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Health And Sanitation

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## Sanitary Latrines

## OVERVIEW

The proper disposal of human waste (called night soil in many parts of the world) is one of the most pressing public health problems in many rural communities. The use of sanitary latrines or privies can be very effective in helping to control disease, which can be spread by water, soil, insects, or dirty hands. While it is necessary to have a sanitary water and food supply, sufficient medical service, and adequate diet to stop disease, the sanitary latrine breaks the disease cycle. Some sicknesses that can be controlled by widespread use of sanitary latrines are dysentery, cholera, typhoid, and worms. The human suffering and economic loss caused by these is staggering. It has been said that half of the food eaten by a person with intestinal parasites is consumed by the very worms that make the person sick.

Most countries that have actively participated in the 1980-90 U.N. Decade of Water Supply and Sanitation have developed latrine designs to meet the sanitary and cultural requirements of their people. Before building latrines the local health or development agency should be contacted for their advice and help. A latrine program must reach most or all of the people. This means a carefully planned, continuing long-range program with participation by government agencies, community leaders and most of all by the individual families. Proper latrine designs that fit the cultural pattern are economically possible and can satisfy the

sanitary needs of a successful latrine program. Selected plans and designs for sanitary latrines are given in the entries that follow.

The recommended kinds of privies are:

- o Pit privies: a simple hole in the ground, covered with a properly built floor and a shelter. It has two forms, the dry pit, which does not penetrate the water table, and the wet pit, which does. The addition of a ventilating pipe (see "The Ventilated Pit," page 156 helps reduce odors and fly problems.
- o Water privies: where a watertight tank receives the nightsoil through a drop pipe or chute. An overflow pipe takes the digested material to an underground seepage pit or drainage area.

A water-seal slab may be used to cover either of these types of privies to provide a completely odorless privy.

Other types of simple latrines are not recommended for general use, because they usually fail to provide enough sanitary protection.

A good privy should fulfill the following conditions:

- o It should not contaminate the surface soil.
- o There should be no contamination of ground water that can enter springs or wells.
- o There should be no contamination of surface water.

- o Nightsoil should not be accessible to flies or animals.
- o There should be no handling of fresh nightsoil; if it is necessary, it should be handled as little as possible.
- o There should be no odors or unsightly conditions.
- o The latrine should be simple and inexpensive to build and use.

Other points to consider:

- o Superstructure can be made from any local building material that will give privacy and shelter from rain.
- o The privy can be squat or sit-down type.
- o The opening should be covered when not in use.
- o In water scarce areas, a standard pit latrine can be used. When pit is full after several years, latrine is moved to a new pit and old one is covered up and marked.
- o If space is limited to change the pit, a permanent location can be maintained with a double pit, as in the double septic tank (composting latrine) used in Vietnam. The urine is collected separately and diluted for use on crops. The composted material is used for fertilizer. One side is used until almost full, then it composts while the other side is used.
- o If water is readily available, a water-seal bore hole latrine can be used.

**When almost full, the latrine must be moved.**

- o If a permanent location is desired, a double bore hole can be used as in India.
- o In most countries using water seal latrines the pan and trap are now available commercially or from a government agency for a nominal fee or for free.
- o Consider including a methane (biogas) generator when building new latrines.

**Source:**

**Charles D. Spangler, VITA Volunteer, Bethesda, Maryland**

**Wagner, E.G. and Lanoix, J.N. Excreta Disposal for Rural Areas and Small Communities. Geneva: World Health Organization, 1958.**

### **Privy Location**

**Outhouses or privies should be close to the home, but they should be lower than water sources and far enough away from these sources that they will not pollute the water.**

**The information given here covers most normal situations, but it is always best to have a trained sanitary inspector or engineer review your installation or program.**

A latrine site should be dry, well-drained, and above flood level.

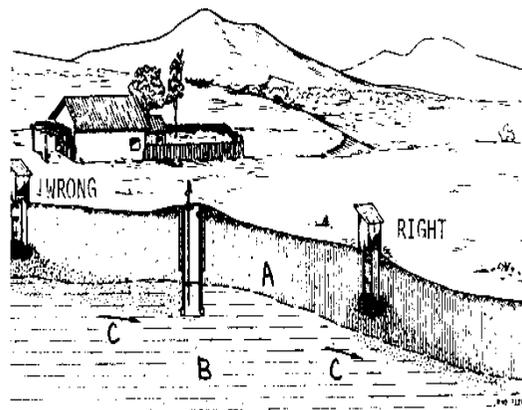
If the bottom of a privy pit is in dry soil and at least 3 meters (10') above the highest water table, there is very little danger that it will contaminate water supplies. This is because the pollution will move downward no more than 3 meters with only 1 meter (3.3') of side movement. (See section on "Ground Water"). If the privy pit enters the water table or comes close to it when the water is at its highest level, pollution will spread to the ground water over a limited area and may endanger health.

Figure 1 shows the movement of pollution through the soil. It is particularly

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## BACTERIAL AND CHEMICAL SOIL POLLUTION PATTERNS AND MAXIMUM MIGRATIONS\*

## MOVEMENT OF POLLUTION IN UNDERGROUND WATER



- A = Top Soil  
 B = Water-bearing formation  
 C = Direction of ground-water flow

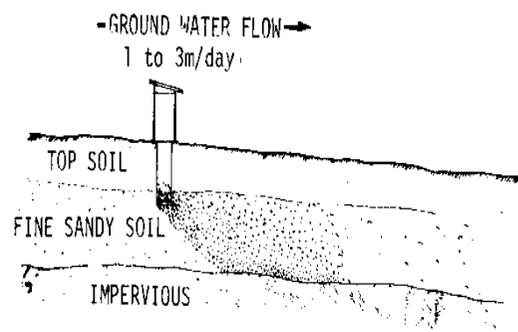
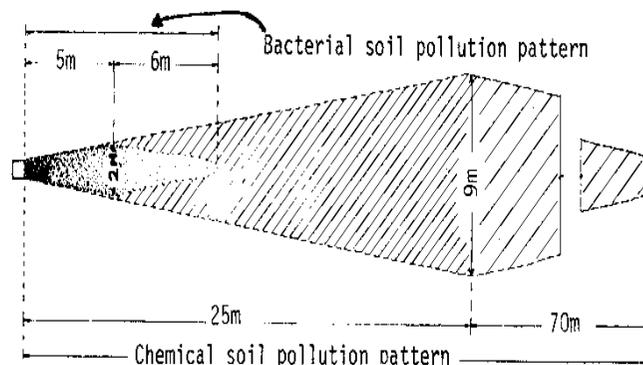


FIGURE 1

The source of contamination in these studies was human excreta placed in a hole which penetrated the ground-water table. Samples positive for coliform organisms were picked up quite soon between 4m and 6m (13ft and 19ft) from the source of contamination. The area of contamination widened out to a width of approximately 2m (7ft) at a point about 5m (16ft) from the privy and tapered off at about 11m (36ft). Contamination did not move "upstream" or against the direction of flow of the ground water. After a few months the soil around the privy became clogged, and positive samples could be picked up at only 2m to 3m (7ft to 10ft) from the pit.

The chemical pollution pattern is similar in shape to that of bacterial pollution but extends to much greater distances.

From the point of view of sanitation, the interest is in the maximum migrations and the fact that the direction of migration is always that of the flow of ground water. In locating wells, it must be remembered that the water within the circle of influence of the well flows towards the well. No part of the area of chemical or bacterial contamination may be within reach of the circle of influence of the well.

**important to understand this movement when choosing a site for a privy or well.  
 Put the privy downhill from a water source, or as far to one side as possible.  
 On**

flat or gently sloping land, water moves toward the well as though it were going downhill. This is because when water is removed from a well, water from the surrounding soil flows toward it. Thus pollution from a nearby privy would move toward the well. If the land is flat or if the well is downhill from the privy, do

not put the privy closer to the well than 10 meters (33'). In sandy soil, a distance of 7.5 meters (25') is sometimes enough because sand helps to stop bacterial pollution.

These rules do not apply in regions containing fissured rocks or limestone formation. Expert advice is necessary in these cases, because pollution can be carried great distances through solution channels to the drinking water supply.

It is important to keep the latrine close to the house so that it will be used, but

not too close. Putting the privy downhill also encourages use. People are more apt

to keep a privy clean if it is close to the house.

Remember that all privies have to be closed up or moved when filled. This should be made easy or there will be a tendency to let them become overfull, which results in very unsanitary conditions and extra work to put the system in proper working order. A permanent location can have two pits that are used alternately. One pit is in use while the other composts before being emptied.

Source:

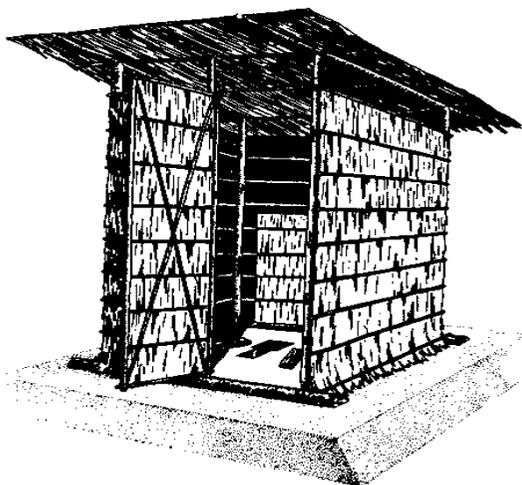
Wagner, E.G. and Lanoix, J.N. Excreta Disposal for Rural Areas and Small Communities. Geneva: World Health Organization, 1958.

## Privy Shelters

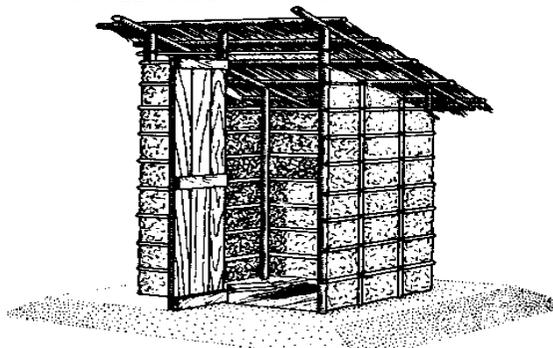
Several designs for privy shelters that have been found satisfactory in many parts of the world are shown in Figure 2.

fig2x160.gif (600x600)

COMPLETED PRIVY, SHOWING PALM THATCH WALL AND ROOF COVERING



WATTLE HOUSE WITH PALM THATCH ROOF



HOUSE OF CUT LUMBER WITH CORRUGATED METAL OR ASBESTOS CEMENT ROOF

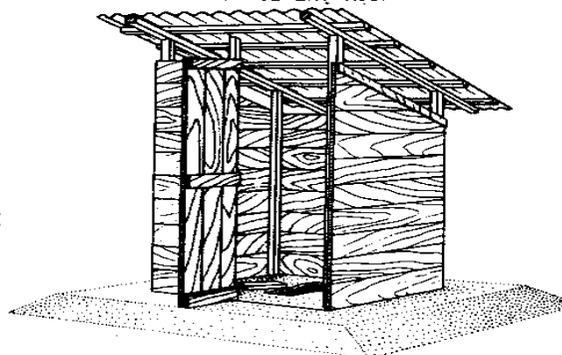
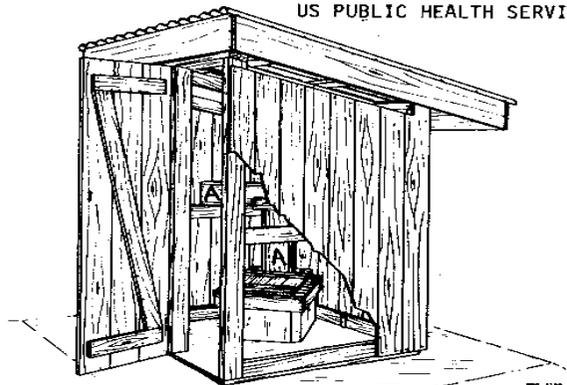


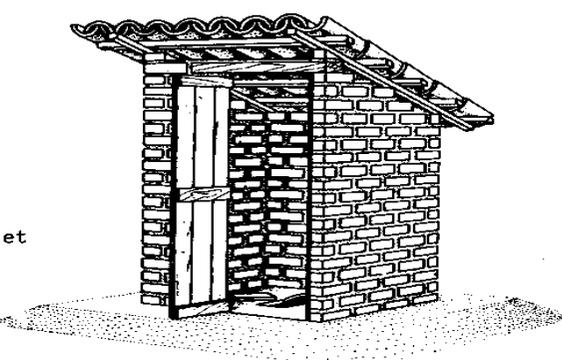
FIGURE 2

TYPE OF SUPERSTRUCTURE RECOMMENDED BY US PUBLIC HEALTH SERVICE



A = Vent pipe with lateral outlet

HOUSE OF BRICK WITH TILE ROOF



Adapted, by permission, from United States Public Health Service (1933) *The sanitary privy*, Washington, D.C. (Revised type No. IV of *Publ. Hlth Rep. (Wash.)*, Suppl.108).

The shelter should be built to suit the abilities and desires of the local people,

because sanitary precautions are less important for the shelter than for the pit and slab. For a properly built shelter:

- o Choose a standardized design for economy in building.
- o Build the shelter to last as long as the pit, 8 to 15 years.
- o Build the shelter to fit the floor slab. It should not be so large that people will be tempted to use any part of the floor when the area around the hole has been soiled by earlier users. The roof should be 2m (6 1/2') high at the entrance.
- o Openings at the top of the shelter's walls, for airing the interior, should be 10cm to 15cm (4" to 6") wide.
- o Some natural light should be let in, but the structure should give enough shade over an uncovered seat or holes that flies will not be attracted.
- o The latrine should be kept neat and clean so that people will continue to use it. Paint or whitewash the shelter. Cut back nearby vegetation. The roof should have a large overhang to protect the walls and the mound from rain damage and to keep the privy area from getting muddy.

Here is a list of tools and materials needed to build one type of privy shelter:

### Tools and Materials

Corrugated sheet metal roofing: 1.2m x 1.2m (4'x 4') or larger

Wooden posts: 5cm x 5cm (2" x 2") and 20m (66') long

**Boards: 2cm (3/4") thick, 20cm (8") wide, 40m (132') long**

**Nails**

**Hand tools**

**Paint: 2 liters (2 quarts)**

**Source:**

**Wagner, E.G. and Lanoix, J.N. Excreta Disposal for Rural Area and Small Communities.**

**Geneva: World Health Organization, 1958.**

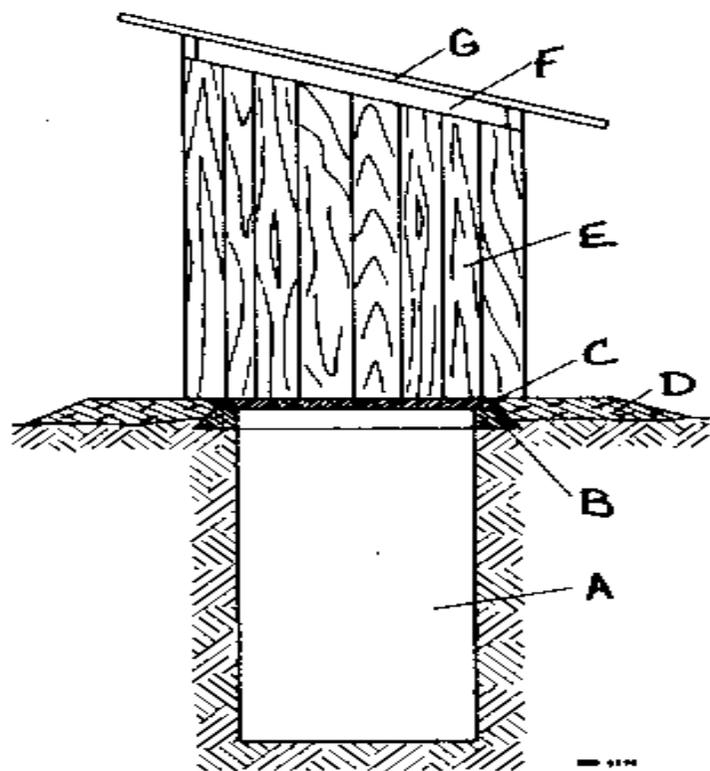
## **PRIVY TYPES**

### **Pit Privy**

**The pit privy is the simplest recommended latrine or privy. It consists of a hand-dug hole, a properly mounted slab, and a shelter (Figure 3). The addition of**

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FIG. 3 VARIOUS PARTS OF A  
SANITARY PRIVY



- |           |                              |
|-----------|------------------------------|
| A = Pit   | E = House,<br>including door |
| B = Base  | F = Ventilation              |
| C = Floor | G = Roof                     |
| D = Mound |                              |

a ventilating pipe will help reduce odors and flies. Of the many existing designs for privies, the

sanitary pit privy is the most widely applicable.

## Tools and Materials

### Materials for building the shelter

Hand tools for digging the pit, making concrete, and building the shelter

### The Pit

The pit is round or square, about 1m (3.3') in diameter or 1m (3.3') on each side, and usually from 1m (3.3') to 3m (10') deep. The pit may have to be lined with brick, wood, bamboo, or some other material to keep it from caving in, even in hard soil. The top 50cm (19 1/2") of the hole should be lined with mortar to make a solid base for the slab and the shelter.

The table in Figure 4 will help you to estimate the depth of hole to make.

fig4x162.gif (600x600)

Estimated volume and depth* for hole with 1 square meter area					
Personal Cleansing Material					
Water					
Solid (for example, grass or paper)					
Pit Type	Years of Service	Volume in cubic meters	Depth in meters	Volume in cubic meters	Depth in meters
Wet-Pit	4	0.7	0.7	1.1	1.1
	8	1.5	1.5	2.3	2.3
	15	2.7	2.7	4.2	4.2
Dry-Pit	4	1.1	1.1	1.7	1.7
	8	2.3	2.3	3.4	3.4
	15	4.2	4.2	-	-

Figure 4. Privy capacities for a family of five. A wet-pit privy is one which penetrates the water table. A dry-pit privy does not.

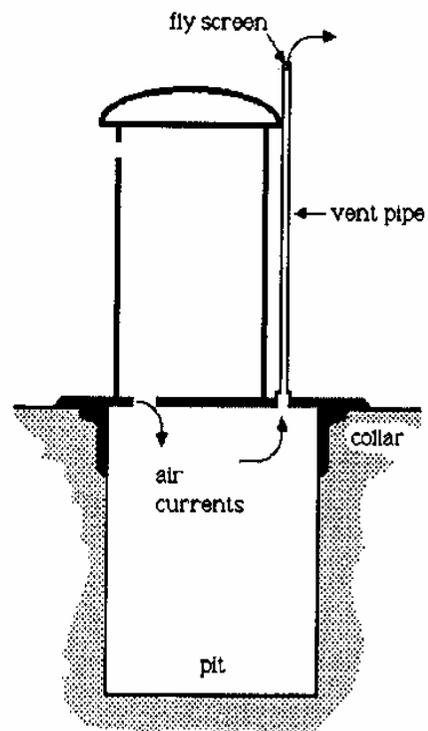
\*Add 50cm to the depth given in the table, because the pit should be closed and filled with earth when the waste comes to within this distance from the surface.

## The Ventilated Pit

**The ventilated pit privy system was field tested during the late 1970s by the Blair**

**Research Laboratories working with the Zimbabwe Ministry of Health (Figure 5).**

**fig5x163.gif (600x600)**



The Ventilated Privy

FIGURE 5

Source:

Cecelski, Elizabeth, "Appropriate Technology in Zimbabwe." *Energy Bulletin/VITA News*, July 1981.

The idea was to reduce the health hazard caused by flies attracted to the standard pit privy. Thousands of the units are now in use in Zimbabwe, as well as

in many other areas where water is scarce.

The Blair design depends on the aerodynamic properties of an efficient flue pipe, 150mm in diameter and about 2.5 meters high. The pipe is fitted onto the concrete latrine slab over a sealed tank or pit. The temperature difference between the inside and outside of the pipe causes a convection updraft, drawing the inside gases from the pit and thus causing a downdraft through the toilet opening.

The toilet opening is kept closely covered between uses. Flies are then attracted to odors passing out the pipe rather than to the pit. Flies that do get into the pit travel up the pipe towards the light. There they are trapped by a screen over the pipe outlet.

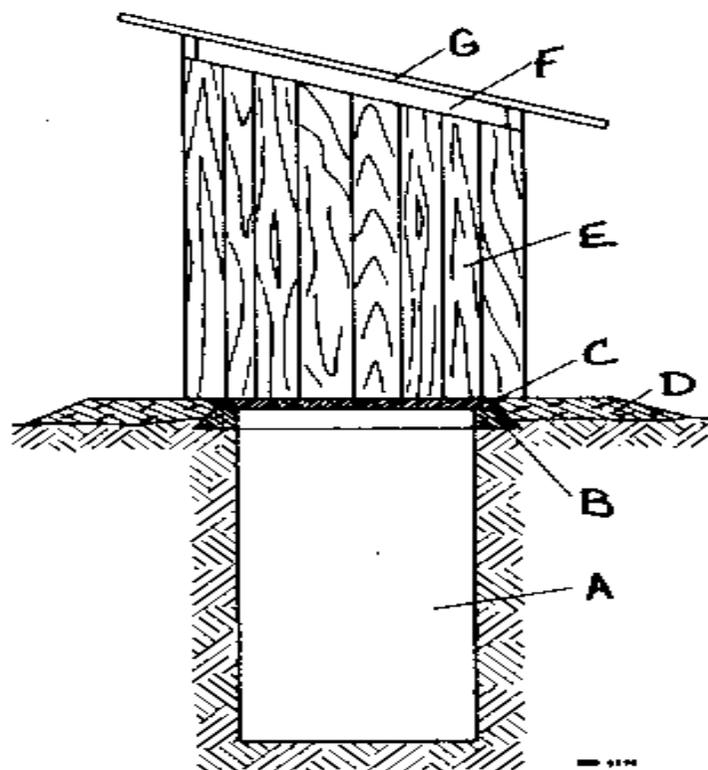
It is essential that the pipe be large enough to enable the system to "breathe" efficiently and that it allow sufficient light to enter the pit to attract flies into the pipe. Efficiency is increased by painting the pipe black to increase the air flow and by facing it toward the Equator so it receives the most sunlight.

## **The Base**

**The base (see Figures 3, 6, and 7) serves as a solid, waterproof support for the**

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FIG. 3 VARIOUS PARTS OF A  
SANITARY PRIVY



- |           |                              |
|-----------|------------------------------|
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| C = Floor | G = Roof                     |
| D = Mound |                              |

a hard, strong material, it helps to keep burrowing rodents and surface water out of the pit. The pit lining will in most cases serve as a base although it may

**need**  
to be strengthened at the ground surface.

### **The Slab**

A concrete water-seal slab is best. It is inexpensive but it means added labor and construction. A concrete open-hole slab is the next best, while a wooden floor is adequate. A built-up floor of wood and compacted soil is sometimes used but it is difficult to keep clean; as it gets soiled, it is likely to spread hookworm.

The concrete should not be weaker than 1 part cement to 6 parts of aggregate with a minimum of water. It should be reinforced with strips of bamboo about 2.5cm (1") wide whose weaker fibers have been stripped away. Soak the bamboo in water overnight before use.

Slabs (see Figure 8) are cast upside down in one operation. The footrests are  

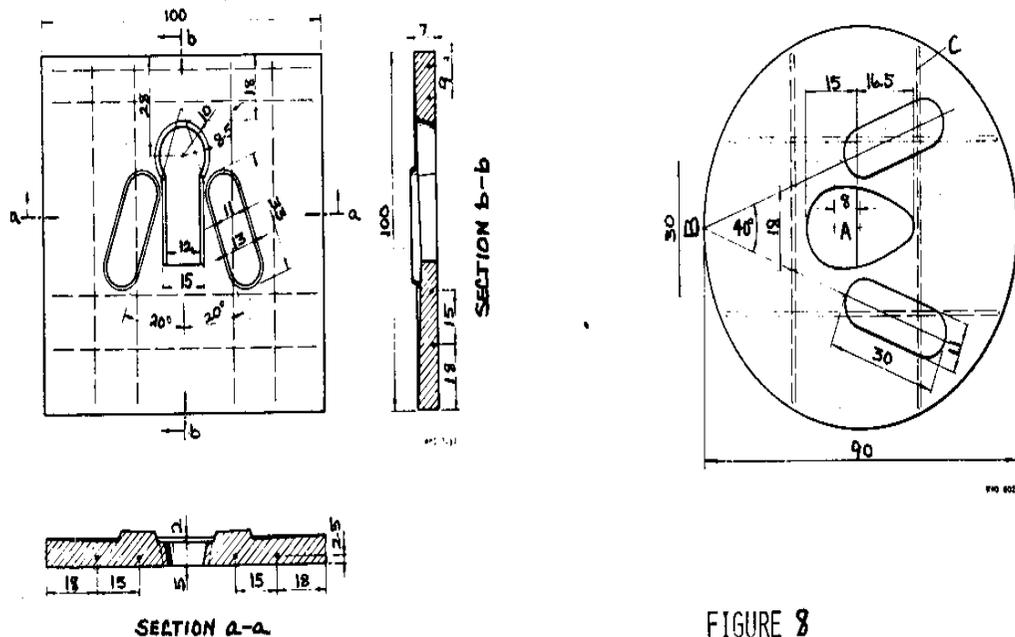



FIGURE 8

Measurements shown are in centimeters.

A = Centre open hole 2.5cm (1 in.) back of centre if slab is 80cm (31 in.) in diameter; centre open hole 8.0cm (3 in.) back of centre if slab is 90cm (35 in.) in diameter

B = Between back centre foot-rests

C = Reinforcement

#### Notes on construction of slab

Concrete for slabs should be not weaker than 1 part cement to 6 parts aggregate, with a minimum of water.

Slab is reinforced with strips of bamboo of timber quality. Reinforcing strips are about 2.5cm (1 in.) wide, have had inner, weaker fibres stripped away, and have been soaked in water overnight before use.

Slabs are cast upside down in one operation. Base of form is of wood with indentations for foot-rests. Base of form is encircled by sheet metal strip which makes outer wall of form. Side walls of hole form and foot-rests are made with slight slope so as to come out easily. Form for open hole is removed when concrete has taken initial set. Slabs are removed from form in about 40 hours and stored under water, preferably for 10 days or more. Since these slabs are round, they may be rolled some distance when conveyance is difficult.

shaped by removing part of the wooden form so as to make two separate indentations in the wood. Sheet metal is placed around the form so that the metal

extends above the wood to the thickness of the slab. Side walls of the hole and footrests are made with a slight slope so as to come out easily. The form for the

open hole is removed when the concrete first sets. Slabs are removed from the forms in about 40 hours and should be stored under water for 10 days or more.

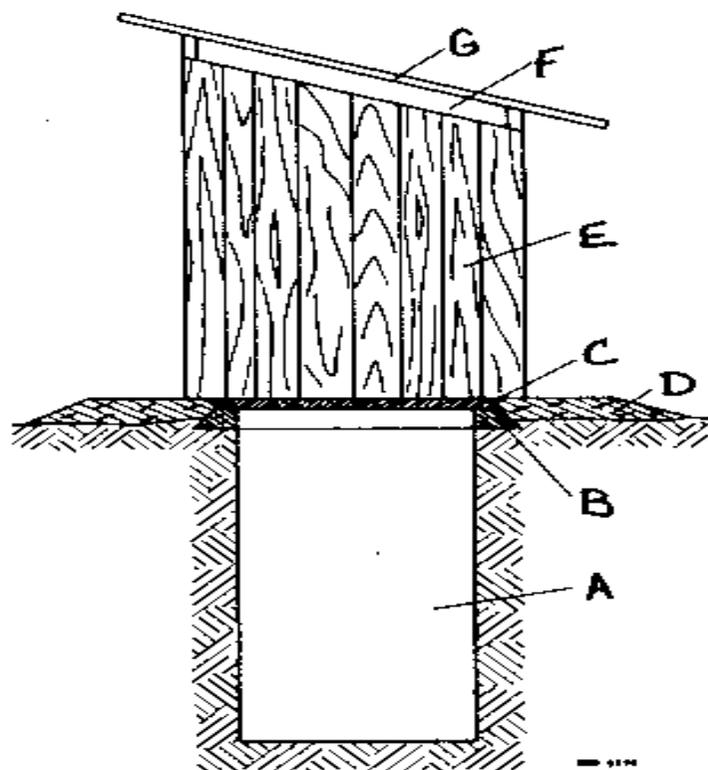
Round slabs can be rolled some distance when carrying is difficult. This is especially handy when the location of the privy has to be moved when the pit fills up.

### The Mound

The mound (see Figure 3) protects the pit and base from surface run-off that

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FIG. 3 VARIOUS PARTS OF A  
SANITARY PRIVY



- |           |                              |
|-----------|------------------------------|
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| D = Mound |                              |

otherwise might enter and destroy the pit. It should be built up to the level of the floor and be very well tamped. It should extend 50cm (20") beyond the base on all sides. The mound may be built much higher than the ground in areas where

protection is needed against floods and high tides. It will normally be built with earth removed from the pit or the surrounding area. A stone facing will help to keep it from being washed away by heavy rains. A masonry or brick step can be built in front of the entrance door to help keep the floor clean.

Source:

Wagner, E.G. and Lanoix, J.N. Excreta Disposal for Rural Areas and Small Communities. Geneva: World Health Organization, 1958.

### Water Privy

A water (or aqua) privy uses a watertight tank in which human excreta and urine partially decompose. A sewer pipe connects the tank's overflow pipe to an underground drain area or seepage pit.

This is a sanitary and permanent installation when it is properly built, used daily, and maintained properly. It can be placed near a building. The first cost of a water privy is high, but it is not expensive in the long run because it will be used for many years. It needs some water and cannot be used in freezing climates. And it is not practical in desert or water scarce areas. The water privy may not be successful in rural areas with no organized sanitation and health education services.

### The Process

The digesting or decomposing tank is usually made of watertight concrete (see Figures 9, 10, and 11). A drop-pipe, 10cm (4") in diameter, attached to the squatting

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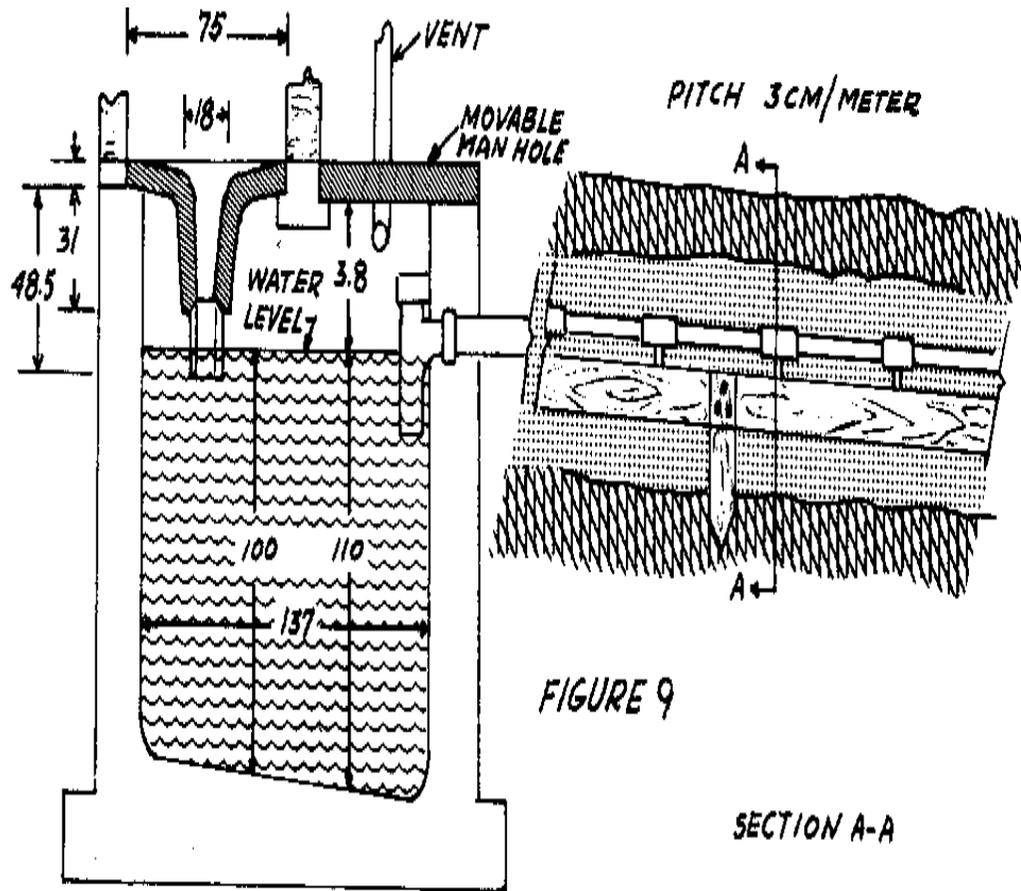


FIGURE 9

SECTION A-A



tank. This forms a water seal, which keeps bad odors from rising into the privy shelter.

The decomposition process forms a sludge in the tank. The amount of sludge is only one-fourth the volume of the total waste deposited in the pit, because some of the solid matter breaks down into very small pieces, liquid, and gas. The liquid and the pieces of waste matter run out the overflow pipe to the drain field. The material that flows out is called effluent. The gas escapes through a vent pipe.

### The Tank

The tank must be watertight. If the tank leaks, the liquid level will fall below the drop pipe, odors will form, flies and mosquitoes will breed, and the soil and ground water will be polluted. Tanks made from bricks or stone and mortar must be faced with a coat of rich cement plaster to make sure they are watertight.

The tank can be made of plain concrete sewer pipes 90 or 120cm (36" to 47") in diameter and sealed at the bottom with concrete (see Figure 11).

Family-sized units should not be less than 1 cubic meter (35 cubic feet), which will usually allow 6 years or more between cleanings. Thus the family water privy need not be too deep, which is an advantage in rocky ground where the water table is high.

### Drop-Pipe

The 10cm drop-pipe with its end 10cm below the surface, prevents water from

splashing and improves flushing. Nightsoil may stick in the pipe from time to time

and must be flushed or poked down to stop odors and to keep flies from breeding. The pipe may be up to 20cm (8") in diameter and reach 20cm below the surface of the water in the pit, which will prevent sticking, but this size will release more odors and cause splashing, and the pipe may crust over.

### Disposal of Effluent

Disposal of effluent from a family unit is usually done in seepage pits or by below ground irrigation. The amount of effluent is equal to the amount of nightsoil and water put into the digesting pit. This averages 4.5 liters a person

each day, but the drainage system should be designed to handle 9 liters a person each day. When a water tap is inside the privy, the effluent disposal system must

be much larger. Too much water causes poor digestion of sludge.

The area of below ground irrigation ditches or seepage pits needed for a family of five will be from 1.4 square meters (10.7 square feet) in very light soil to 5 square meters (53 square feet) in soils that are hard to penetrate.

These methods are not practical in regions where the water table rises to within 1m (3') of the ground surface, or in clay soils or swampy land. Here some type of

sand filter may help, but this requires help and approval from local health experts

and continued maintenance.

## Operation

The first step in putting a new water privy into operation is to fill the tank with water up to the overflow pipe. Digested sludge from another privy can be added to the tank; this will seed the water and start the decomposition process. If the tank is not seeded, it will take about 2 months for the process to get going efficiently. Once this level of operation is reached, the privy will keep the process going, provided it is used daily. Cleaning and flushing the slab and bowl daily with 25 to 40 liters (6 to 10 gallons) will give the tank the small amount of water it needs to keep the process going.

## Removing Sludge

The sludge that forms in the tank must be bailed out before the tank is half-full, about 6 to 8 years after the privy is put into operation. A manhole, often located outside the shelter, is made for this job.

Notice in Figure 9 that the tank floor slopes toward the manhole for easier

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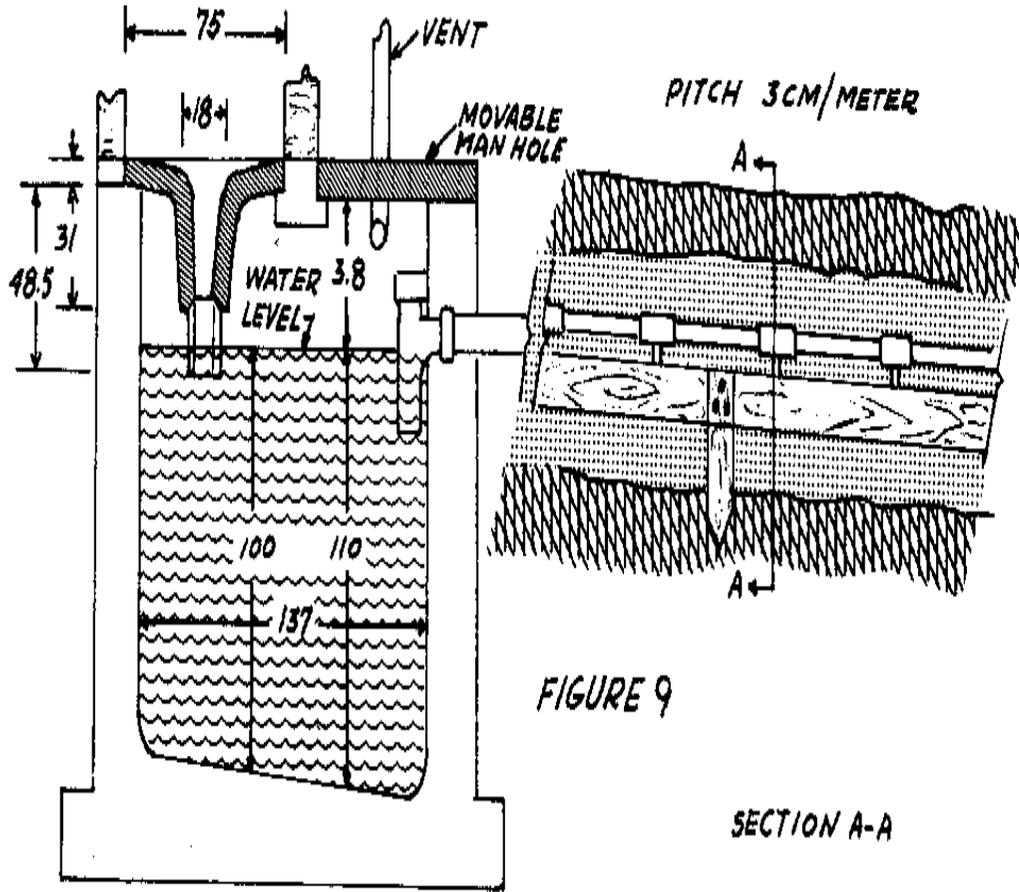


FIGURE 9

SECTION A-A



cleaning. Both the vent and the drain are easily reached. The drain has a T-shaped section that helps to keep hard surface scum from entering and plugging

**the drain and whose shape makes it easy to clean. The overflow pipe in Figure 10**

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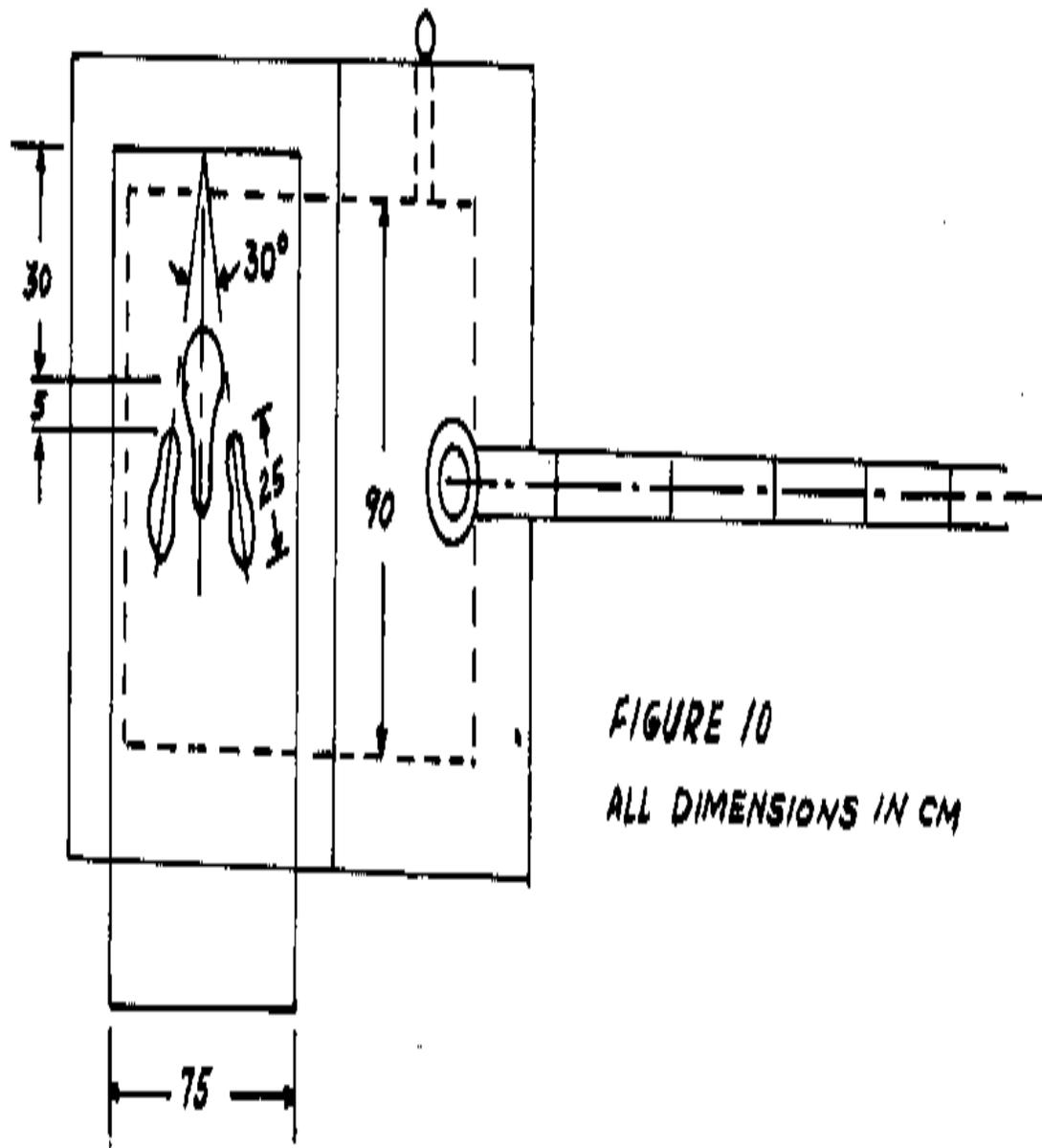


FIGURE 10  
ALL DIMENSIONS IN CM

is an elbow.

Bury the sludge in shallow trenches about 40cm (16") deep.

**Source:**

**Wagner E.G. and Lanoix, J.N. Excreta Disposal for Rural Areas and Small Communities.  
Geneva: World Health Organization, 1958.**

**Philippine Water-Seal Latrine**

**A water-seal bowl improves a latrine by keeping flies out of the pit and preventing odors from escaping. The mold described here (see Figure 12) has been made**

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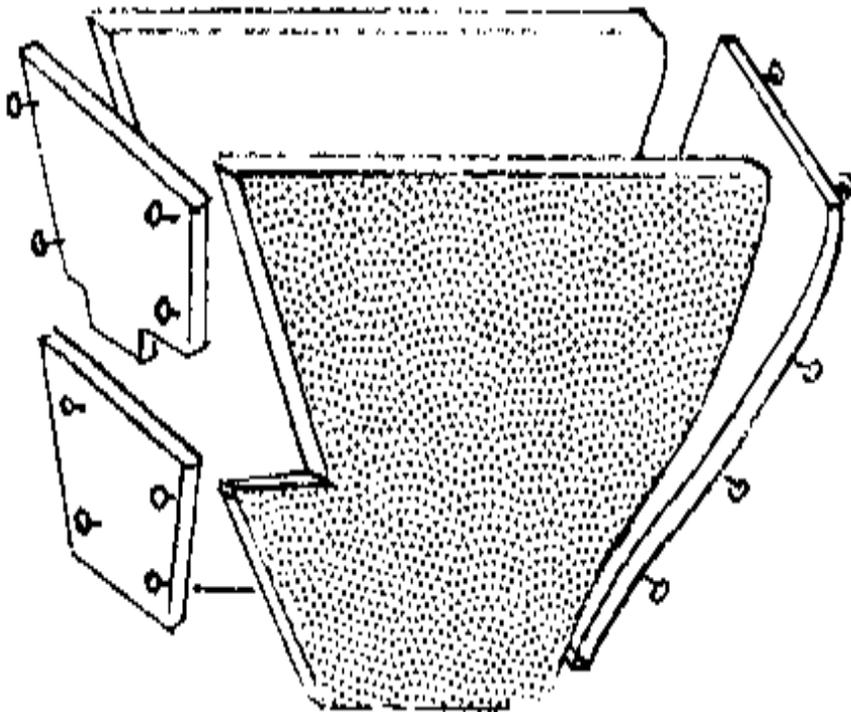


FIGURE 12

and used successfully in sanitary latrine programs in the Philippines. The advantage of this mold over a concrete mold is that it requires no drying time.

#### Tools and Materials

Wood: 19mm (3/4") thick, 31cm (12 1/2") wide and 152.5cm (5') long

Galvanized iron: 0.75mm x 32cm x 40.5cm (1/32" x 12 1/2" x 16")

Large nails: 18

Cement and clean sand

Galvanized wire: 5mm (3/16") in diameter and 30.5cm (1') long, for interior mold handle

Bamboo pole or iron rod: 30.5cm (1') long, to position interior mold

### Making the Mold

If the materials for the mold are cut according to Figures 13 and 14, the bowl is

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o Attach the two front pieces with large nails through the loose-fitting holes. These holes make it easy to remove the front pieces. The extension at the bottom of piece No. 1 is important in making sure that the bowl will seal well below the water level.

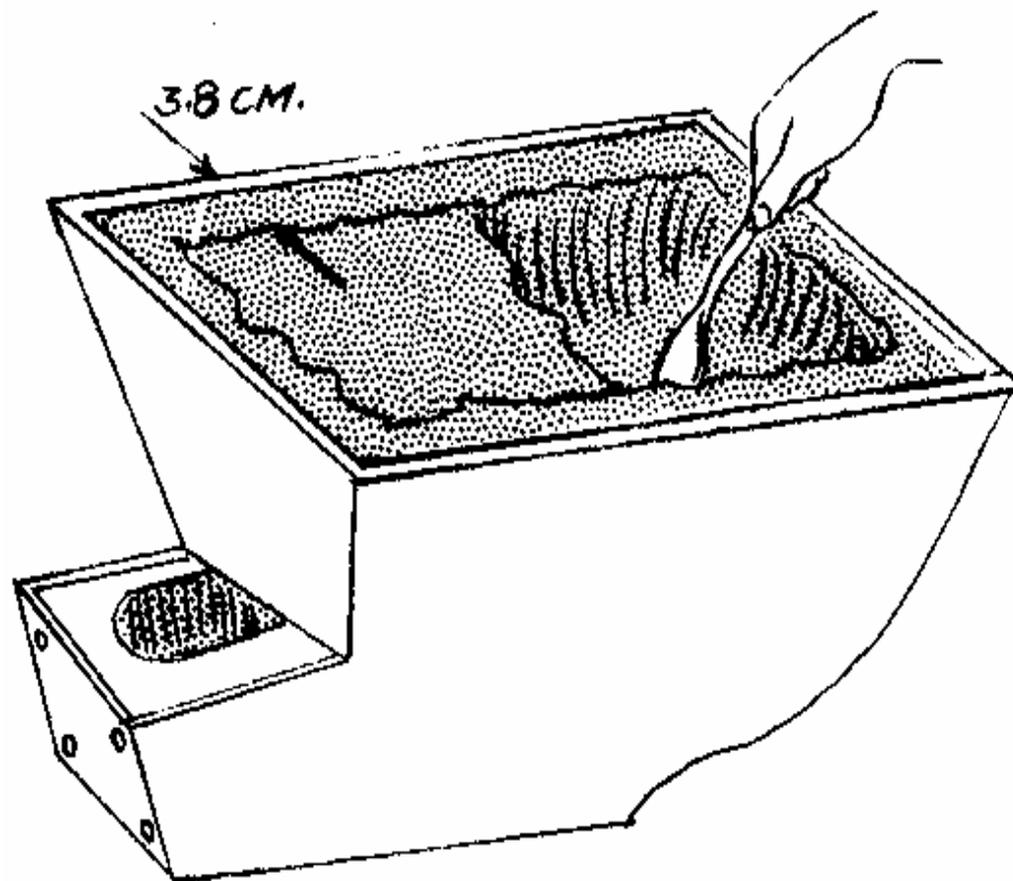
### Making the Bowl

Since the mold has no bottom, find a flat place to work where the mold can be propped against a wall. Fill the mold with a mixture of two parts fine sifted sand to one part cement.

Use only enough water to make the mixture workable. Pack it in so that there are no airpockets. Let it set for 15 to 20 minutes until the mixture is stiff.

Next, with a ruler, measure a 38mm (1 1/2") wall around the top and outlet and dig out the inside with a tablespoon (see Figure 15).

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**FIGURE 15**

Keep a straw handy to gauge the thickness of the walls of the bowl while digging, because it is difficult to judge otherwise.

Dig out the large interior first, then the outlet. The finished

interior of a bowl is shown in  
Figure 16.

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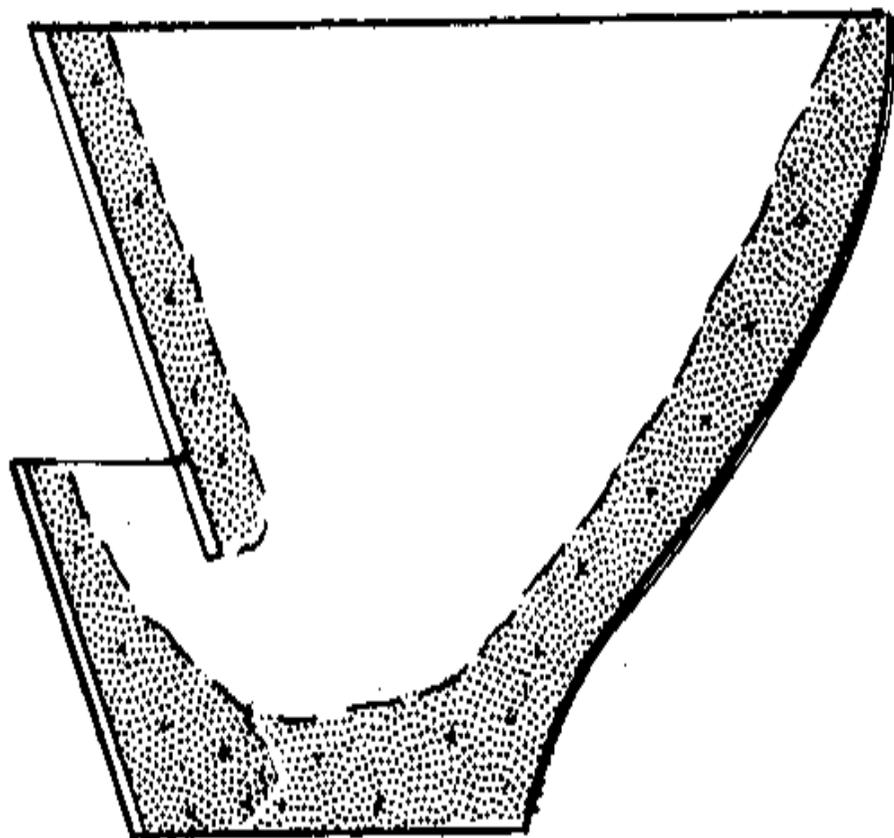


FIGURE 16

Be sure you can insert three fingers vertically, 5cm (2"), through the hole leading

to the outlet. Be careful to release front piece No. 1 by inserting the spoon around the edges (see Figure 16).

After the interior has been dug out, the walls will have slumped down about an inch. Use the cement taken from the interior to build the walls back up; then smooth all exposed surfaces with the back of the spoon as in Figure 18.

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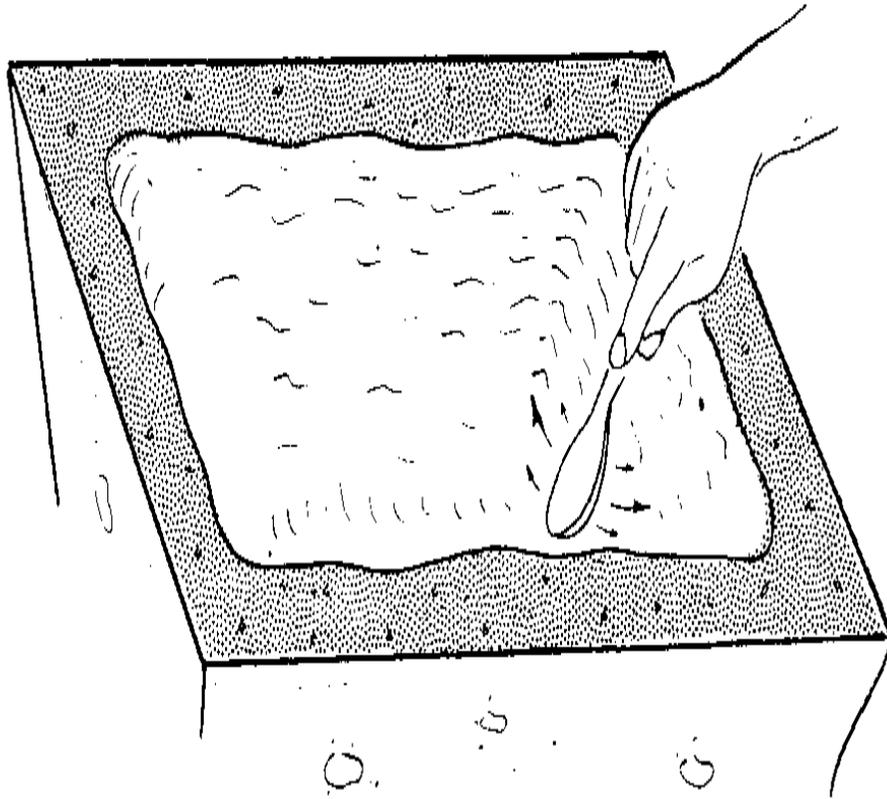


FIGURE 18

To be sanitary, the bowl must be as smooth as possible so that germs cannot build up in crevices.

For a finishing coat, one of two methods may be used: (1) immediately after smoothing, sprinkle dry cement over the still wet surfaces and smooth again with the spoon (Figure 18); or (2) let the bowl set for half an hour and apply a mixture of pure cement and water—a coconut husk brush is good enough. Either

method gives good results.

For a luxury product, use white or red cement for the finishing coat; several coats are necessary.

The finished bowl should be left in the mold to dry 48 hours. It can be removed after 24 hours only if extreme care is taken. Pull out the front nails and remove pieces No. 1 and No. 2; pull the sides and back away from the bowl.

### Making an Interior Mold

Because digging by hand is tedious and because it must be done very carefully to make the walls consistently thick, it is better and faster to use an interior mold.

After the first bowl has hardened thoroughly, fill the outlet with dry sand so that the cement cannot flow into it. This would make it impossible to remove the interior mold when it hardens (see Figure 19). Line the large interior

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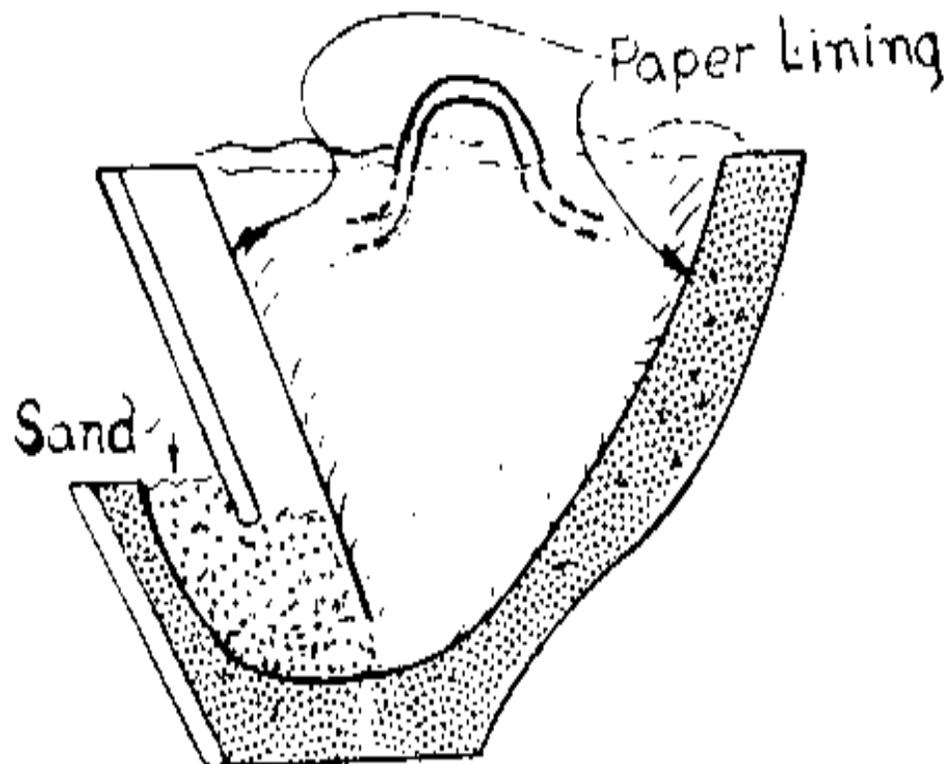


FIGURE 19

with paper and fill it with cement—a 4 to 1 sand-cement ratio is good enough. Insert a heavy wire loop in the top so that the interior mold can be positioned on the exterior mold with an iron bar or bamboo pole.

When an interior mold is used, it is only necessary to dig out the outlet. It is a good idea to have several interior molds, but not necessary to have one for each exterior mold. The interior mold should be removed after 15 to 20 minutes so that the bowl can be smoothed and finished. Then it can be used to make the next bowl.

### Using the Interior Mold

To use the interior mold, fill the wooden mold about 12.5cm (5") from the bottom and insert the interior mold in the correct position (see Figure 20). Push the

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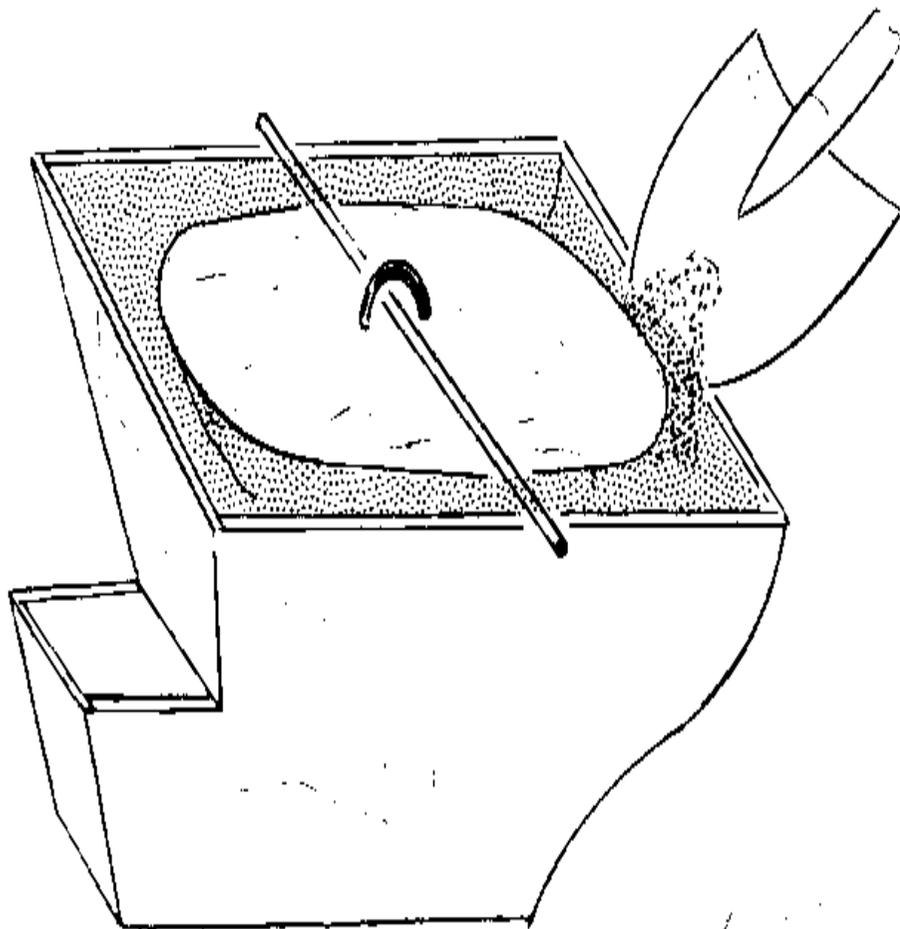


FIGURE 20

cement around the mold with a stick and pack it well to get rid of air spaces.

After the molds are removed, the finished bowl should be left to dry until it is rock hard-a week is usually

safe-before delivery.

A sand-cement ratio of 2 1/2 to 1 has been used successfully with the bowls. A ratio wider than this may make them too expensive. There are many ways to strengthen cement; experiments may bring a cheaper solution. One possibility is to add short coconut husk or abaca fibers.

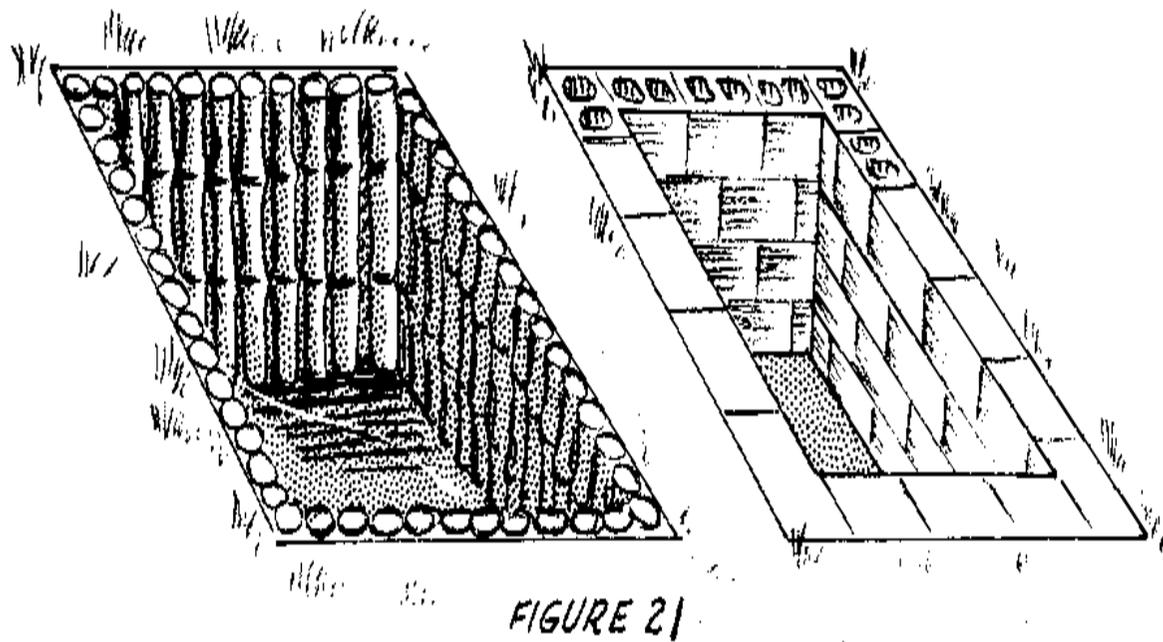
### Installing the Toilet

For use in private homes, dig a pit about 1.5m (5') deep and 1m (3') square. The deeper the pit and the smaller the width the better, since a small slab is cheaper

(see "Pit Privy" Section). It can even be dug under the house-especially in cities-because the toilet gives off very little odor, unless this position endangers

the household water supply. The pit may be lined or unlined, depending upon the soil. Hard clay soil need not be lined. But, if the house is near the sea or on sandy soil, the pit should be lined with, for example, bamboo poles or hollow blocks as shown in Figure 21.

fg21x173.gif (300x600)



Place boards around the outside of the pit 15cm (6") from the edge of the pit to form the perimeter of the slab (see Figure 22). Place large pieces of bamboo split

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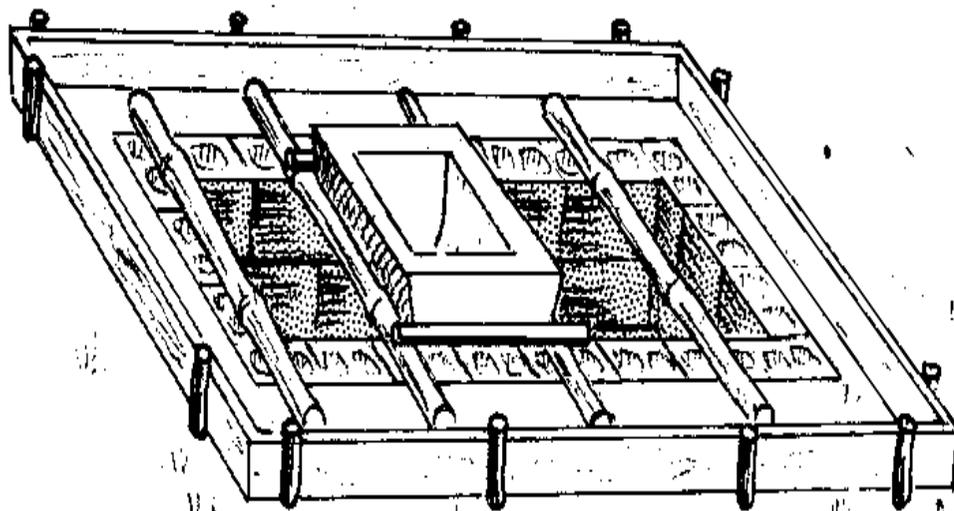


FIGURE 22

in half across the pit as a base for the slab. Place the bowl between two of the bamboo pieces with a piece of wood under the front and back; nail these to the bamboo. After the bowl is positioned in this way, pour water into it to be sure it will seal off the outlet. The top of the bowl should be 7.5cm (3") above the bamboo base.

Now put bamboo slats across the pit at right angles to the large pieces of bamboo, completely covering the pit. Cover this with several thicknesses of newspaper. Pour cement around the bowl until the slab is about 5cm (4") thick. A mixture of two parts gravel, two of sand, and one of cement is good. The slab can be reinforced by placing bamboo slats between two layers of cement. Make sure that the outer edge of the slab is higher than the bowl and slants towards the center, so that the toilet can be easily cleaned. Apply a finishing coat of pure cement to the slab. Many people prefer to add foot rests and urine-guard-there

is room for imagination.

It is extremely important to have an ample water supply at hand. About 1 liter (1 quart) of water is needed to flush the toilet, and people will be discouraged from using the latrine properly if they have to go some distance for water. It is a good idea to have an oil drum or a small concrete tank nearby to supply water for the latrine.

Do not use the latrine for at least 3 days-a week is best-after it is installed.

A pit with the suggested dimensions should last a family of eight about five years. One person uses about 28 liters (1 cubic foot) a year.

Source:

Gordon Zaloom, Peace Corps Volunteer.

### Thailand Water-Seal Privy Slab

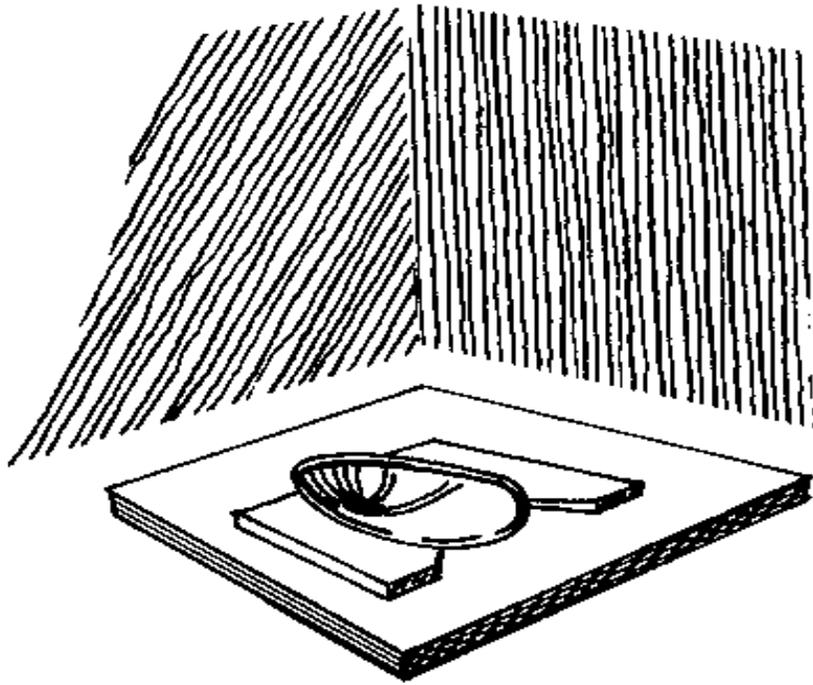
The Thailand Water-Seal Privy Slab, made from concrete, is useful for large-scale privy programs. The slab, which includes a bowl and trap, is used to cover an ordinary pit privy.

Master molds for the bowl and trap are used to make secondary molds from which the bowl and trap are

actually made. The master molds can be made from the plans in the entry that follows. The master molds can sometimes be purchased from local health officers.

The finished slab is quite strong because its three parts are cast at the same time (see Figure 10). The

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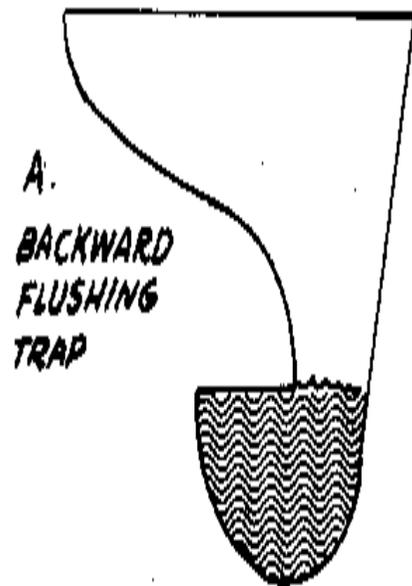


*FIGURE 1*  
*SKETCH OF FINISHED PRIVY.*

method described here can be applied to other water-seal slab designs.

The water-seal trap is curved back under the bowl as shown in Figure 2a. This

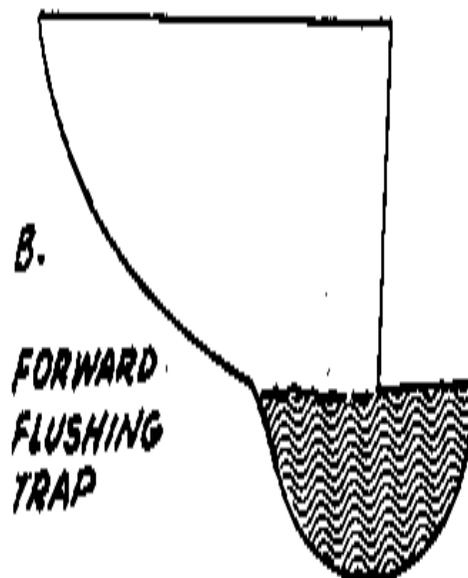
fg2ax175.gif (393x486)



**FIGURE 2 . WATER SEAL TRAPS**

makes flushing more difficult, but prevents erosion of the back of the pit on loose soil. The same general method could be used to make a forward flushing trap (see Figure 2b).

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## FIGURE 2 . WATER SEAL TRAPS

The basic method for making these water-seal slabs is to cast the slab, bowl, and water-seal trap using three forms:

1. A wooden form for shaping the slab (see Figure 6).

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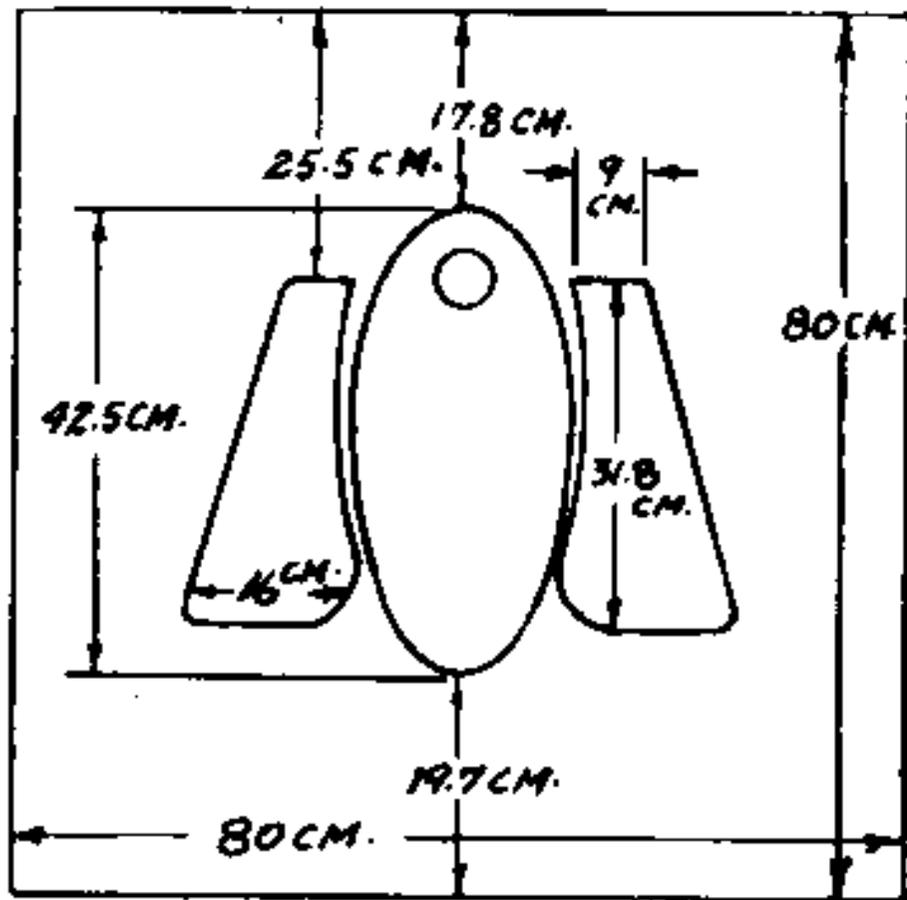
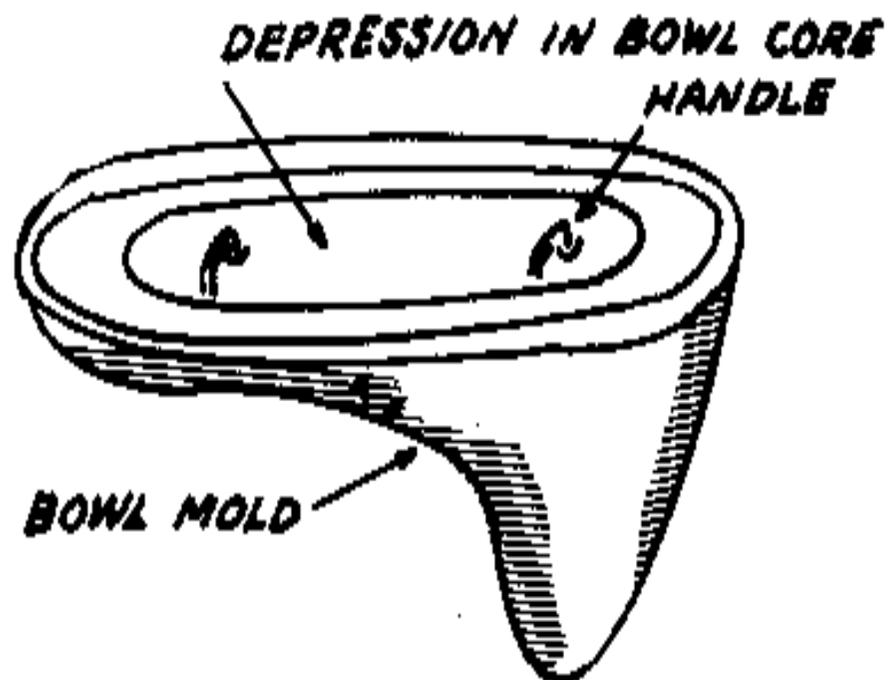


FIGURE 6 PRIVY SLAB OUTLINE

2. A concrete bowl core for shaping the inside of the bowl (see Figure 3).

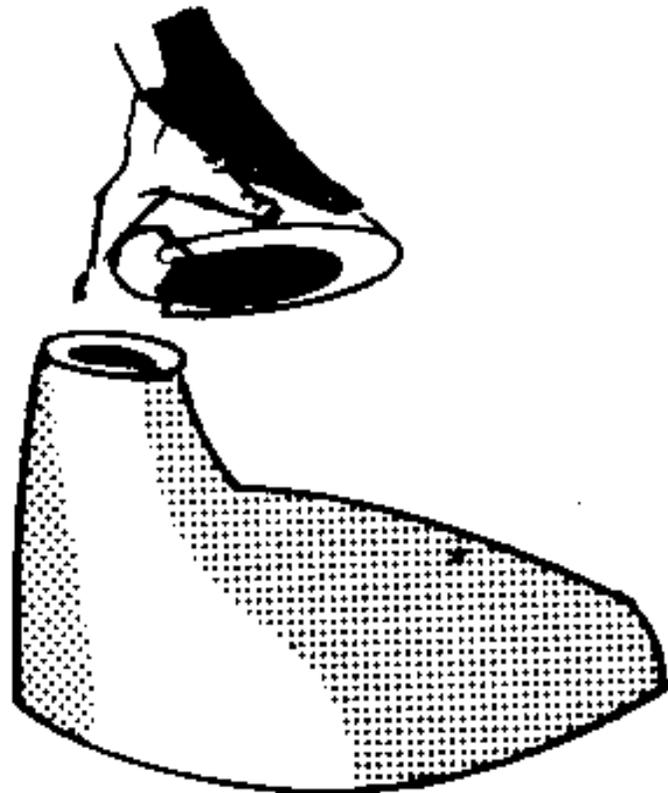
fg3x176.gif (486x486)



**FIGURE 3 BOWL CORE HANDLES**

3. A concrete core for shaping the inside of the water-seal trap (see Figure 9).

fg9x178.gif (486x486)



**FIGURE 9. MOUNTING THE TRAP CORE.**

### Tools and Materials

Master molds

Materials for making concrete

Wool for platform forms

Reinforcing rod and wire

Clay

**Crankcase oil**

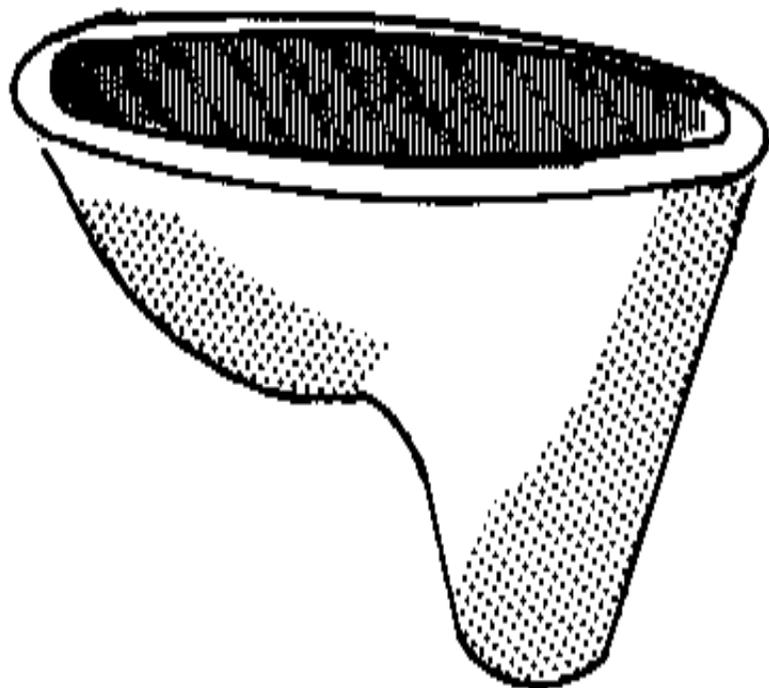
**Beeswax and kerosene (optional)**

**Steel bars: 19mm x 19mm x 7.5cm (3/4" x 3/4" x 5")**

The forms used when making a slab must stay in place until the concrete is strong enough, usually 24 hours. For this reason, many sets of forms are necessary

if a reasonable number of slabs are to be cast every day. Here is where the three master molds are needed: one of them to cast the bowl core, and the other two to cast the trap core (see Figures 14 and 18).

fg141810.gif (486x486)



**FIGURE 14. BOWL MOLD**

### Casting the Bowl Core

Oil the inside of the master bowl mold and insert a 19mm x 19mm x 7.5cm (3/4" x 3/4" x 3") steel bar into the bottom.

Add a fairly loose mixture of cement and water, called neat cement, to a depth of about 15cm (6"). Then fill to brim with a 1:1 cement-sand mixture. The 1:1

should

be firm, not runny, and should be laid into the loose neat cement without stirring

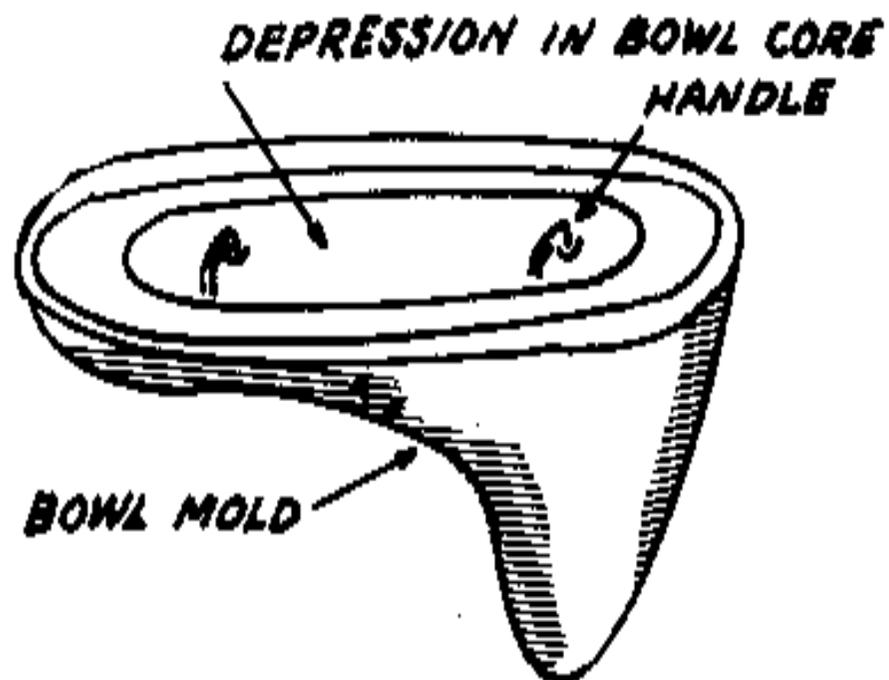
to insure a smooth finish on the bowl core.

After the bowl core has become firm enough, scoop a depression into the surface to install two steel hooks made from the reinforcing rod. They should be about 22.5cm (9") apart, and should not protrude above the surface of the concrete

(see

Figure 3).

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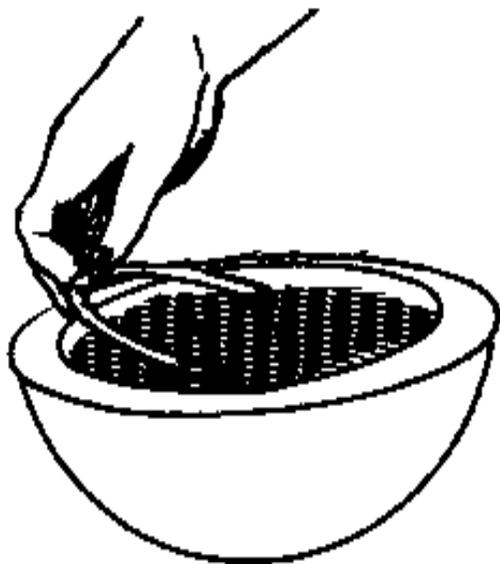
**FIGURE 3 BOWL CORE HANDLES**

Let the concrete set at least 24 hours before removing the bowl core from the master molds. The bowl core can be used to make another master mold and the master mold can be used to make more cores.

## Casting the Trap Core

Add about 2.5cm (1") of 1:1 cement-sand mix to the oiled trap master mold and put in some wire for reinforcing. Then fill it with 1:1 almost to the brim (see Figure 4).

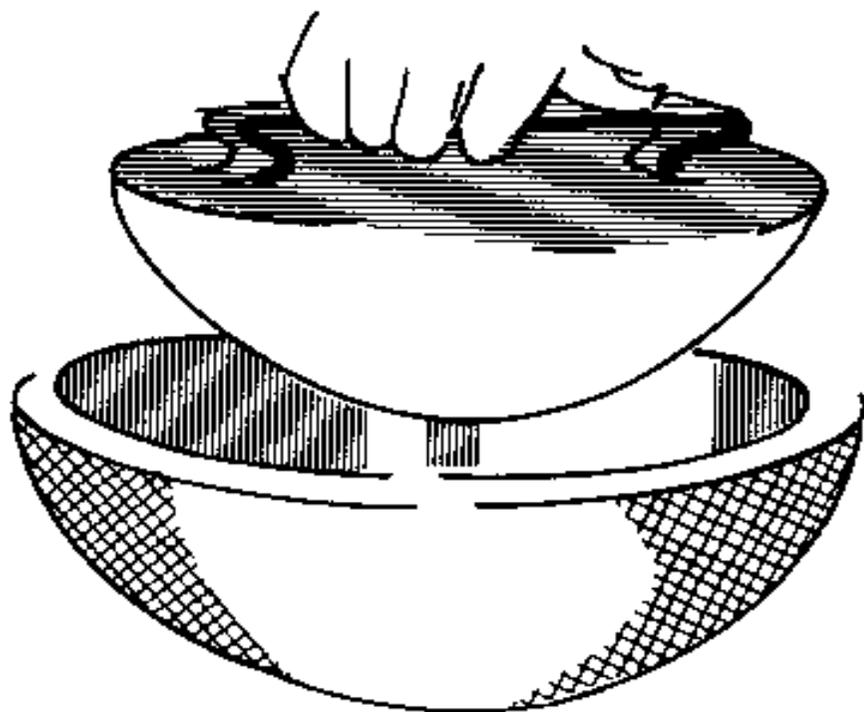
fg4x176.gif (486x486)



**FIGURE 4 REINFORCING THE  
TRAP CORE**

Put the oiled insert mold into place  
and scrape off excess (see Figure 5).

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**FIGURE 5 PLACING THE  
INSERT MOLD**

After 45 minutes, remove the insert and put a square sheet metal pipe 19mm (3/4") high into the cubical indentation left by the insert. The pipe is made by wrapping sheet metal around a 19mm x 19mm (3/4" x 3/4") steel bar. Let the concrete

dry in the mold for 24 hours.

Remove the finished trap core by tapping the master mold gently with a wooden block.

### Making the Wooden Slab Form

Make a wooden platform 90cm x 90cm (35 1/2" x 35 1/2") out of 2.5cm (1") thick planks. This is the base of the form. The finished slab will measure 80cm x 80cm (31 1/2" x 31 1/2"). See Figure 6.

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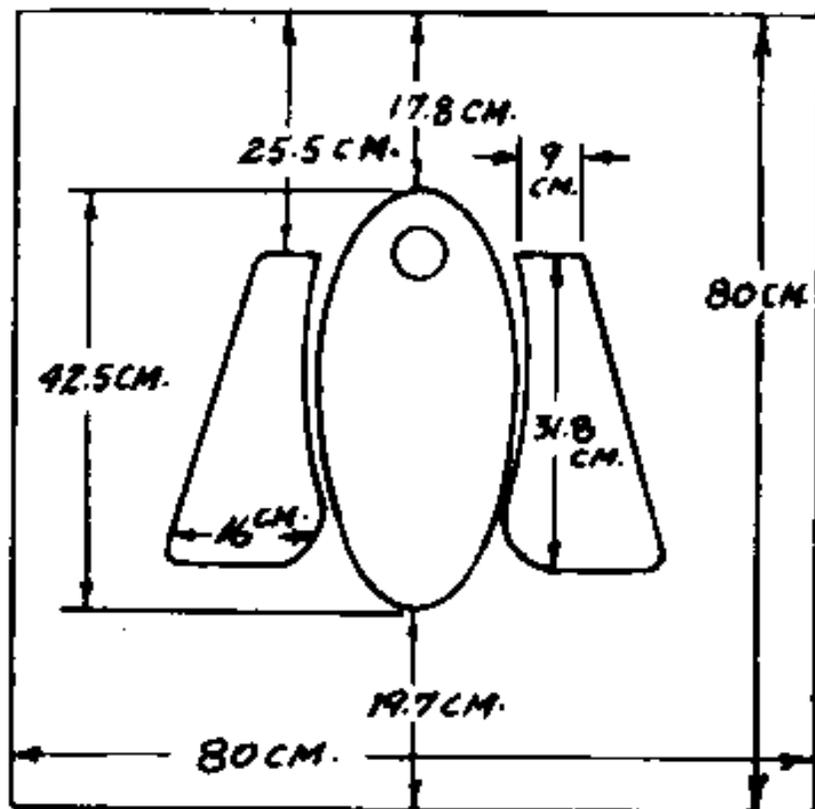


FIGURE 6 PRIVY SLAB OUTLINE

Cut out of the platform a hole 10cm x 33cm (4" x 13") for the hooks of the bowl core to extend into. The back of the hole should be 28cm (11") from the back of the platform. To determine the location of this hole, draw the outline of the bottom of the bowl on the platform, with the back of the bowl outline

23cm (9") from the back of the platform.  
(This is 17.8cm from the edge of the slab, as shown in Figure 6.) The back of the hole should be 28cm (11") from the back of the platform.

Using 38mm x 38mm (1 1/2" x 1 1/2") wood, make a frame with inside dimensions of 80cm x 80cm (31 1/2" x 31 1/2") (see Figure 7).

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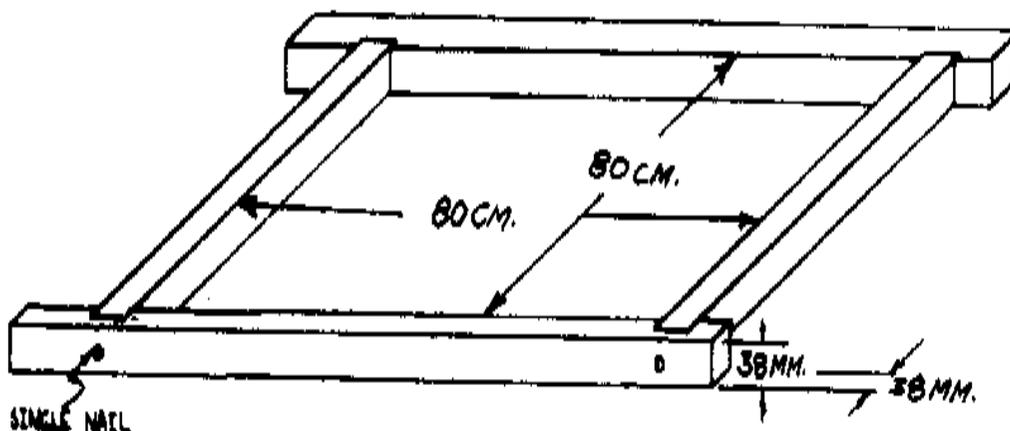


FIGURE 7 FRAME

Gouge out the footrest with a wood chisel. The inside of the foot-rests should be about 12.5mm (1/2") from the outline of the bowl.

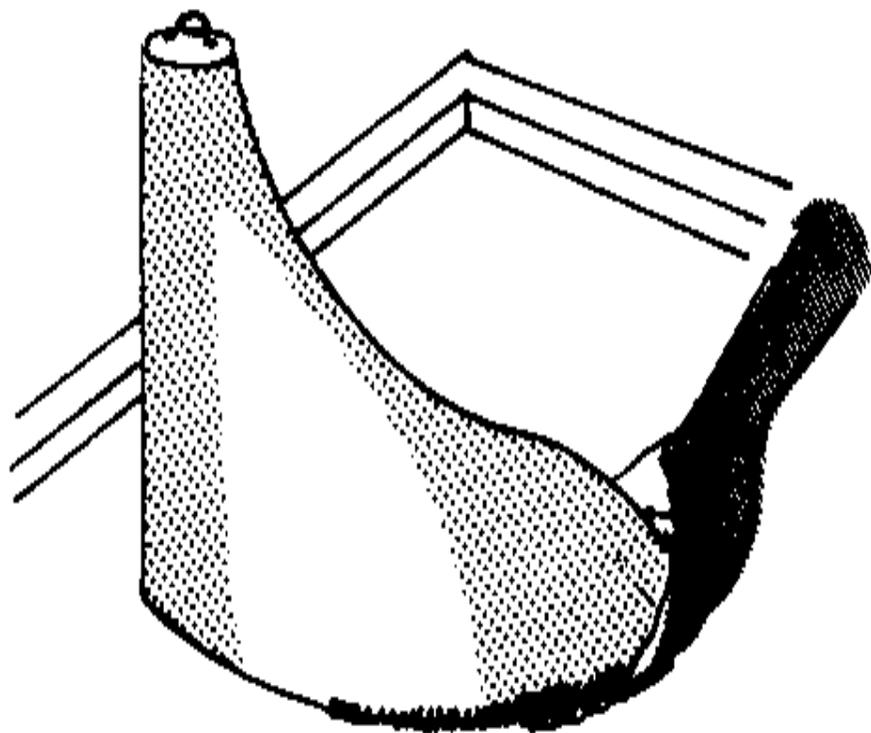
## Casting the Slab

With these three forms finished, you are ready to cast the first waterseal slab.

If desired, coat the bowl core and the trap core with a layer of wax about 3mm (1/8") thick. Prepare the wax by dissolving 1kg (2.2 pounds) of melted beeswax in 0.5 liter (1 pint) of kerosene. Apply the wax with a paintbrush. The wax coating will last 5 to 6 castings. Wax makes removing the cores much easier, but it is not absolutely necessary. Let it dry before oiling.

Place the bowl core on the wooden slab form and fill all cracks with clay (see Figure 8). Oil the bowl, platform, and frame.

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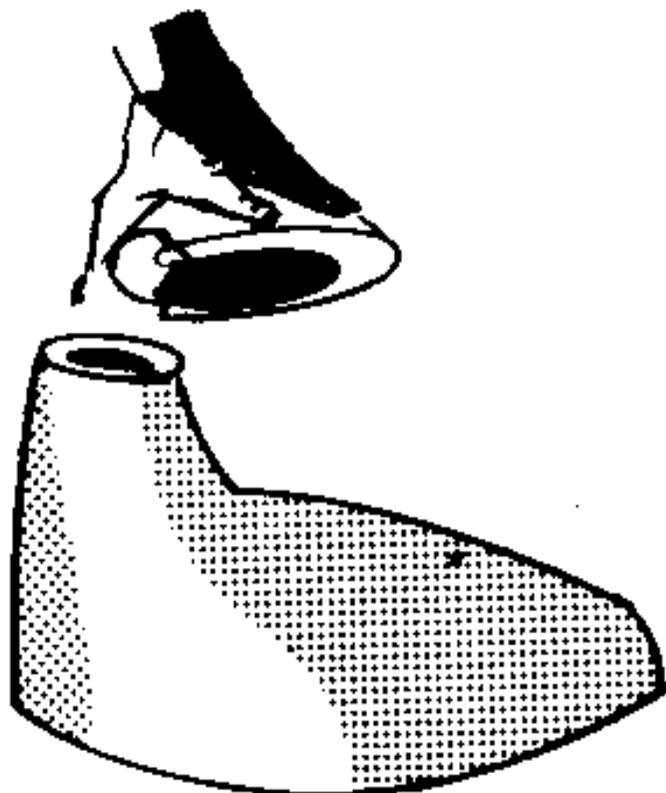
**FIGURE 8. SEALING CRACKS WITH CLAY.**

Apply a 6mm (1/3") thick coat of pasty cement and water mixture to the bowl core and platform. (Many people prefer to spend a little more for an attractive polished slab. To do this, use a mix of 5 cement: 5 color: 1 granite chips instead of a

mixture of cement and water. After the forms are removed, polish with a carborundum stone and plenty of water.)

Cover the bowl core with a 1:2 cement-sand mixture to a total thickness of 12.5mm (1/2"). Make a smooth lip on the cement 10mm (3/8") from the top of the bowl core as in Figure 9. This lip is your water seal. Use fairly dry cement; let it

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**FIGURE 9. MOUNTING THE TRAP CORE.**

set for 15 minutes before cutting the lip.

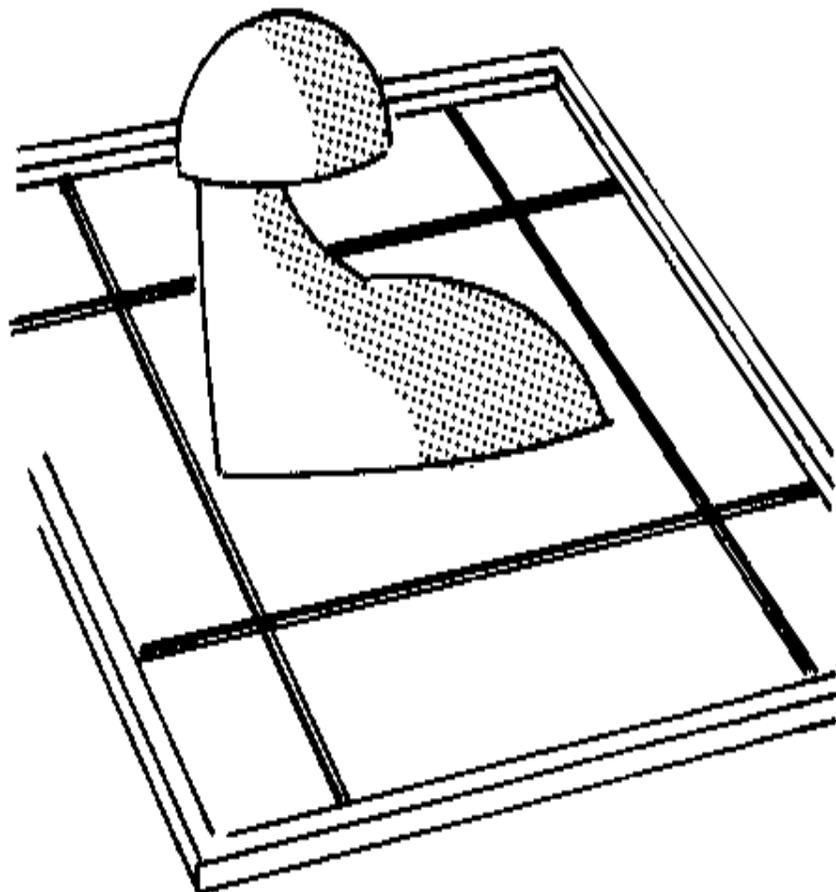
Place the trap core on the bowl core and seal the crack with clay. Also add a little clay on each side of the form (near the thumb in Figure 9) to prevent cement from getting to the front lip.

Cover with 1:2 cement-sand mixture to a thickness of 12.5mm (1/2"). Do not exceed the 12.5mm (1/2") thickness below the trap core or you will not be able to remove this core.

Fill the slab form with a mixture of 1 cement: 3 clean gravel or crushed rock almost to the top. In preparing the concrete, first mix cement and sand, then add gravel and water. Use water conservatively. The looser the mixture, the weaker the concrete will be.

Press in 4 pieces of 6mm (1/4") steel reinforcing rod (see Figure 10). Fill to top

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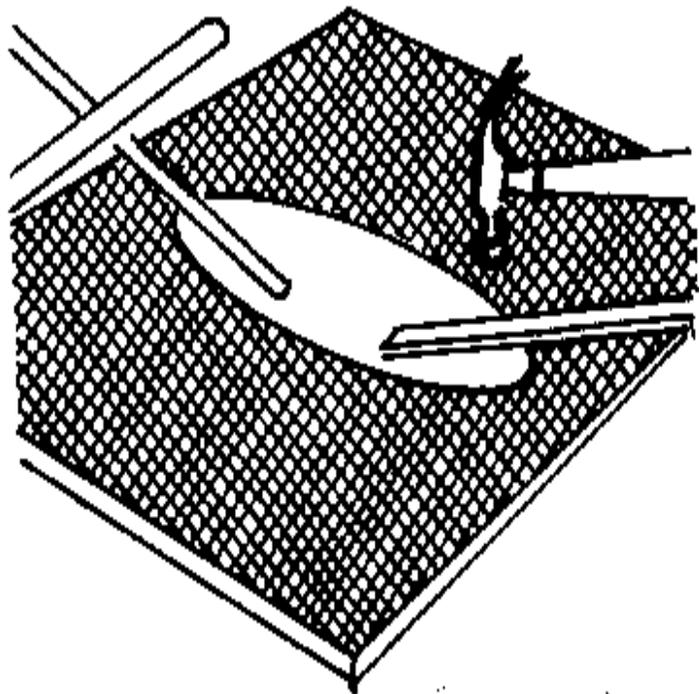


**FIGURE 10. PLACING REINFORCING ROD.**

of frame and smooth. Allow at least 24 hours for setting. Remove the frame by tapping lightly with hammer.

Turn the slab form over on a wooden stand and use simple levers to remove the bowl core. You must remove the bowl core before the trap core (see Figure 11).

fg11x179.gif (486x486)



**FIGURE 11. REMOVING THE  
BOWL CORE.**

Tap the trap core gently and slip it out. Add a little water and check to see if your seal is 10mm (3/8").

Keep the slab damp and covered for a minimum of three days and preferably a week to gain strength.

**Master Molds for the Thailand Water-Seal Privy Slab**

This entry describes how to make the three master molds from which cores can be cast. The cores in turn are used for casting Thailand Water-Seal Privy Slabs.

## Tools and Materials

### Cardboard

Materials for making concrete

Steel rod, 19mm (3/4") square

Sheet metal (tin-can metal is satisfactory)

Reinforcing wire

Clay

Oil (used crankcase oil is satisfactory)

Paint brush

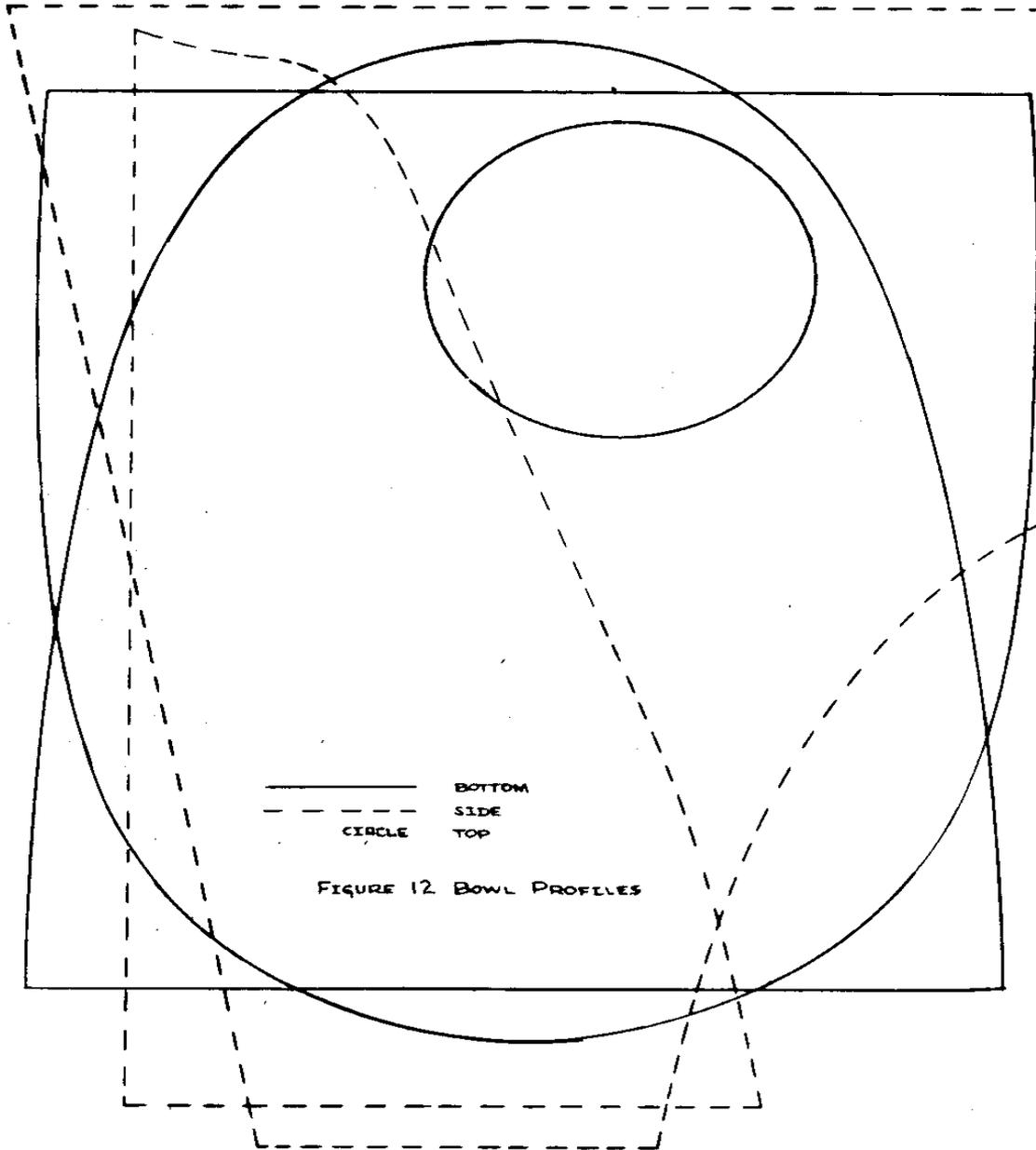
It may be necessary to make master molds rather than to purchase them. Study the entry "Thailand Water-Seal Privy Slab" before starting to make these master molds:

- o The Master Bowl Molds,
- o The Master Trap Molds, and
- o The Trap Mold Insert.

## Making the Master Bowl Mold

Enlarge the templates of the bowl outlines on Figure 12 (increase all dimensions

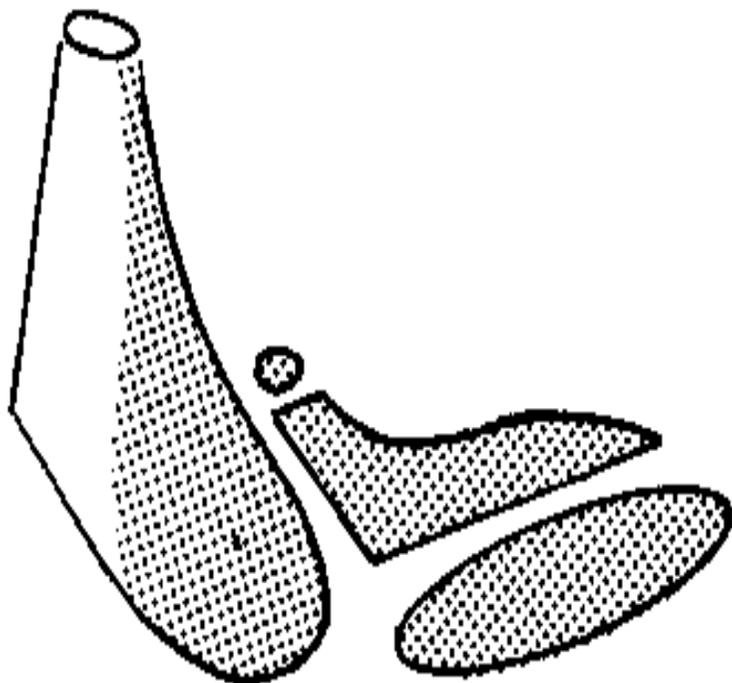
fg12x180.gif (600x600)



by one third). Cut out profiles from your larger templates.

Shape a mound of clay using the cardboard profiles as a guide (Figure 13). Form

fg13x181.gif (486x486)

**FIGURE 13 CLAY MOUND**

a little square pipe, 19mm (3/4") long, of sheet metal on the 19mm (3/4") square steel rod. Make several of these as they will be used later when casting the cores. Fill the square pipe with clay and press it into the

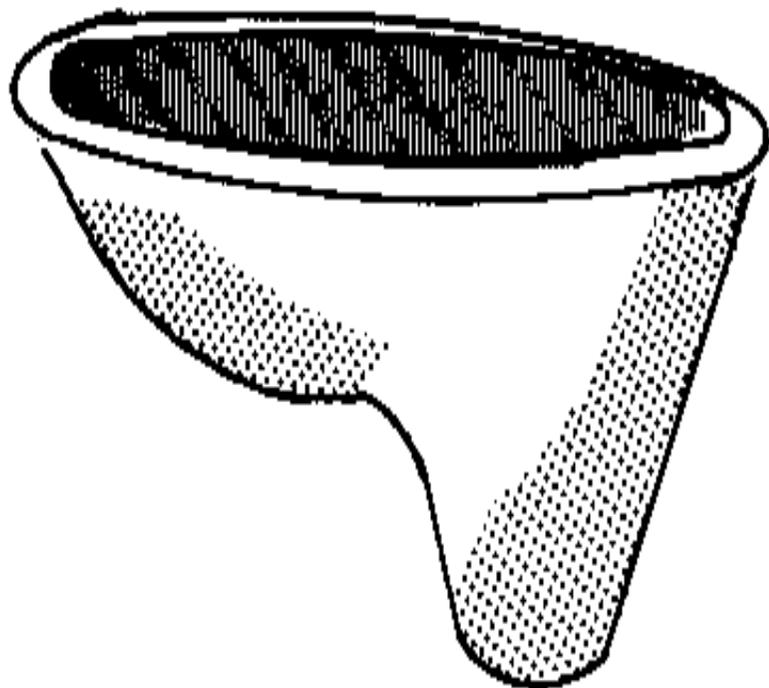
top of the day mound a little bit.  
This will be used later to "key" the  
cores together.

Use a paint brush to paint the clay  
mound with oil; old crankcase oil is  
fine.

Cover the clay mound with a stiff mixture of cement and water to a thickness of  
12.5mm (1/2"). If the clay mound was properly prepared, the inside finish of the  
bowl mold will need no further smoothing.

After this cement has set 30 minutes,  
build up the thickness to 38mm (1 1/2")  
with 1:1 cement-sand mix. Let this set  
24 hours and carefully lift the finished  
master bowl mold from the clay mound.  
The finished bowl mold is shown in  
Figure 14.

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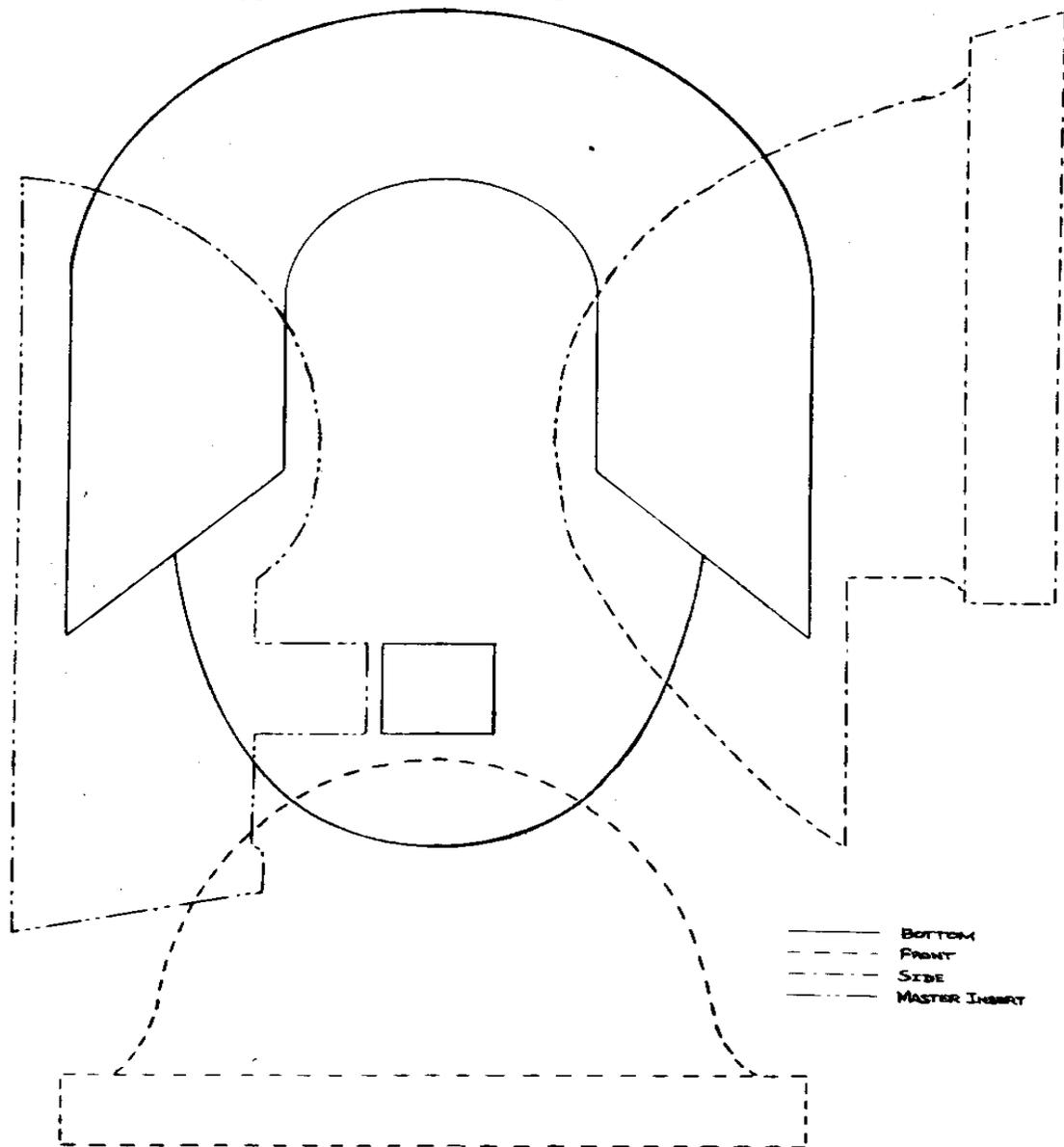


**FIGURE 14. BOWL MOLD**

### **Making the Master Trap Mold**

**Make cardboard profiles of the trap from Figure 17 as you did above with the fg17x182.gif (600x600)**

FIGURE 17. TRAP PROFILES

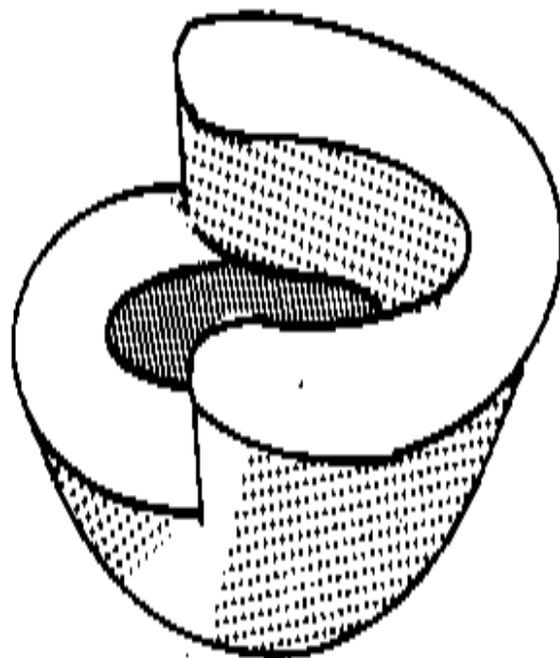


**bowl.** Shape the outside of the trap from clay and let it harden overnight.

Shape the under side by hand with a trowel using Figure 15 and the insert

profile

fg15x181.gif (486x486)



**FIGURE 15. CLAY TRAP**

from Figure 17 as guides. Mark the locations for a 19mm (3/4") square metal pipe by holding the clay trap over the clay mound used to shape the bowl mold, and letting the square sheet

metal cube mark the trap.

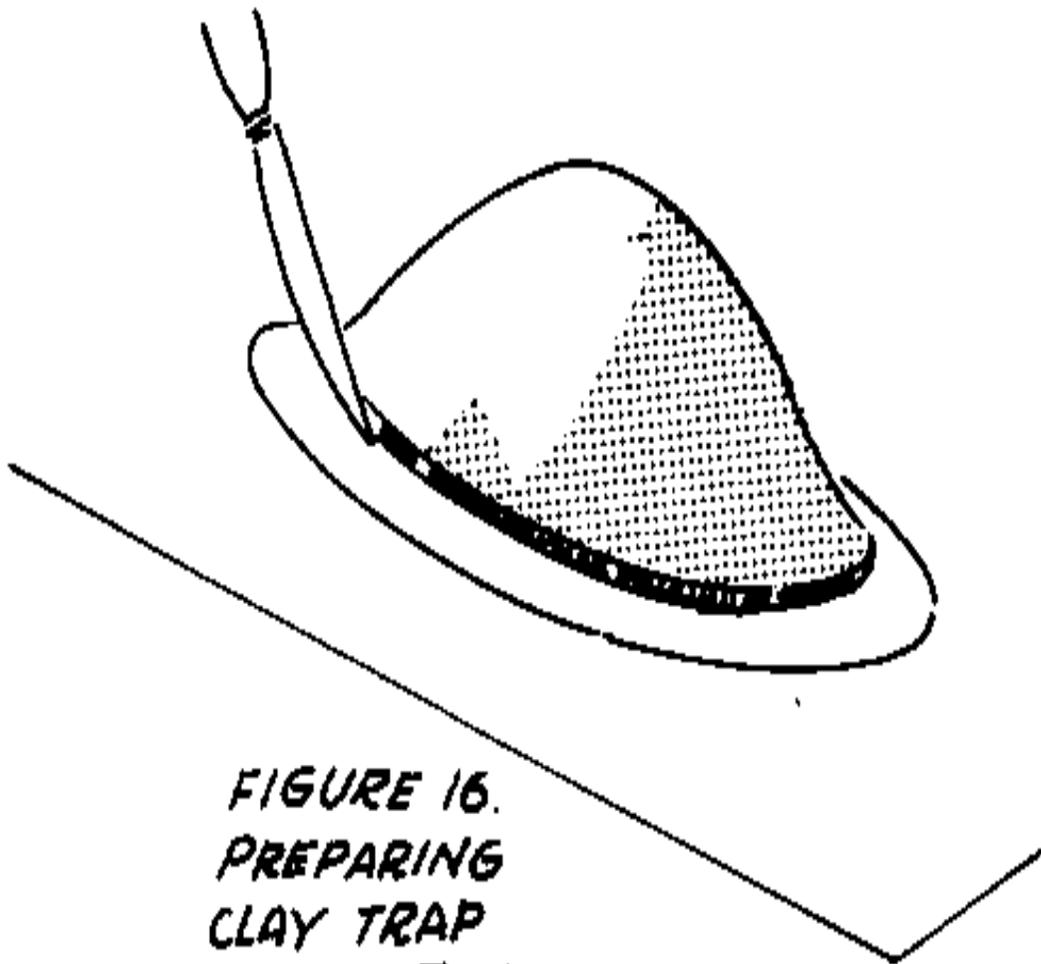
Insert the sheet metal pipe into the clay trap and scoop out the clay from inside (see Figure 15).

Check the clay trap on the bowl mound again to be sure it lines up properly.

Oil the clay trap.

Put a heel-shaped piece of clay under the clay trap and trim the sides. This will prevent the cement from running under the mold (see Figure 16).

fg16x183.gif (540x540)



**FIGURE 16.  
PREPARING  
CLAY TRAP  
FOR CASTING MOLD**

Cover with cement and water to 19mm (3/4"), add steel reinforcing wire, and cover with 19mm (3/4") more of 1:1 cement-sand mixture.

Flatten the top and insert wire handles. Let it set at least 24 hours. This completes the master trap mold.

### Making the Trap Mold Insert

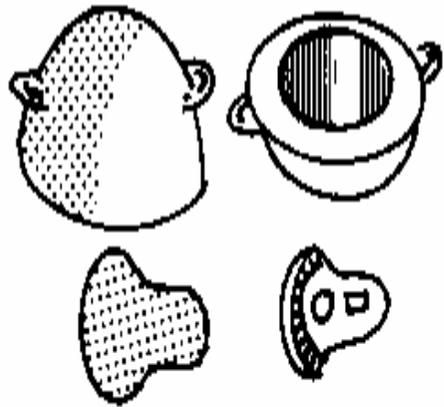
Turn the master trap mold over carefully and remove the heel-shaped clay plug.

Oil all inner surfaces and fill to the brim with 1:1 cement-sand mix.

Insert a small wire handle and let the concrete set for at least 24 hours before separating the finished molds.

Figure 18 shows the completed master trap mold and insert.

fg18x183.gif (600x600)



*FIGURE 18. TRAP MOLD  
AND INSERT*

**Source :**

18/10/2011

<b> Health And Sanitation

**Karlin, Barry. Thailand's Water-Seal Privy Program. Korat, Thailand: Ministry of Public Health.**