Sewage Disposal for the Farm Home

By R. C. Kelleher
and E. W. Lehmann

This circular describes a simple, effective and inexpensive method of disposing of farm sewage. Many tanks built in accordance with these plans are being successfully used. While directions given in this circular are complete, larger blueprint plans can be obtained from the Farm Mechanics Department of the University by those who wish them, for ten cents.

A circular describing the installation of water and plumbing systems for the farm home (No. 303) will be of interest in connection with this circular and can be obtained free of charge by addressing the College of Agriculture, University of Illinois, Urbana.

University of Illinois
College of Agriculture and Agricultural Experiment Station

Circular 336

SEWAGE DISPOSAL FOR THE FARM HOME

By R. C. KELLEHER AND E. W. LEHMANN[1]

A system of plumbing has become essential in the modern farm home. Running water reduces the drudgery of the kitchen and makes possible a bathroom for the greater comfort and health of all the members of the family.

The installation of plumbing conveniences makes it necessary to provide for the proper disposal of waste water and sewage. It is not only unsightly but unsafe to discharge sewage on to the surface of the ground or into a ditch, even at a distance from the house, because of the danger of spreading diseases. Discharging it into a small stream is almost as bad, for polluted water not only is a nuisance to the community, but it may also cause the spread of water-borne diseases. Many epidemics of typhoid fever, dysentery, and summer complaint for example, have been traced to polluted water supplies.[2]

The septic tank is the most satisfactory solution of the farmer's problem of sewage disposal. It is neither difficult nor expensive to construct, and it will operate efficiently for long periods without cleaning.

Tanks of various designs have been in use for many years, but authorities have differed on questions of construction. With a view to studying the efficiency and design of simple tanks, experiments were undertaken by the University of Illinois Agricultural Experiment Station in coöperation with the Illinois State Water Survey, and the recommendations made in this circular are based on the results of that experimental work.[3]

Purpose of Septic Tank and Disposal Line

A septic tank does not completely purify sewage, as is sometimes believed; it merely accomplishes one step in the process of purification. The solid materials settle to the bottom of the tank and are slowly digested by microscopic organisms, thus becoming liquefied to a large extent and put into condition to be finally disposed of.

The discharge, or effluent, from a septic tank is still dangerous, however, unless care is taken to dispose of it properly. This is usually done by means of an underground line of 4-inch drain tile which allows the discharge from the tank to seep into the soil.

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[2]The State Department of Health should be consulted before sewage of any kind is discharged into a stream or other body of water.

[3]For a complete report of the experimental work see Bulletin 304 of this Station.

Location of Septic Tank and Tile Line

With Reference to Water Supply. Maintaining the health of the family and that of neighbors is the first point to consider in deciding on the location of a septic tank, its sewer, and disposal line. The water supply must be completely protected from contamination by sewage. This is necessary in order to prevent the spread of water-borne diseases.

The site of the tank and disposal tile should drain away from any well, and should be far enough from the well to prevent seepage into it from the subsoil. The location of the disposal tile at the outlet of the tank with respect to the well is of even greater importance than the location of the tank itself, for seepage from this tile is still a source of danger to water supplies.

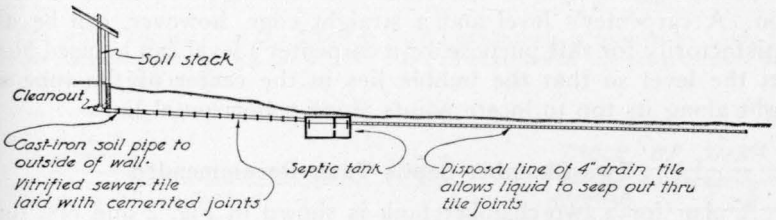

FIG. 1.—PARTS OF A SEWAGE DISPOSAL SYSTEM

In fairly heavy soil the septic tank and the disposal tile should be at least 75 feet from the well; in more porous soils the distance should be 150 feet or more. These rules apply also, in a general way, to the location of the sewer line from the house to the tank, altho if this line is of tight construction, as it should be, the distance from the well need not be so great.

When space is limited, the septic tank may be placed only a few feet from the house. Most people, however, prefer a distance of 50 to 60 feet in order to avoid inconvenience when the tank is being cleaned. In some cases a more distant location must be selected in order to secure the proper fall.

Fall Necessary. Another governing factor to be considered in selecting the location for the septic tank and the sewer and disposal lines is the fall available for the construction of the sewer line between the house and the tank, and also for the disposal line on the outlet side of the tank. There must be sufficient fall in the tile lines to insure proper flow of sewage thru them.

If there is sufficient fall, the sewer line may be laid below the level of the basement floor, thus providing drainage for fixtures in the basement. However, when little fall is available, it may be neces-

sary to place the sewer tile at the house as near the ground surface as is consistent with frost protection.

The sewer line between the house and the tank should have a fall of at least 1 and preferably 2 feet to 100 feet. Where the ground has plenty of slope, more fall than this is desirable. In addition, allowance must be made for a 4-inch drop thru the septic tank, since the outlet tile is placed 4 inches lower than the inlet tile, and also for fall on the outlet side of the tank to provide the proper slope for the final disposal tile. This disposal line of 4-inch drain tile is usually given a slope of 4 to 8 inches to 100 feet.

To summarize, allowance for fall should be made as follows: (1) fall in sewer tile of at least 1 to 2 feet in 100; (2) a 4-inch drop thru the septic tank; (3) fall in the disposal tile at the outlet of the tank of 4 to 8 inches to 100 feet.

A surveyor's level is convenient for finding differences in elevation. A carpenter's level and a straight edge, however, can be used satisfactorily for this purpose, or a carpenter's level can be used alone. Set the level so that the bubble lies in the center of the tube and sight along its top to locate points along a horizontal line.

Two-Chamber Septic Tank Recommended

A plan for a two-chamber tank is shown in Fig. 2 and one for a single-chamber tank in Fig. 16.

The two-chamber tank is recommended for best results and might well be considered for all conditions. It is somewhat more expensive to construct than the single-chamber, but its more efficient chemical and mechanical operation, and the fact that it requires less frequent cleaning, are points worth considering.

The single-chamber tank, which is two-thirds as large as the two-chamber tank, is easy to build and should give reasonably good service where there is ample area of porous, well-drained soil for the location of the disposal tile.

Cost. For the ordinary two-chamber tank the materials cost about $30, and for the single-chamber tank about $20. The tile in either case will cost about $15 or more in addition. These figures do not include labor.

Size of Tank Needed for Average Farm

Ordinary Installations. The most common farm installation will be a septic tank large enough to take care of seven people or less. If a two-chamber tank is used, this will require a 6-foot length for the first chamber and a 3-foot length for the second. If a single-chamber tank is used, an inside length of 6 feet should be allowed. Smaller tanks than these are not recommended, even for families of fewer than seven persons.

Larger Installations. The directions for construction given in this circular are for tanks designed to care for the sewage from a household of seven people or less. For installations serving a larger number, adjustments in length should be made which will conform with Table 1

TABLE 1.—DIMENSIONS AND MATERIALS REQUIRED FOR TWO-CHAMBER SEPTIC TANKS FOR INSTALLATIONS ACCOMMODATING UP TO 15 PEOPLE

Number of people	Length of 1st chamber (distance *C*, Fig. 2)	Length of 2d chamber (distance *D*, Fig. 2)	Cement	Sand	Gravel	Concrete
	ft.	*ft.*	*bags*	*cu. yds.*	*cu. yds.*	*cu. yds.*
7 or less	6	3	20	1½	3	3⅛
9	7	3½	22	1⅔	3¼	3½
12	8	4	24	1⅞	3½	3⅞
15	9	4½	26	2	3¾	4½

The proper capacity for the different sized installations is secured by using the chamber lengths given in this table. All other dimensions of the tank remain constant, as shown in Fig. 2.

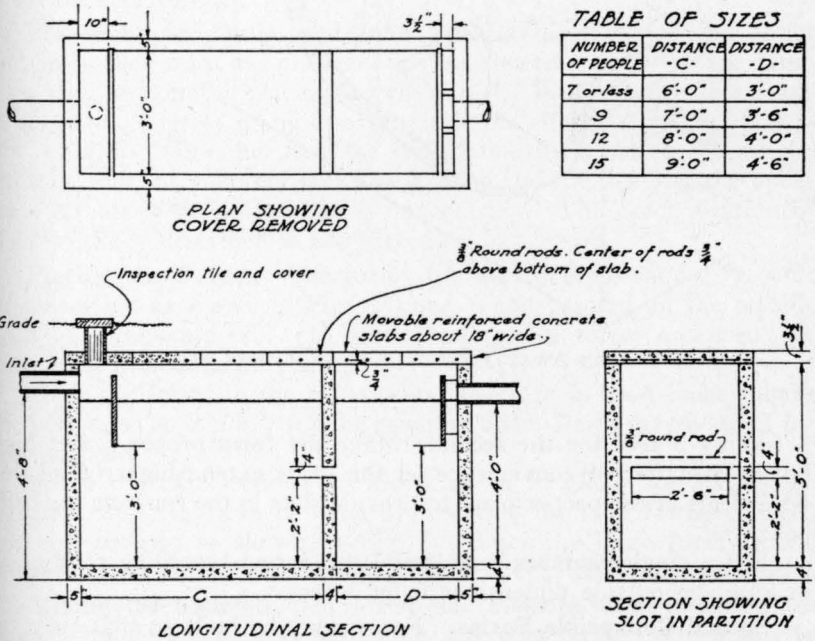

FIG. 2.—DESIGN FOR A TWO-CHAMBER SEPTIC TANK

This type of tank is recommended for best results and might well be considered for all conditions. It is somewhat more expensive to construct than the single-chamber tank but its more efficient operation, additional purification, and longer service without cleaning are points worth considering in planning an installation.

in the case of the two-chamber tank and with Table 2 for the single-chamber tank. The size of the forms used and of the excavation will necessarily conform to the size of the tank being built.

Making the Forms for the Concrete

Simple Forms. It is a simple matter to construct forms that are to be used but once. They can be made of cheap lumber and nailed together according to the plans shown. The walls of the earth excavation serve as the outside forms for the concrete.

For a two-chamber tank, build the forms according to Fig. 10, making the outside dimensions 6 by 3 feet for the first chamber and

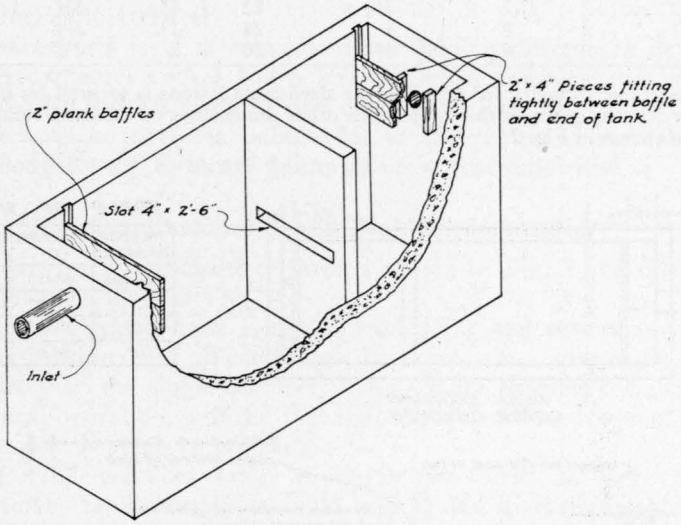

FIG. 3.—CUT-AWAY VIEW OF A TWO-CHAMBER SEPTIC TANK

3 feet by 3 feet for the second. Make the form proper 5 feet high, but as a matter of convenience let the studs extend higher than this. Nail cleats at the proper place to provide slots in the concrete for baffle boards.

For a single-chamber tank, build the forms according to Fig. 18, making the outside dimensions 6 by 3 feet.

Special Collapsible Forms. Forms may be built so that they can be bolted together for repeated use. Either lumber or steel may be used. In some Illinois counties collapsible forms can be obtained at a considerable saving from the county farm bureau, the local plumber, or a contractor. To build these forms, see the directions given on pages 18 to 20.

How to Build a Two-Chamber Septic Tank

The ordinary size of two-chamber tank suitable for seven people or less includes one chamber 6 feet long and a second chamber 3 feet long (Figs. 2 and 3).

Materials Needed. Twenty bags of cement, 1½ cubic yards of sand, and 3 cubic yards of gravel are required. Before starting the excavation, haul the concrete materials and have the form ready so that the concrete can be poured immediately. If this is done, there is little possibility of the excavation walls crumbling or being damaged by rain.

The Excavation. After selecting a satisfactory site for the tank, stake out the excavation 10 feet 2 inches long and 3 feet 10 inches wide (Fig. 4). The depth of the excavation will usually be about 6½ to 7 feet. The exact depth will be determined by the location of the outlet and inlet tiles, for the bottom of the excavation should be 4 feet 8 inches below the bottom of the inlet tile and 4 feet 4 inches below the bottom of the outlet tile.

In digging, use a plumb-bob occasionally to be sure that the side walls are kept vertical.

Provisions for Outlet and Inlet Tiles. Openings for the outlet and inlet tiles must be provided in the concrete walls of the tank. This may be done by placing the tile directly in the trench that leads to the tank (Fig. 4) or by inserting it in the side wall of the excavation (Fig. 5). In either case the end of the tile is butted against the form so that the concrete will flow around the tile, leaving the opening. A hole in the form itself is unnecessary. The exact location of the two tile is described in the preceding paragraph.

Placing the Forms. The forms for the concrete should be built or assembled as shown in Figs. 10 and 6 and painted on the outside with old crankcase oil. (If special collapsible forms are used, see additional directions on page 20.)

Place the forms in the excavation. Block them up 4 inches above the bottom so as to allow for the concrete floor. Brick may be used for this purpose.

Space the two sections of forms so as to allow for the 4-inch partition wall; this can be done by inserting the core frame between the two sections as shown in Fig. 7. Brace the large form section with struts so as to prevent bulging. Now the concrete may be poured.

Mixing the Concrete. In a concrete mixture, cement and water form a paste, which upon hardening acts as a binder, cementing the particles of sand and pebbles together into a permanent mass. Consequently it is important that the proper proportions of cement and water be used, the exact proportions depending on the use to which the construction is to be put.

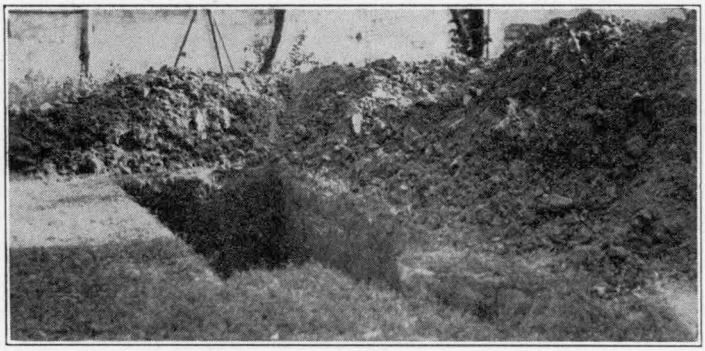

FIG. 4.—THE EARTH WALLS MAY SERVE AS OUTSIDE FORMS FOR THE CONCRETE

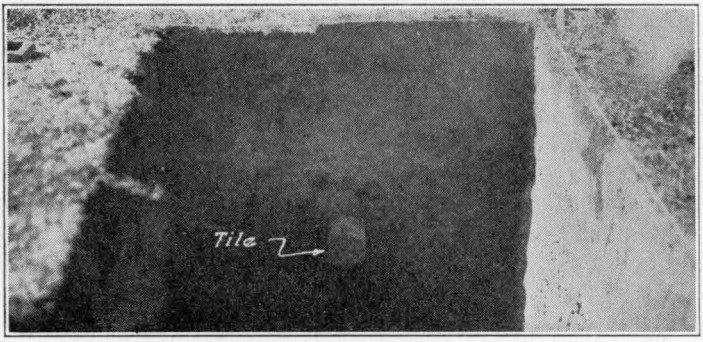

FIG. 5.—OUTLET TILE EMBEDDED IN THE EXCAVATION WALL

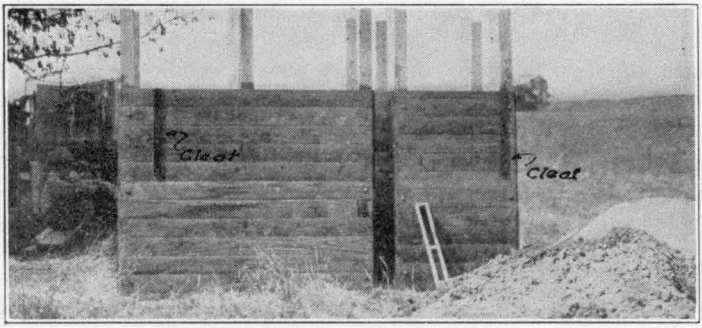

FIG. 6.—FORMS ASSEMBLED AND READY TO BE PUT INTO PLACE

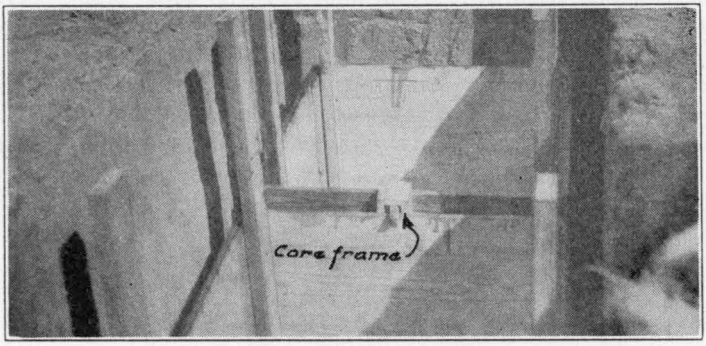

FIG. 7.—CORE FRAME TEMPORARILY PLACED BETWEEN FORMS INSURES CORRECT SPACING

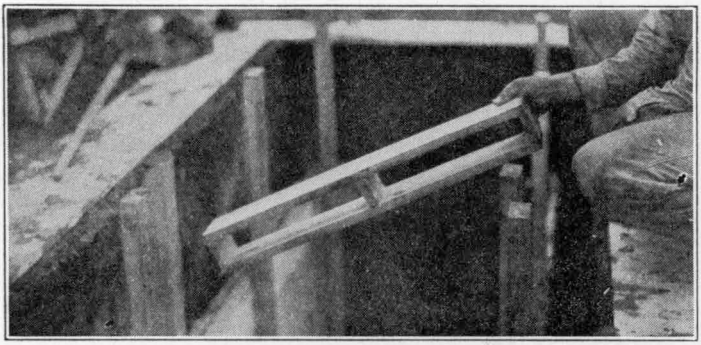

FIG. 8.—WHEN CONCRETE IS 2 FEET 2 INCHES ABOVE FLOOR, PLACE THE CORE FRAME

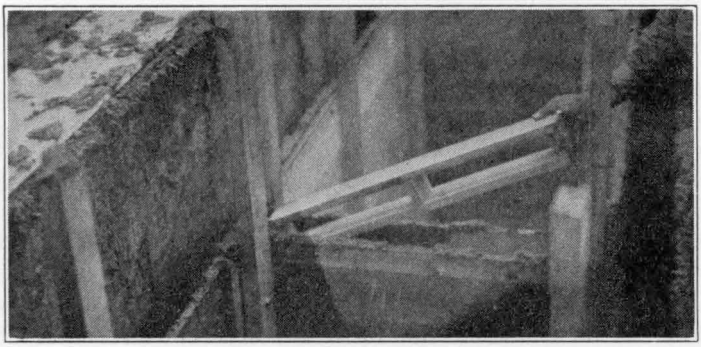

FIG. 9.—CORE FRAME BEING DROPPED TO HORIZONTAL POSITION BETWEEN FORMS

The concrete used in a septic tank must be water tight. Five and one-half gallons of water with each sack of cement will make water-tight concrete provided the sand and gravel used are dry. If the sand and gravel are moist, only 4¼ gallons of water should be used, while 3¾ gallons of water are required if they are wet. To secure the right consistency of concrete a trial batch may be mixed, using a 1:2:3 mix (1 part cement, 2 parts sand, 3 parts gravel) with the required amount of water. If this mixture is too dry, discard it and mix

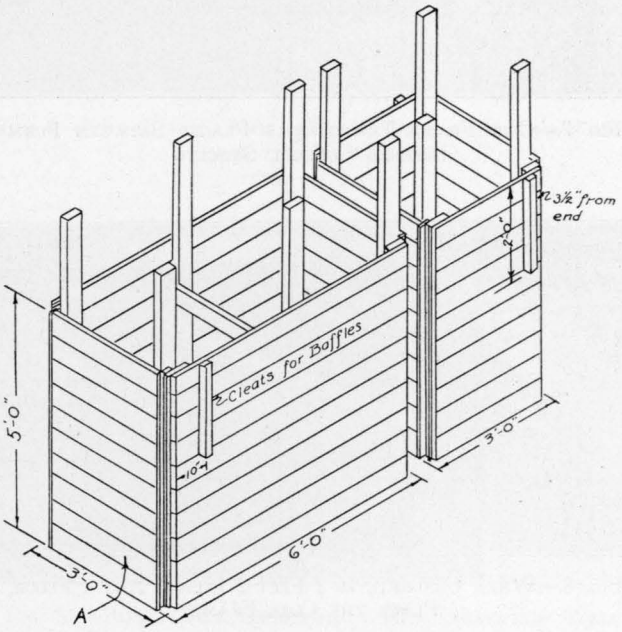

FIG. 10.—FORMS ASSEMBLED FOR TWO-CHAMBER SEPTIC TANK

These dimensions are for the ordinary size of tank. For larger tanks, make forms longer according to dimensions given in Table 1 and Fig. 2.

another, using less sand and gravel. If the first mix is too wet, sand and gravel may be added. Care must be taken not to vary the water used per sack of cement.

It is important that the sand and gravel be clean and entirely free from clay and organic matter. The forms must be rigid and strong to stand the pressure of spading and tamping.

Pouring the Concrete. Place first the concrete for the side walls, and allow the floor to be built up by leakage underneath the forms and by material that is wasted as the pouring proceeds. If the floor is poured first, the waste will accumulate above the bottom edge of the forms and make it difficult to remove them.

Take special care, by tamping and spading, to avoid pockets in the wall. The spading is done by forcing the large pebbles away from the forms by means of a wedge-shaped wooden paddle.

When the concrete in the partition wall has reached a level of 2 feet 2 inches, place the core frame so as to provide the slot in the partition wall (Figs. 8, 9, and 11).

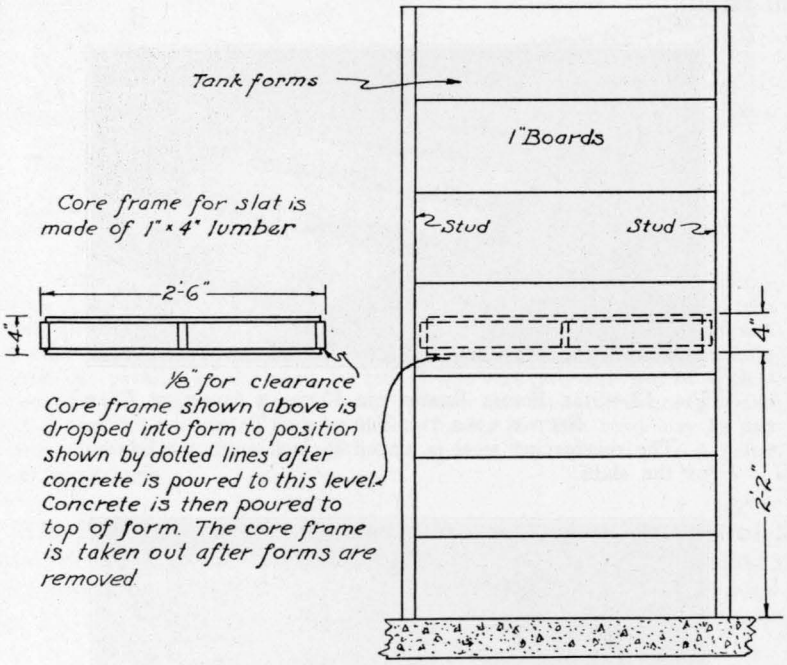

FIG. 11.—CROSS-SECTION OF THE PARTITION WALL SHOWING THE CORE FRAME IN PLACE

The concrete when poured will flow around the core indicated by the dotted line, leaving an open slot in the wall.

Keep the concrete at the same level on all sides of the wall while pouring. If possible, carry on the work continuously until the job is completed.

Making the Slabs for the Cover. The top of the tank should be made of concrete slabs 18 inches wide so that the cover can be removed easily when cleaning the tank. The slab sections may be built on a floor or platform, using 2-by-4 and 1-by-4 lumber for the side forms (Fig. 12). Paper should be laid on the floor or platform before the concrete is poured. If no platform is available, the slabs may be poured on the ground provided the surface is properly leveled.

Make the slabs 3 feet 10 inches long, or as long as the tank is wide, and 3½ or 4 inches thick. For reinforcement, use ⅜-inch round

steel bars, 3 bars in each slab, placing the center of each bar ¾ inch above the bottom of the slab. Imbed a tile in one slab (Fig. 13) to provide an inspection hole for the tank. Allow the slabs to set for 10 to 14 days before placing them on the tank.

Place the slabs with the same side up as when they were made; if they are turned over, the reinforcing will be ineffective and failure will result.

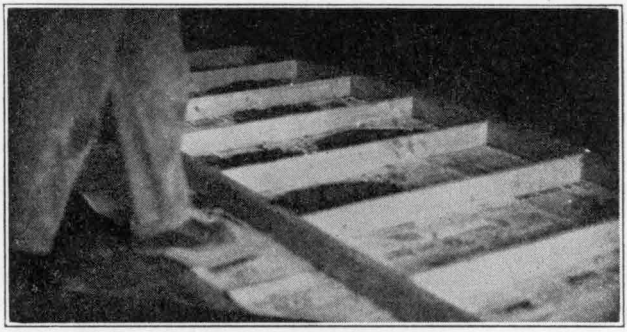

FIG. 12.—SIDE FORMS READY FOR POURING CONCRETE SLAB SECTIONS FOR THE TOP OF THE TANK

The reinforcing steel is placed ¾ inch from the bottom of the slabs.

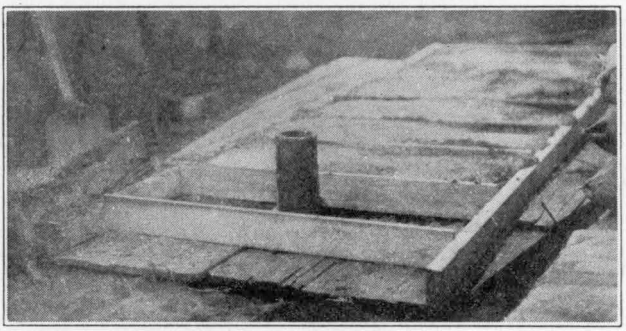

FIG. 13.—A TILE IS EMBEDDED IN ONE SLAB IN ORDER TO PROVIDE AN INSPECTION HOLE FOR THE TANK

To make the cover slabs for a single-chamber tank, follow the above procedure, but make the slabs 20 instead of 18 inches wide.

Laying the Tile Between House and Tank

The sewer line from the house to the tank should be laid in a straight line and on a uniform grade if possible.

Place the tile deep enough to drain all plumbing fixtures and to provide protection from frost. To drain properly, the line should

have a fall of at least 1 and preferably 2 or more feet to 100 (Fig. 14). For ordinary installations, 5-inch or 6-inch vitrified sewer tile is recommended, but 4-inch vitrified tile is satisfactory where a fall of 2 feet or more to 100 is available.

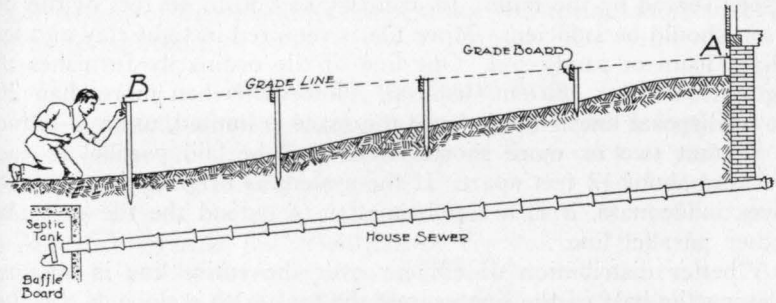

FIG. 14.—ONE METHOD OF LAYING TILE TO A STRAIGHT GRADE

After the boards or targets are set at *A* and *B*, making proper allowance for fall, the others are lined up by sighting over the tops of the two already set. The grade boards are usually spaced 50 feet apart and a cord is stretched over their top edges. The bottom of the trench is then cut parallel to the cord by measuring vertically downward with a rod equal in length to the distance between the top of the grade board at *A* and the bottom of the tile directly under it. The cord may be any convenient height above the proposed sewer, the measuring rod being cut accordingly.

The laying of the sewer tile should begin at the outlet end of the drain, never in the middle. Face the large end of the tile, called the hub, up-grade. Insert a homemade swab into the tile, as shown in Fig. 15, then place some cement mortar on the lower inside part of

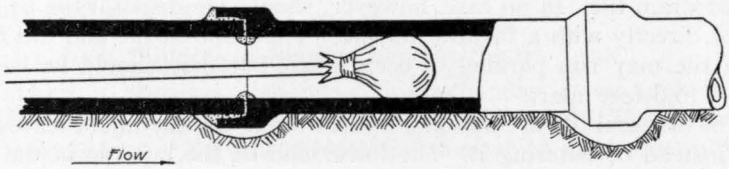

FIG. 15.—HOMEMADE SWAB USED IN LAYING SEWER TILE

the hub. Place the end of the next tile inside the hub and force additional mortar into the hub until the space between the two tiles is completely filled. Then draw the swab past the joint, leaving a clean surface on the inside of the tile. Proceed in the same manner to lay the next tile, taking care not to disturb the one already laid.

Laying the Disposal Tile

Since the liquid discharge, or effluent, from a septic tank is only partially purified, precaution must be taken for its proper disposal.

The simplest and probably the most effective method for average conditions is to lay ordinary 4-inch drain tile at a depth of 12 to 16 inches on a slightly downward grade from the tank. The length of this line will depend on the porosity of the soil and the number of persons served by the tank. In ordinary soil 30 to 40 feet of tile per person should be sufficient. More tile is required in tight clay and less in light loam or sandy soil. One line of tile ordinarily furnishes the length needed for efficient disposal. However, when more than 200 feet of disposal line is needed and the space is limited, use a V-branch tile so that two or more shorter lines may be laid parallel to each other and about 12 feet apart. If the system as originally constructed proves inadequate, it is a simple matter to extend the tile or to lay another parallel line.

A better distribution of effluent over the entire line is obtained by laying the half of the line nearest the tank with a slope of 8 inches to 100 feet and the other half with a slope of 4 inches to 100 feet.

Seepage and purification go on best in the open soil near the surface; hence the tile should be laid no deeper than is necessary to avoid freezing. Numerous installations indicate that there is no danger of frost at a depth of 12 to 16 inches. Below this depth conditions are not favorable for bacterial action, which is important in the purification and final disposal of the sewage.

In unusually tight soil it may be necessary to place a layer of sand or gravel next to the disposal tile in order to allow the liquid to seep away more readily. Where drainage is poor, it may be necessary to lay tile drains on one or both sides of the disposal tile. These drains may be laid 3 to 10 feet to one side and a foot or more below the disposal tile. In extremely tight soils it may be necessary to use a gravel fill around the disposal tile and supplement this with a line of drain tile. In no case, however, should the disposal tile be connected directly with a farm drain tile. The disposal tile and the farm drain tile may run parallel to each other, but they should be laid at least 2 to 3 feet apart.

The disposal tile are laid like a farm drain, but the liquid leaves the pipe instead of entering it. The lower end of the last tile in the line is closed with a stone or plug. One method of laying tile lines to a straight grade is shown in Fig. 14.

Under exceptional conditions, where the necessary space or fall is not available for the disposal line of drain tile, the effluent from the septic tank can be discharged into a cesspool. This, of course, should be located at a safe distance from the water supply.

Putting the System Into Operation

When the forms for the concrete are removed, plaster all pockets that appear in the walls and floor with cement mortar so there will be

no leakage. Finally, cut the baffle boards from 2-inch planks and place two 2-by-10-inch planks in each groove.

When the tank has been completely filled with water it is ready for operation. If it is covered with earth to a depth of 6 or more inches, it will be less offensive and its temperature will remain more favorable for bacterial action.

Maintaining the Septic Tank

The tank will require cleaning at intervals in order to keep it working efficiently. It should be inspected at least once a year. Scum and sludge will gradually accumulate at the top and bottom of the tank and reduce bacterial activity. The sewage may still continue to pass thru as usual but it will not be digested and purified.

Effluent should never be allowed to back up into the tank. If this should occur it can be detected without uncovering the tank by passing a stick thru the inspection tile that is provided in the tank cover directly over the inlet tile and noting height of sewage at inlet.

A tank of proper size should operate efficiently for three to seven years without cleaning, but a tank that is too small may require cleaning more than once a year. In general, a depth of scum of about a foot on top of the large chamber indicates that cleaning is needed. Less scum and sludge accumulates in the second chamber, but it is well to clean both of them at the same time.

A septic tank can be cleaned easily by pumping it out with a diaphragm or trench pump while the contents are agitated with a board paddle. Additional water may be used to dilute the solids if necessary. A bucket may be used to bail out the contents if a satisfactory pump is not available. The sludge may be dumped in a trench and covered or it may be placed on a field and plowed under but it should not be so disposed of in a garden.

Building a Single-Chamber Septic Tank

Figure 16 shows a plan for a single-chamber septic tank suitable for seven people or less. The inside length is 6 feet. The location of the tank and other features of construction which are more fully discussed under the two-chamber tank on pages 3 to 6 and 12 to 15 should be read and referred to in planning the work for this tank.

Materials Necessary. Fourteen bags of cement, 1⅛ cubic yards of sand, and 2¼ yards of gravel are required for this size of tank.

The Excavation. For the ordinary size of tank make the excavation 6 feet 10 inches long and 3 feet 10 inches wide. The depth of the excavation will usually be the same as that for the larger tank, that is, about 6½ to 7 feet, but the exact depth, as for any other installation, is determined by the location of the outlet and inlet tiles. The bottom of the excavation must be 4 feet 8 inches below the bottom of the inlet and 4 feet 4 inches below the bottom of the outlet tile.

TABLE 2.—DIMENSIONS AND MATERIALS REQUIRED FOR SINGLE-CHAMBER SEPTIC TANKS FOR INSTALLATIONS ACCOMMODATING UP TO 15 PEOPLE

Number of people	Inside length of tank (distance *C*, Fig. 16)	Cement	Sand	Gravel	Concrete
	ft.	*bags*	*cu. yds.*	*cu. yds.*	*cu. yds.*
7 or less	6	14	1⅛	2¼	2⅛
9	7	15	1¼	2¼	2⅜
12	8	17	1⅓	2½	2⅝
15	9	18	1½	2¾	2⅞

The proper capacity for the different sized installations is secured by using tank lengths given in this table. All other dimensions of the tank remain constant, as shown below.

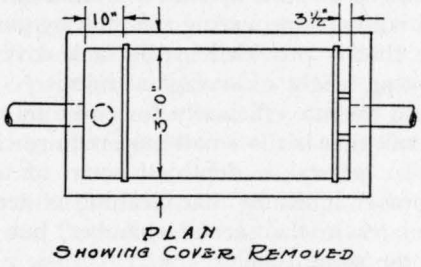

TABLE OF SIZES

NUMBER OF PEOPLE	DISTANCE -C-
7 or less	6'0"
9	7'0"
12	8'0"
15	9'0"

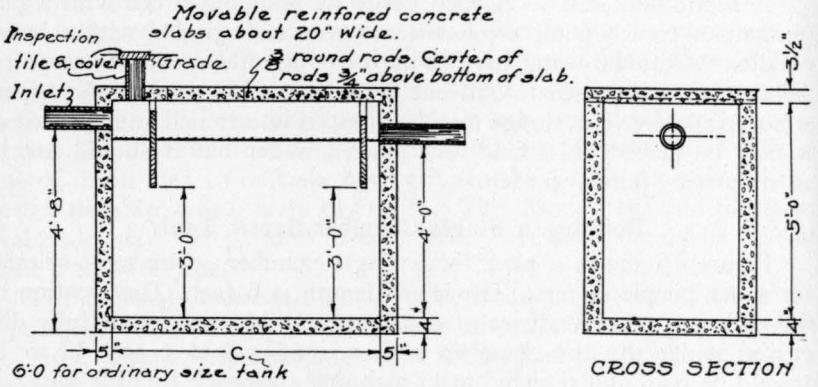

FIG. 16.—DESIGN FOR A SINGLE-CHAMBER TANK

The single-chamber tank is less expensive than the two-chamber tank, is easy to build, and should give reasonably good service where there is an ample area of porous, well-drained soil for the location of the disposal tile.

Provision for Outlet and Inlet Tiles. Openings must be made in the concrete wall of the tank for the entrance of the inlet and outlet tiles at the proper levels. The easiest way to do this is to lay the tile directly in the trench (Fig. 4) or to insert it in the side wall (Fig. 5)

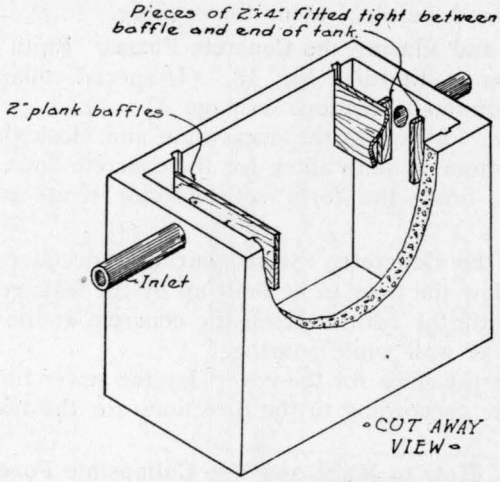

FIG. 17.—CUT-AWAY VIEW OF A SINGLE-CHAMBER TANK

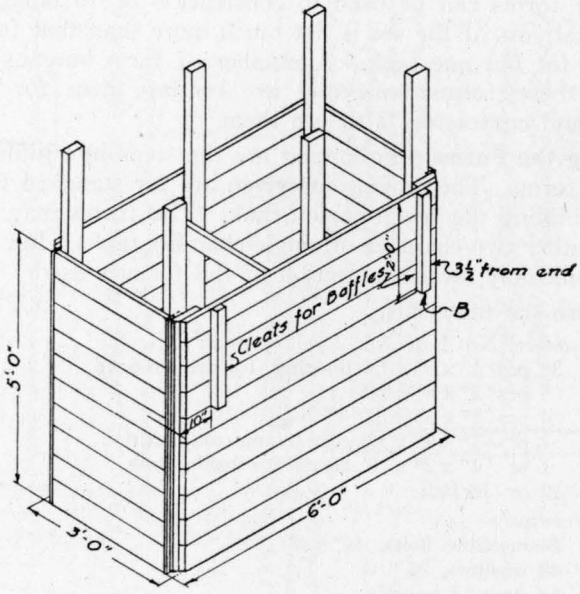

FIG. 18.—FORMS ASSEMBLED FOR BUILDING A SINGLE-CHAMBER SEPTIC TANK

and then butt it firmly against the side of the form. The concrete will flow around the tile, leaving the opening.

Building and Placing the Concrete Forms. Build or assemble the form sections as shown in Fig. 18. (If special collapsible forms are used, see additional directions on page 20.)

Lower the forms into the excavation and block them up 4 inches above the bottom so as to allow for the concrete floor. Before placing the concrete, brace the form with interior struts so as to prevent bulging.

Pouring the Concrete. Start pouring the concrete for the side walls and allow the floor to be built up by the leakage underneath the bottom edge of the forms. Keep the concrete at the same height on all sides of the wall while pouring.

Construct the slabs for the cover, lay the sewer tile, install the disposal line, etc., according to the directions for the two-chamber tank.

How to Make and Use Collapsible Forms

Collapsible forms for the concrete work on septic tanks effect considerable saving when several tanks are to be built. They are built in sections so that they can be bolted together for repeated use. One set of forms can be used to construct 8 or 10 tanks, or more, and the total cost of the set is not much more than that for a simple form used for but one tank. A number of farm bureaus in Illinois have had these forms built and are renting them for farm use. Plumbers and contractors also use them.

Building the Forms. Following are the steps in building a set of collapsible forms. The dimensions given are for standard forms to be used for building the seven-person tank. The forms may be used to construct either two-chamber or single-chamber tanks. For the single-chamber tank only the large section of the form is used.

1. Secure the materials.

Lumber, No. 1 or No. 2 yellow pine:

30 pcs	1″ x 6″ x 12′	flooring, tongue grooved
5 pcs	2″ x 4″ x 14′	
4 pcs	1″ x 6″ x 10′	
1 pc	1″ x 4″ x 12′	core frame and struts
1 pc	1″ x 2″ x 8′	cleats for baffle slots
10 or 12	lath	

Hardware

24	machine bolts, ⅜″ x 4″
48	washers, ⅜″
	6d nails, 2 pounds
	8d nails, 3 pounds

2. Study the details of construction shown in Figs. 10 and 19.

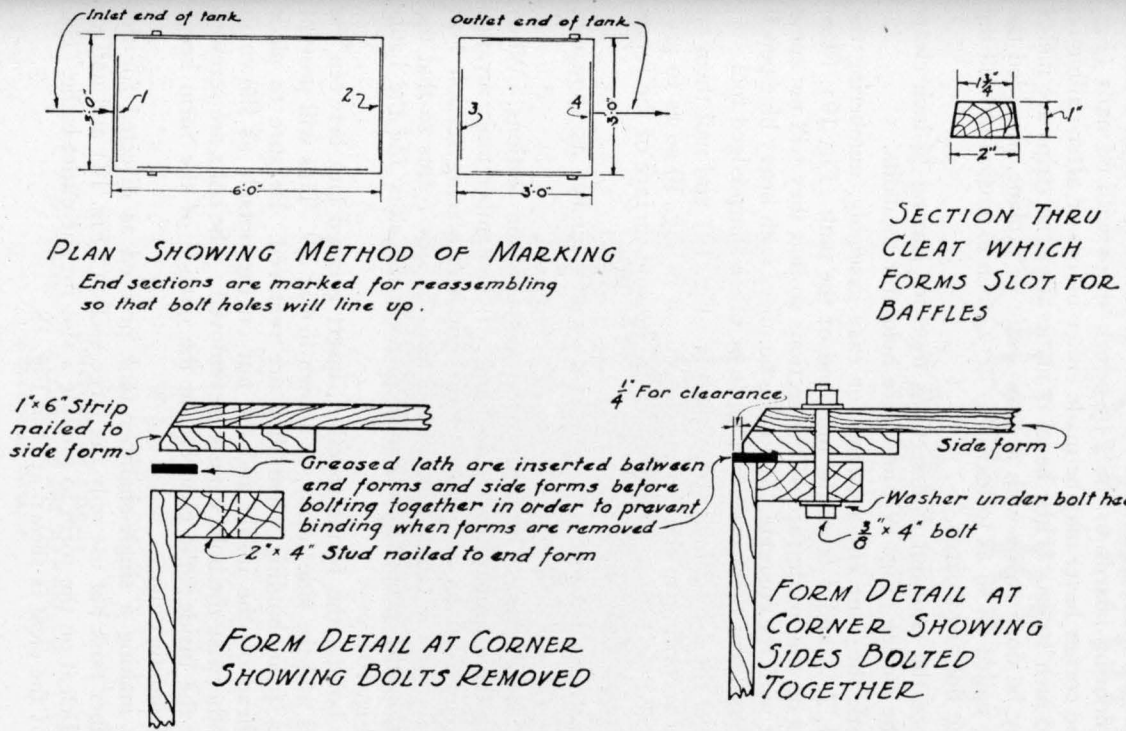

FIG. 19.—DETAILS IN CONSTRUCTION OF SPECIAL COLLAPSIBLE FORMS WHICH CAN BE USED REPEATEDLY

These forms can be removed from the concrete by drawing the bolts from the inside and then removing the sections one at a time. They can then be easily hauled to another place and reassembled as shown in Fig. 10 for the construction of other septic tanks.

3. Build up the four ends sections (Fig. 10, *A*) . Each of these sections is built in the same manner by cutting the flooring 2 feet 9 inches long and nailing to studs. Use 8d nails for this work.

4. Build up the side sections for both the small and large chambers. Nail the flooring boards to the 1-by-6-inch strips with 6d nails (Fig. 19). The corner bevel may be made either before or after nailing on the 1-by-6-inch strips. If the bevel is made after the strips are nailed on, it may be done easily with a draw knife or a plane, provided the strips are nailed on so as to leave ⅛- or ¼-inch extension beyond the end of the flooring boards.

5. Place the end and side sections together leaving ¼-inch clearance at the corner (Fig. 19), and bore holes for the bolts.

6. Mark the four end sections for easy assembly, numbering the sections 1, 2, 3, and 4 from the inlet end of the tank (Fig. 19). Place the marks on the inside face of the sections so that they will not come in contact with the concrete. Make the numbers with heavy blue pencil or, better still, cut them in with a knife or other sharp-edged tool.

7. Bevel the 1-by-2-inch strips slightly (Fig. 19) and nail them on the forms according to the dimensions shown in Fig. 10 so as to provide slots for the baffles. Paint the entire outside surface of the forms with old crank-case oil.

8. Construct the core frame of 1-by-4-inch lumber as shown in Fig. 11.

Using the Forms. The forms are transported in sections. When assembling them preparatory to building a two-chamber tank, arrange the four end sections according to the numbers placing section 1 at the inlet end of the tank (Fig. 19). Place the side forms so that the cleats are in the proper position to provide the slots for the baffle boards (Fig. 10).

When bolting the forms together, insert greased lath between the end forms and the side forms, as shown in Fig. 19. This will prevent the forms from binding when they are removed. Be sure to place the bolt head on the inside and the nut on the outside as shown in Fig. 19; otherwise the bolts cannot be removed. The bolts are screwed out from the inside; the concrete on the outside of the form keeps the nut from turning.

When making a single-chamber tank proceed as directed for the two-chamber tank but use only the large section (Fig. 18) and nail an additional cleat on the form to provide a slot for the outlet baffle. The position of the cleat is shown at *B* in Fig. 18.