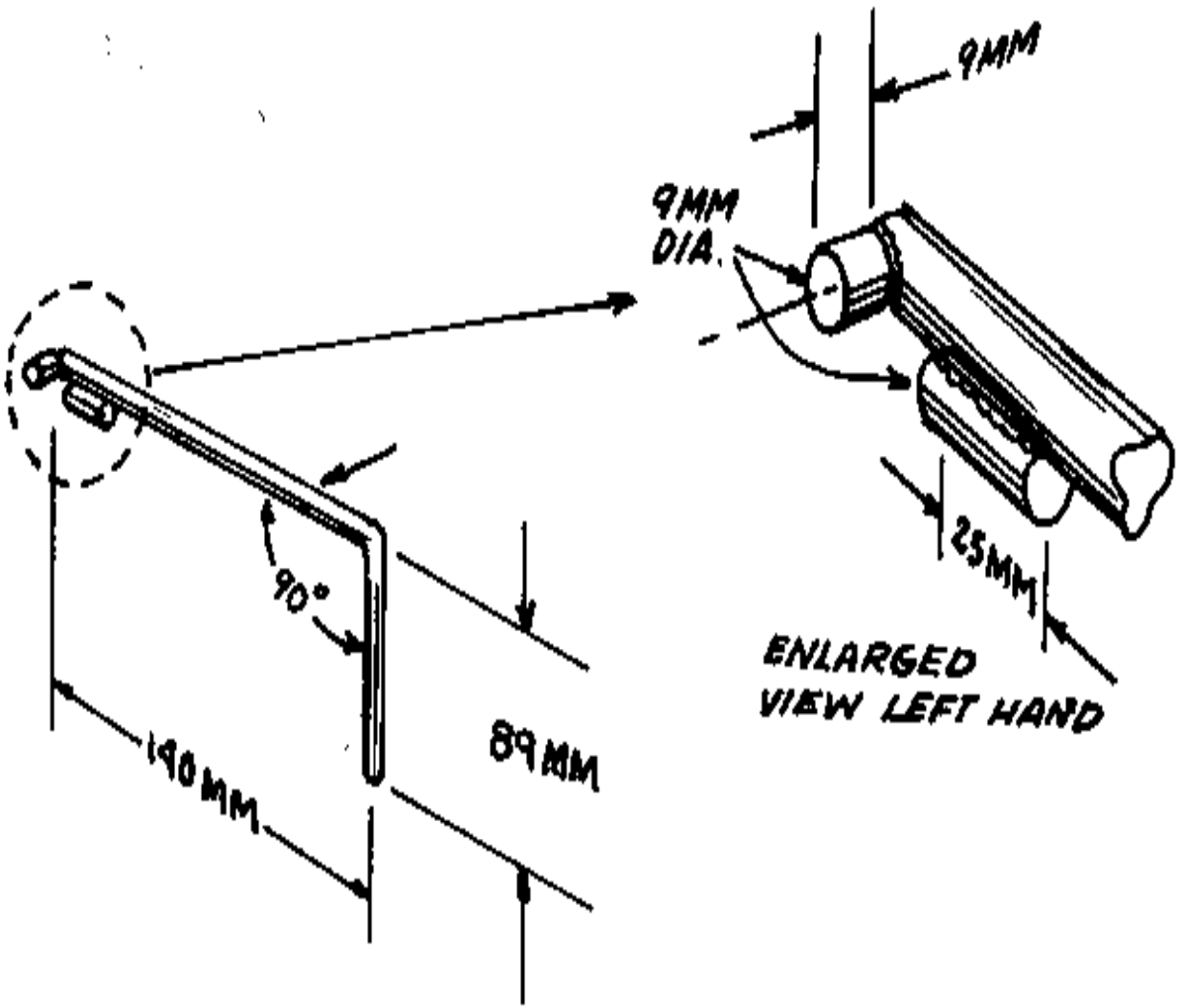

FIGURE 10 MAKE 4 LEVERS, 2 RIGHT HAND AND 2 LEFT HAND

These are bent to form the levers and are welded into pairs by means of the connecting piece, No. 13 (see Figure 9). Notice the tiny tabs welded to the

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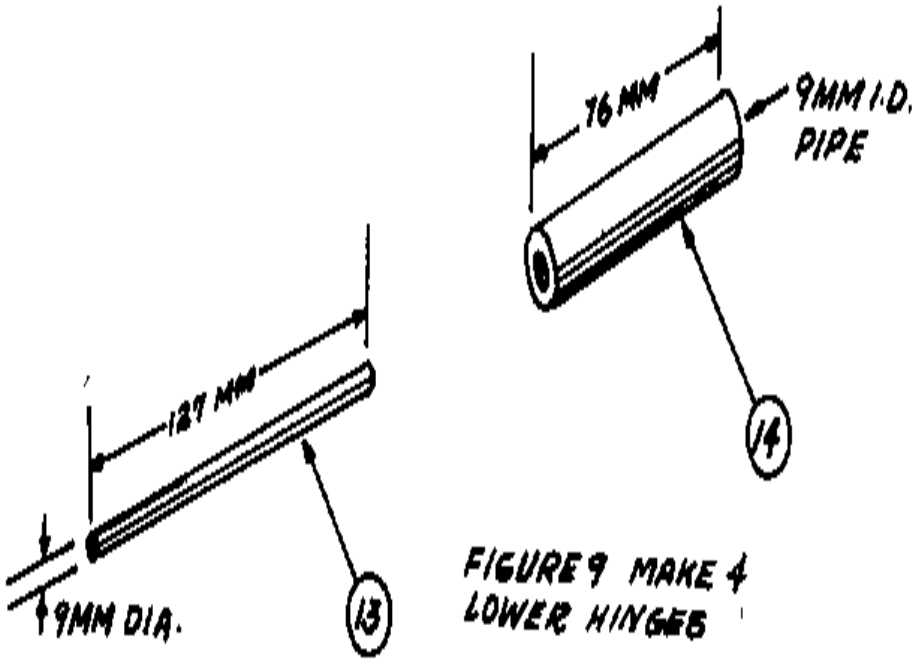

FIGURE 9 MAKE 4 LOWER HINGES

handle end of the levers. These are to keep the hand hold from turning or sliding endwise from its proper position. By the "hand hold" we mean the assembly made of Parts No. 10, 11 and 12.

6. Galvanized sheet metal, 16-gauge, 14cm x 16.5cm (5 1/2" x 6 1/2"). Two are needed. These are the doors and the parts that hold the center pipe in its proper position. They should be cut and shaped after Part No. 1 has been tack-welded in its place (see Figure 5).

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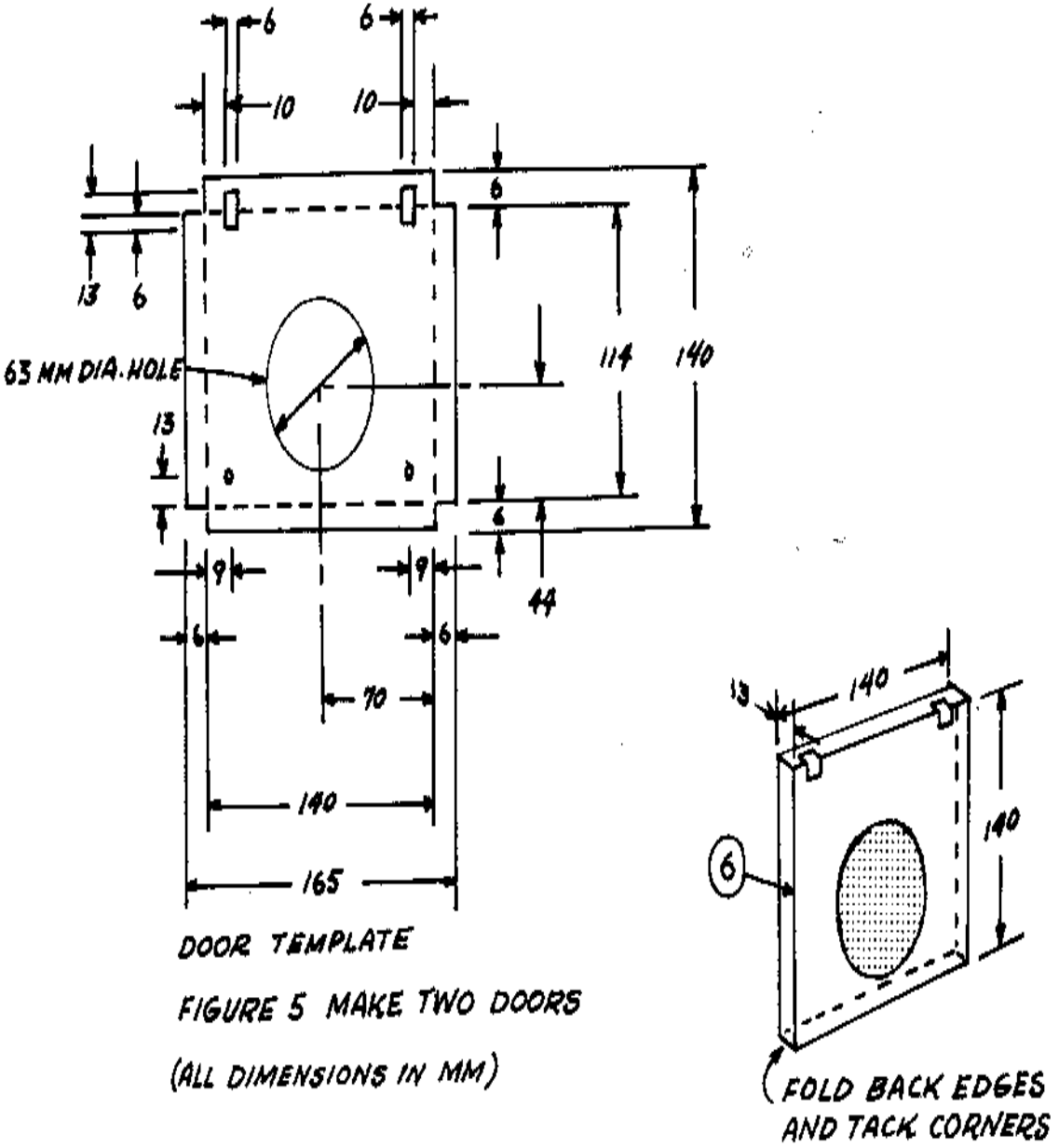

7. Galvanized sheet metal, 16-gauge, 38mm x 10.2cm (1 1/2" x 4"), bent to angle as shown in Figure 6. Two are needed. These are handles for lifting

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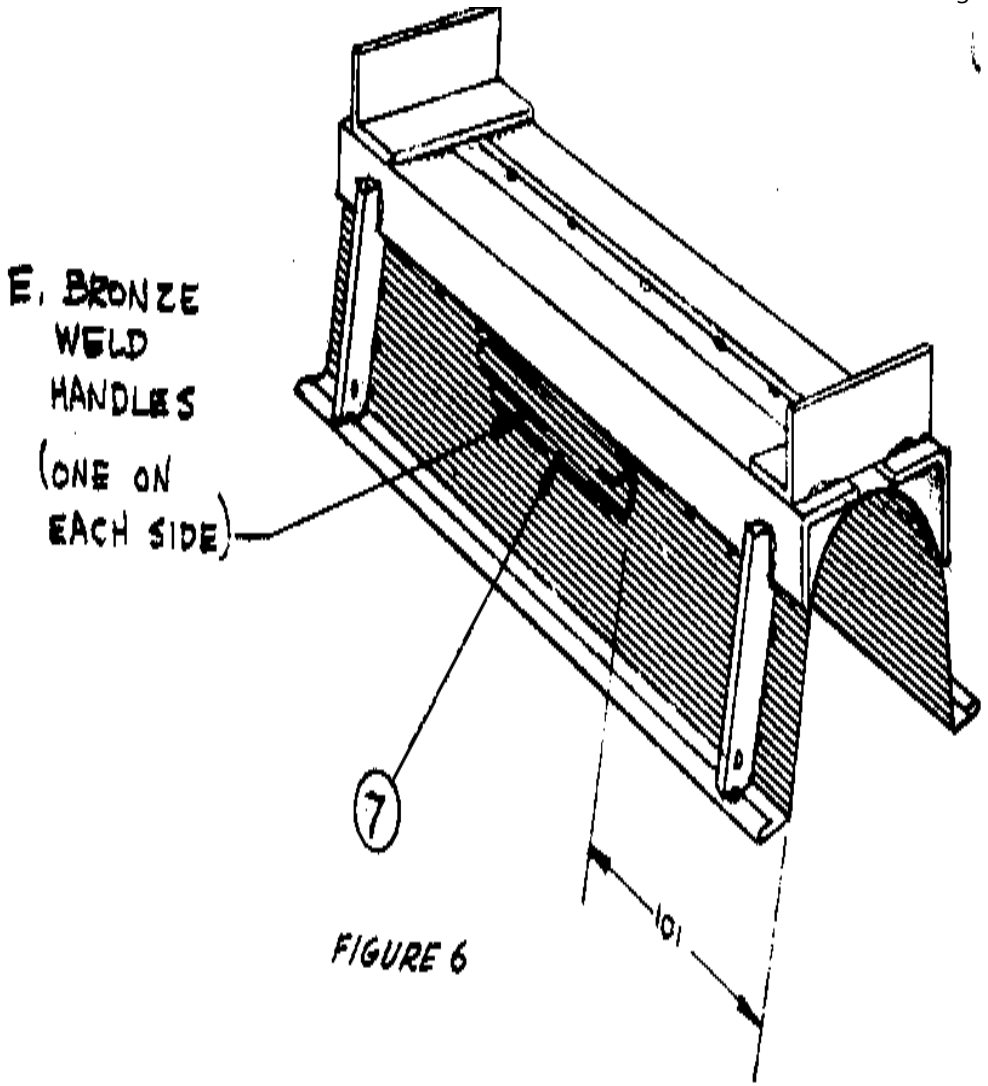

FIGURE 6

the form. They are dressed smooth and bronze welded to the sides of No. 1 after the doors are properly installed as explained under No. 15 below.

8. Mild steel bar, 19mm x 6mm x 7cm (3/4" x 1/4" x 2 3/4"). Four are needed (see Figure 1). They are welded to No. 2 to complete the cradle for the

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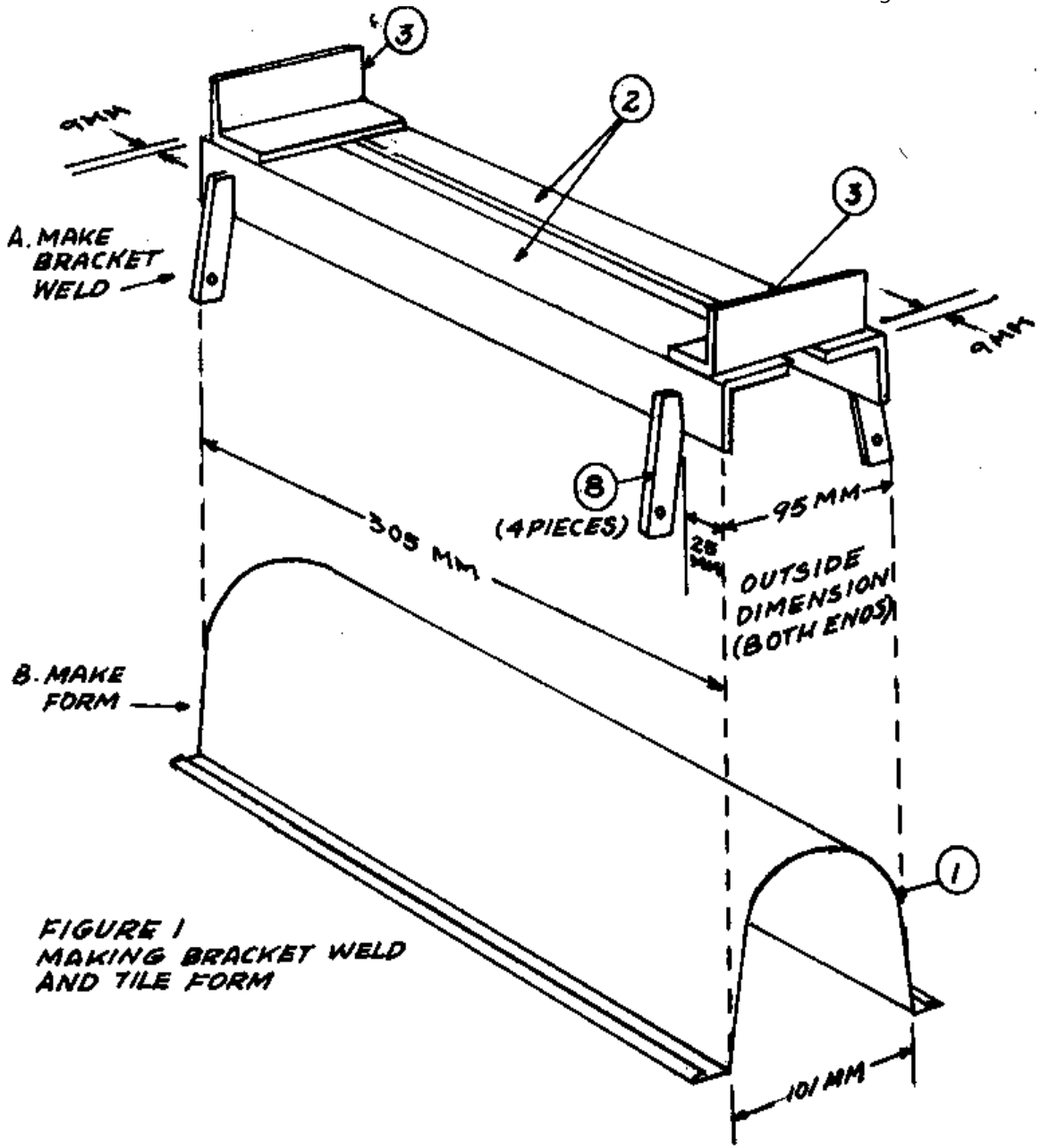

FIGURE I
MAKING BRACKET WELD AND TILE FORM

lining of the form. Then the lining, part No. 1 is welded to No. 8 at the fold in the edge of No. 1. Check to see that the space for the thickness of the tile wall remains 13mm (1/2").

9. Screen door spring, cut into coils as shown, 14cm (5 1/2") long with the end loops bent out to form eyes. Two are needed (see Figure 7).

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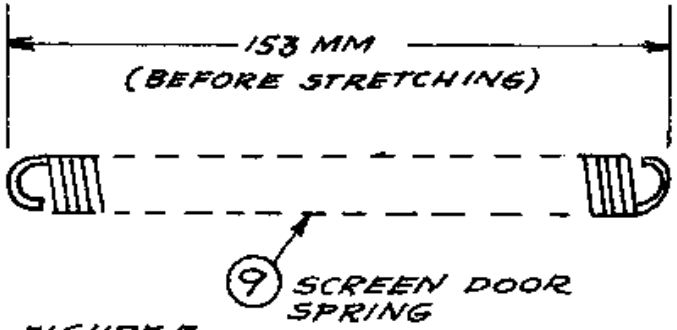

FIGURE 7
MAKE TWO SPRINGS

10. Channel iron, 31mm x 19mm x 8.2cm (1 1/4" x 3/4" x 3 1/4"). Two are needed. Countersink hole for screw head. Dress parts No. 10 and 11 smooth as they are handles.

11. Strap iron, 2.5cm x 3mm x 8.2cm (1" x 1/8" x 3 1/4"). Two are needed (see Figures 8 and 14). Drill and thread hole to match the screw hole in part No.

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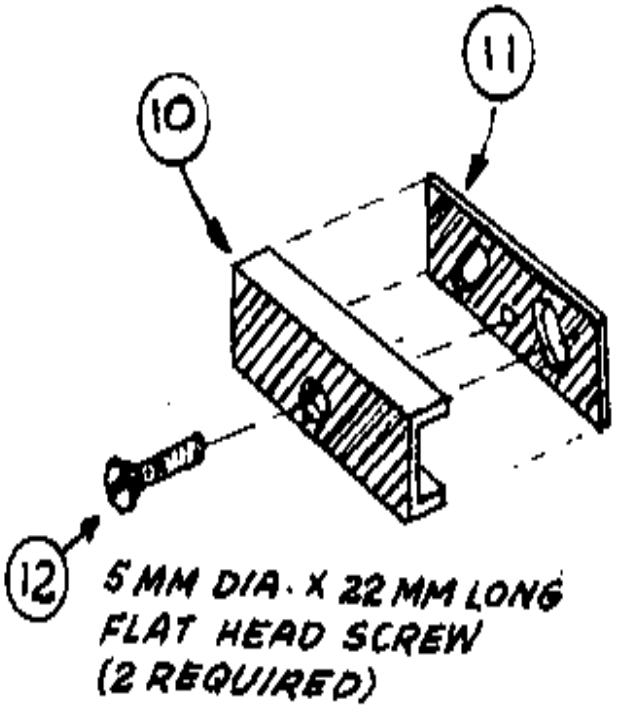

FIGURE 8

10. Make guide holes for the round tabs that are welded to the end of the levers, No. 5. The tabs on No. 5 is made by sawing off a 10mm 3/8") length of 10mm (3/8") diameter rod and bronze welding it to the end of the handle as shown.

12. Machine screw, flat head, 6mm x 19mm (1/4" x 3/4"). Two are needed. This unites No. 10 and 11.

13. Mild steel rod, 9mm x 12.7cm (3/8" x 5"). Two are needed (Figure 9 and 11).

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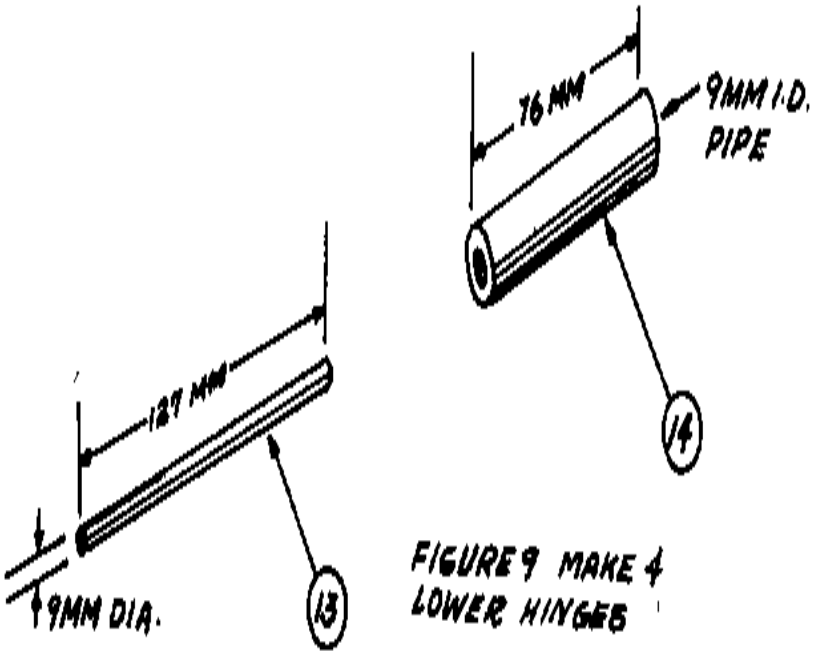

FIGURE 9 MAKE 4
LOWER HINGES

Parts No. 5 are made in pairs by welding to the ends of part No. 13. Before welding, insert part 13 in the tube, No. 14, which will become the pivot (after No. 14 is welded to the inside angle of No. 3). Thus we have the levers that open the doors.

14. Pipe, 10mm (3/8"), 7.6cm (3") long; two are needed. They form the pivots for levers.

15. Steel welding rod, 6mm x 10.8cm (1/4" x 4 1/4"). The ends are ground flat and smooth. Two are needed (see Figure 14).

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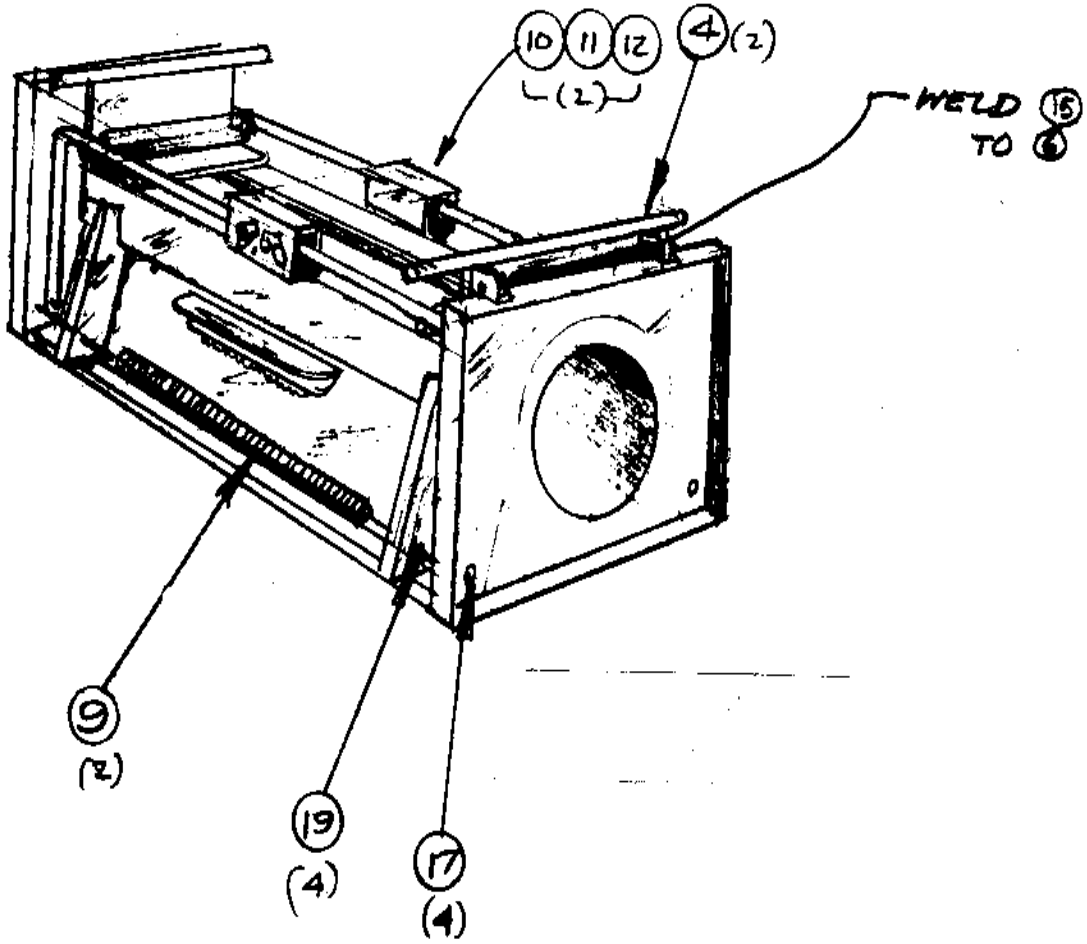

FIGURE 14. ATTACH DOORS WITH HINGEPIN (15), WELD IN PLACE, AND PUT SPRINGS (9), CONNECTORS (19), AND ATTACHMENTS (17) IN PLACE. UNIT IS NOW COMPLETE EXCEPT FOR PARTS 10, 11 AND 12, WHICH NOW CAN BE INSTALLED.

These are the hinge pins for the doors.

After the hinge holes, No. 16, are welded to part No. 3, parts No. 15 are put in place in the holes.

Then parts No. 6, the doors, are put in place, checked for exact position and bronze welded to the hinge pins, No. 15. This weld extends almost the entire distance between one pivot hole (part No. 16) and the other. The weld holds the door to the hinge pin and prevents the hinge pin from sliding out of place. <see figure 12>

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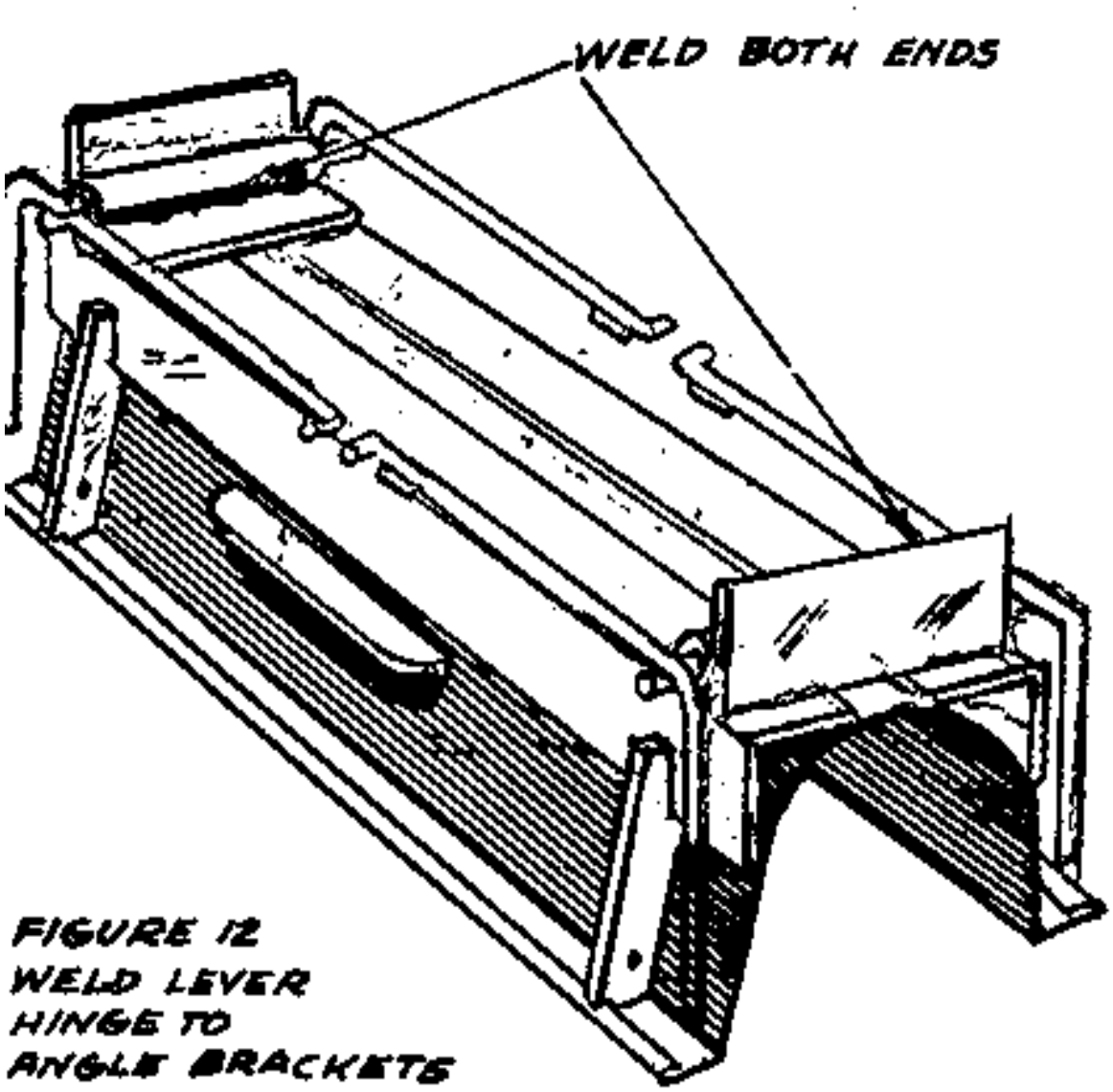

FIGURE 12
WELD LEVER
HINGE TO
ANGLE BRACKETS

16. Steel bar, 19mm x 2.5cm x 6mm (3/4" x 1" x 1/4") (see Figure 13). Four are

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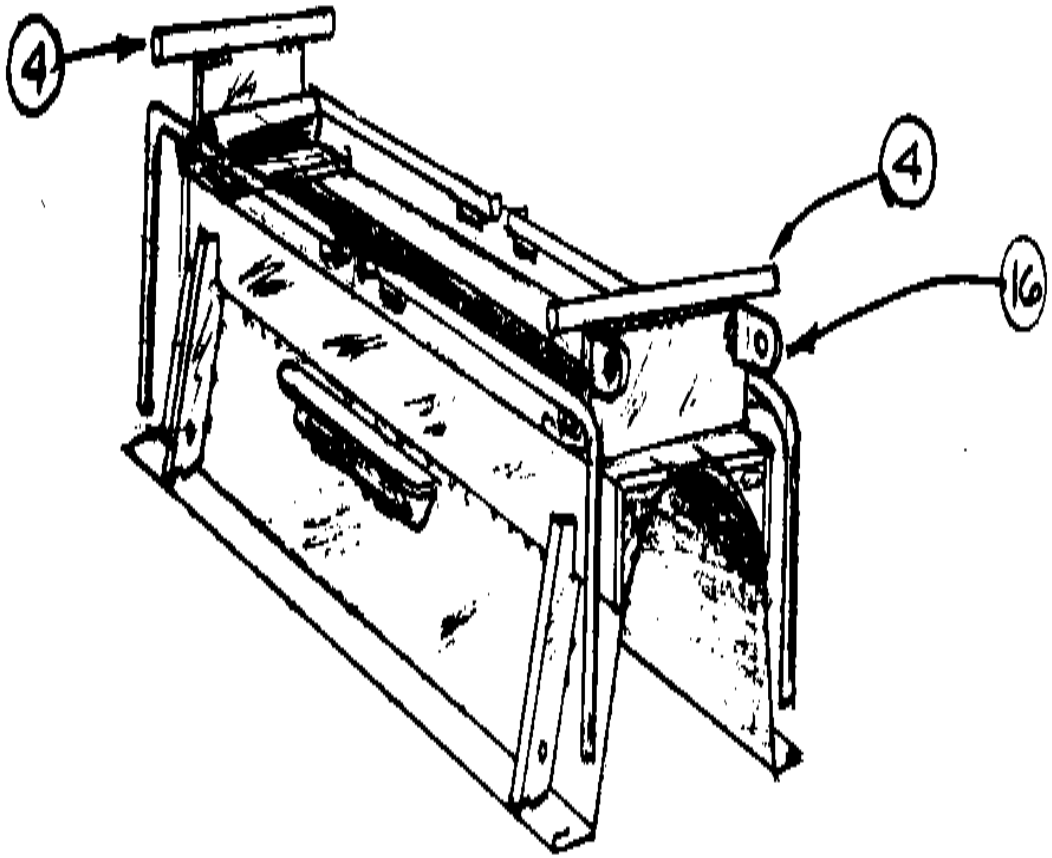

FIGURE 13 WELD ON HINGE PIECES (16) ON BOTH ENDS USING DOORS (6) AS GUIDES. ALSO WELD ON TWO RODS (4).

needed. Bore 6mm (1/4") hole for the hinge rod as shown. No. 15 pivots in

these holes to make hinges for the doors. Parts No. 16 are welded to part No. 3 in such position as to be as far to the outside edge of the door as possible. It is best to make a trial positioning of the door and parts No. 15 and 16 by tack welding No. 16 lightly before welding it permanently. Then it is possible to make sure that the door is going to be in such place that the pipe will have its proper position.

17. Common nails, 6 penny, with strong heads (see Figure 14). Four are needed.

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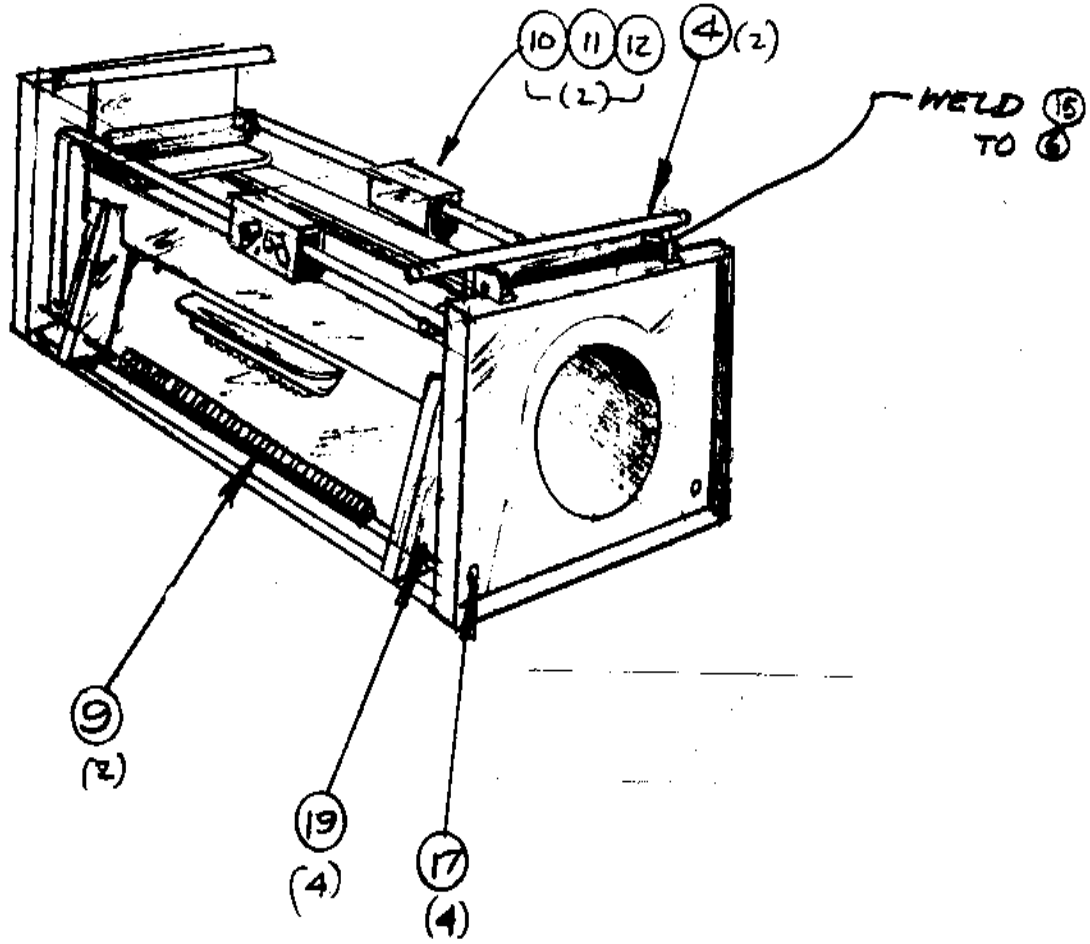

FIGURE 14. ATTACH DOORS WITH HINGEPIN (15), WELD IN PLACE, AND PUT SPRINGS (9), CONNECTORS (19), AND ATTACHMENTS (17) IN PLACE. UNIT IS NOW COMPLETE EXCEPT FOR PARTS 10, 11 AND 12, WHICH NOW CAN BE INSTALLED.

Connect the nail to the spring by a wire through the hole in No. 8. Put the wire through the holes before forming the second end loop.

18. Piston, 5cm (2") galvanized pipe, 40.6cm (16") long. (The 5cm (2") measurement is the inside diameter of the pipe.) Weld one end shut by bronze welding a metal disc to the end. Then dress lightly in the lathe, making the dosed end 0.5mm (1/64") smaller than the other. It will serve well without turning, but will be easier to operate it dressed.

19. Wire or welding rod, 2mm (3/32") to make the connection between parts No. 9 and 17 (see Figures 2 and 14).

fg2x2290.gif (176x353)

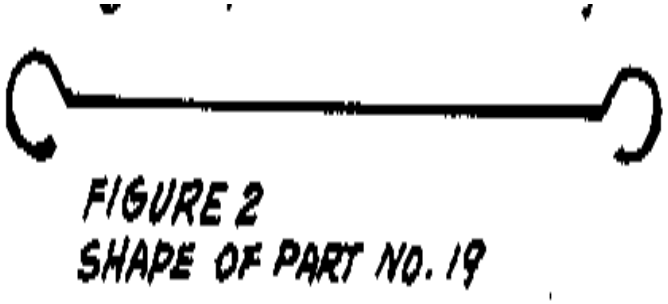

FIGURE 2
SHAPE OF PART NO. 19

Making the Tile

It is possible for one worker to make two tiles per minute, although a good day's work would be 300 or more. The mortar remains in the form only a few seconds. The cement mixture is tamped into the form with a tamper. Then the form is immediately turned upside-down on a (slightly oiled) concrete floor and emptied, leaving the tile completed and ready to start its curing process. The same

general
method can be adapted for the wooden tile-making machine in Figure 15 of the

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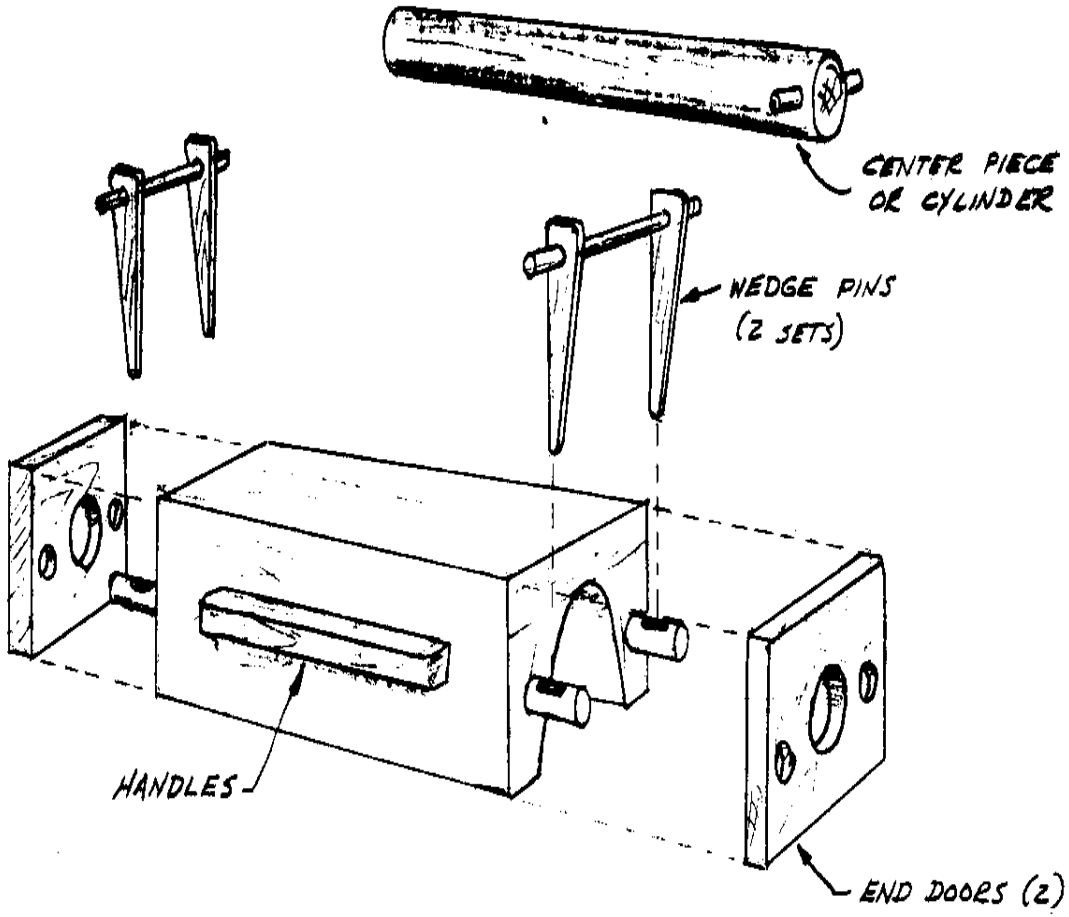

FIGURE 15 ALL-WOOD CEMENT-TILE MACHINE (DIMENSIONS OF TILE SAME AS ALL-METAL MACHINE). BLOCK IS STRONGER IF MADE FROM 3 PIECES JOINED LENGTHWISE.

preceding entry. <see figure 1>

fg1x236.gif (600x600)

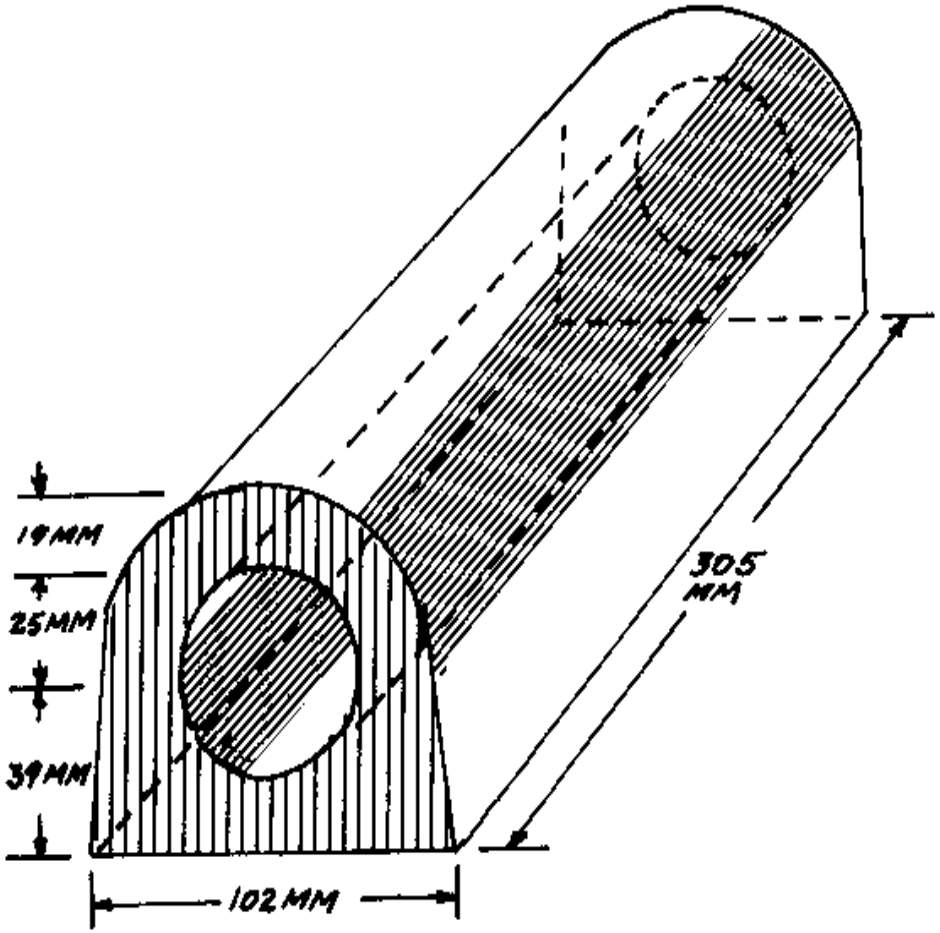

FIGURE 1 THE FINISHED TILE

Tools and Materials

Fresh Portland Cement
Clean sand, screened through a 6mm (1/4") screen
Clean water
All-metal tile machine
Metal tamper
Plastering trowel
Work bench
Shop with concrete floor
One (11-liter) bucket
D-handled shovel (square point)
Large hoe for mixing cement
A strong dust pan without a handle.
Gloves

Make the tile by following these steps:

1. Screen the sand and spread out 28 liters (1 cubic foot) on the shop floor. Use a 28-liter (1 cubic foot) measuring box without a bottom.

2. Spread 7 liters (1/4 cubic foot) cement over the sand. Measure in the box, filling it 1/4 full.

3. Mix thoroughly with shovel and hoe. Turn over the pile four to six times.

4. Spread the pile out and scatter the mixing water over it. The amount of water should be no more than 2/3 the volume of cement, including any water in the damp sand. The mix should be as dry as possible and still be plastic.

5. Make the batch into tile before 45 minutes of time elapses. Cement loses its strength if put into the form too long after mixing.

6. Fill the form (without the pipe) 1/4 full and tamp the ends with two strokes with the (gloved) left hand. This gives the tile perfect ends.

7. Insert the pipe and fill the form with mortar, using one dip from a strong dust pan without a handle.

8. Tamp the sides of the tile, Make three strokes with the iron tamper.

9. Fill the form again, with another dip from the dust pan.

10. Turn the tamper over and pack the cement again. Give three strokes with the flat surface of the tamper.

11. Use the trowel to finish the tile. Strike off the surplus with one stroke and leave the surface trowelled level with a second stroke.

12. Carry the tile and form to a place where the floor has been lightly oiled. In carrying the form, do not touch the pipe.

13. Place the form carefully on its side on the floor and then tip it quickly to an upside down position. Hesitation in the middle of the tipping action may cause the mortar to fall out.

14. Pull out the pipe, turning it slightly first. Hold the form down with one hand. If the pipe is too hard to remove, it may have irregularities and need to be dressed lightly in the lathe.

15. Lay the pipe on top of the form. This gives the form a slight jar.

16. Gripping the sides of the form with both hands, push down on the levers, which open the hinged ends, and then lift the form off the tile. In lifting use leg action and hip action. Bending the elbows may knock an end off the tile.

**17. Leave the tile in its place on the floor over night. Sprinkle very lightly with
water if it begins to get dry. To dry at this stage would ruin it.**

18. The next day the tile can be picked up by gripping it at its middle with the hand. Stack the tile at the side of the shop to clear the center floor space for another day of production. The first day, stack only two layers high, as the tile is not strong yet. The second day, they can be stacked as high as desired.

19. When tiles are one day old, it is a good time to make 45-degree ends on tile that have been injured in manufacture. About 5 percent (or more) of the tile made will need a 45-degree end for use in turning corners in the tile line.

20. Keep the tile wet at least a week. The strength is increased by each day that the tiles are kept wet.

If you need further instruction on the fundamental principles of good concrete

construction, study the entries on concrete.

Source:

Brown, J. Oscar. A Machine for Making Concrete Tile for Irrigation and Drainage. O.T.S. Information Kit, Vol. 2, No. 2. Washington, D.C.: U.S. Department of Commerce, 1961.