The Septic Tank and Tile Sewage Disposal System
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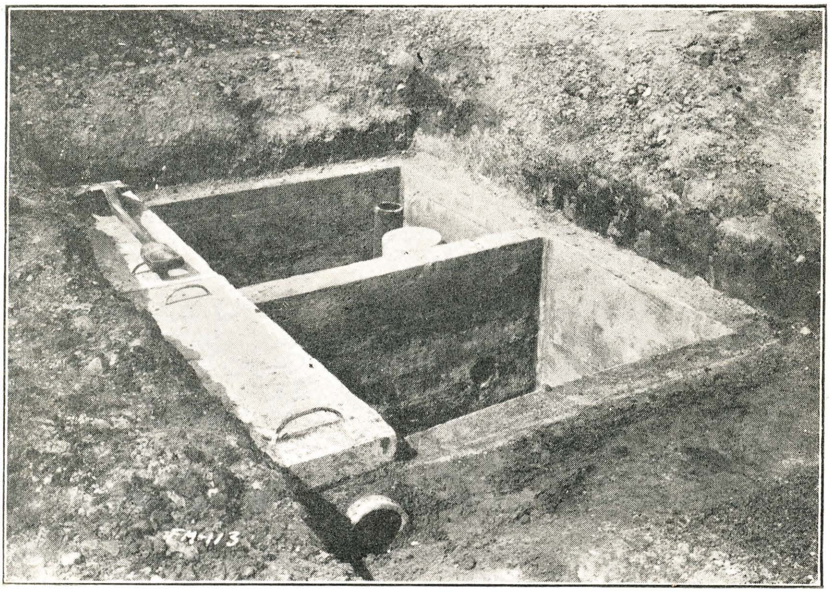
By H. H. MUSSELMAN AND O. E. ROBEY



Septic Tank—Part of Top Slabs Removed

AGRICULTURAL EXPERIMENT STATION
MICHIGAN STATE COLLEGE

AGRICULTURAL ENGINEERING SECTION

East Lansing, Michigan

INFORMATION

If suggestions are wanted on an installation to meet unusual conditions, the following blank should be filled out giving the necessary information.

1. Name .... Date....................
2. Address ....
3. Location............... Miles North........ Miles East........
   of.................................
   Miles South........ Miles West........
   of.................................
4. How is water supplied?..
5. How many persons will be served?............................
6. How many houses will be served?.............................
   ....Subsoil?.............
7. What other liquids will go into the tank besides house sewage and wastes? ....
8. What kind of soil is found around site for the septic tank?........
9. What is the slope of ground in feet per hundred feet distance? ....
10. Are underdrains near the site of tank?........ How far?........
11. Is drainage good? ....
12. How far are outlets of underdrains from tank?..................
13. How far from tank to a running stream?.......................
14. Kind and depth of well?...
15. Distance of well from tank site?..............................
16. Does water come from gravel, clay or rock?....................
17. Is gravel convenient for building purposes?....................
18. Make sketch of house and other buildings near and show ground slope by arrows pointing down the slope. Also state amount of slope. Questions should be sent to the Department of Agricultural Engineering, Michigan State College of Agriculture and Applied Science, East Lansing, Michigan.

The Septic Tank and Tile Sewage Disposal System

BY H. H. MUSSELMAN AND O. E. ROBEY

Part I

DESIGN

A sewage disposal system is fundamental to the installation of other conveniences in the farm home. Before running water can become possible, or at least practicable, it is necessary to provide some means of removing the waste water. A septic tank and tile system provides that means, and at the same time provides the best possible methods of safe-guarding the water supply against contamination from these wastes.

The septic tank and tile system is to the farm home what the sewer system is to the city. It provides a satisfactory means of disposing of the wastes from the kitchen, laundry, and bathroom.

Its operation is dependent upon a natural decomposition process,—through the action of bacteria. These bacteria first break down the sewage and then render it practically sterile and harmless. At all times the sewage is kept away from flies, and thus the food and water supply is safe-guarded and the family protected from typhoid and kindred diseases.

Its cost is not prohibitive, and its construction is little more difficult than the building of a concrete water tank.

The Michigan Septic Tank

The septic tank described in this bulletin is the outgrowth of the experience gained through the construction of several systems and from observations on the operation of many of these systems under various conditions, extending over a period of thirteen years.

The design follows very closely the accepted design of systems of this type, but slight changes have been made to cheapen or simplify its construction.

Features of Design

In the Michigan Septic Tank, as well as in many other designs, two distinct processes of bacterial action are employed to bring about complete decomposition of the sewage. These processes will be described by indicating the use of the four units which make up the complete system. These units are as follows:

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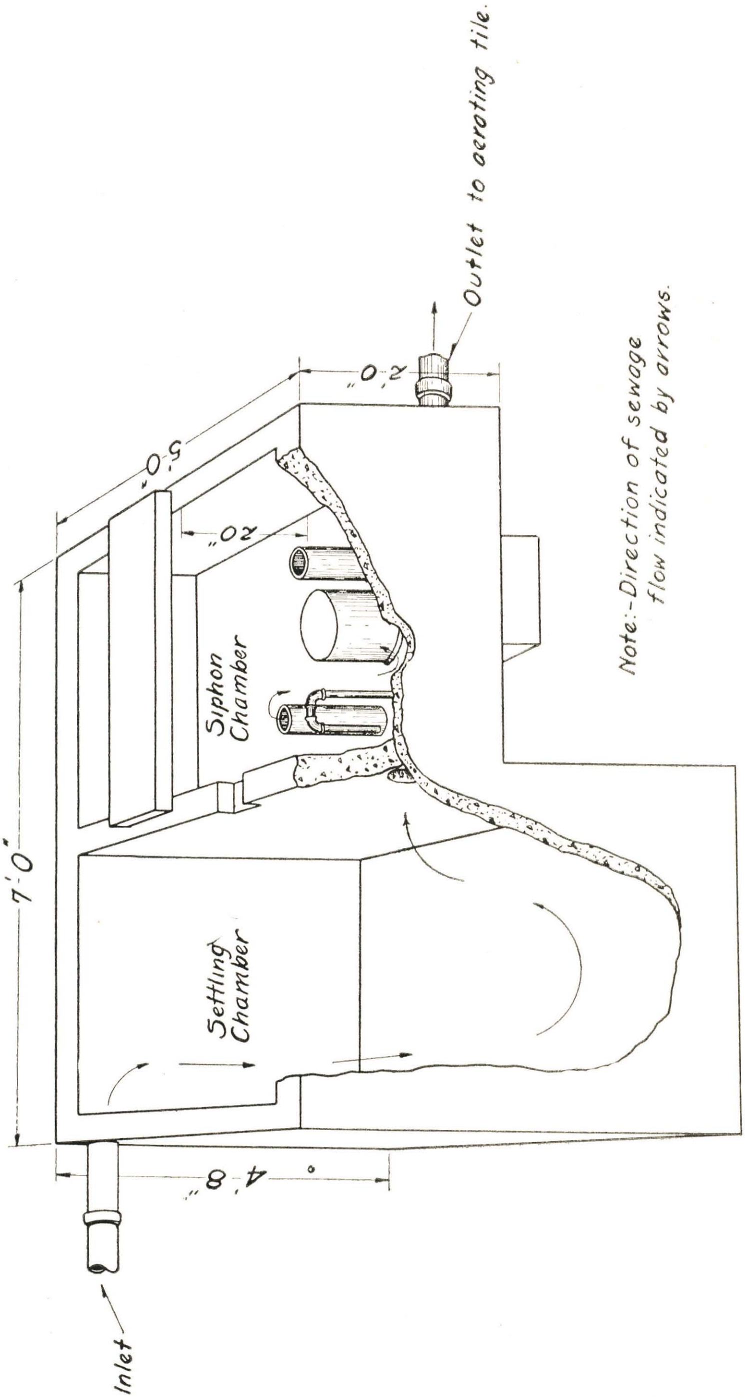

Fig. 1.—Interior of tank showing inlet, overflow, siphon, safety overflow, and outlet.

1. Anaerobic and settling chamber for the decomposition of solids in the sewage.
2. Siphon chamber for the accumulation of sewage from the settling chamber in quantities large enough to insure effective distribution in the aerating tile system.
3. Siphon for discharging at intervals the contents of the siphon chamber into the aerating tile system.
4. Aerating tile system of drain tile which has for its purpose the spreading or distribution of the sewage through a large area of porous soil.

ANAEROBIC AND SETTLING CHAMBER

Minute organisms which flourish in the absence of light and air attack the organic matter of the sewage which enters the first compartment, the anaerobic and settling chamber, and reduces it to a partly liquid and partly gaseous state. Mineral and other matter which is not affected by bacterial action settles to the bottom of the compartment as a dark, mud-colored sludge. Due to these changes, some of the lighter matter rises to the surface, and a growth or blanket of material may form over the surface of the liquid which will serve to exclude the air and aid in furnishing the desired working conditions for bacteria. The formation of this scum, however, is not essential. Because the sewage undergoes a progressive process of breaking down, its passage should be gradual through the tank and the contents should be disturbed as little as possible by the incoming stream.

In operation, the inlet pipe empties the sewage in one corner of the tank. It then flows to the other end, creating little disturbance in the tank. The opening which carries the liquid from this chamber of the tank to the next is placed in the opposite corner so that the liquid moves through the length of the tank before passing out. This latter opening takes the liquid from some distance beneath the surface so that very little scum, sludge, or obstructing matter will be taken through into the next chamber.

The inlet pipe sometimes consists of a sewer pipe ell, bent down below the surface of the liquid. Experience with this tank, however, has indicated that the omission of the ell inlet permits ventilation of the tank and sewer, and that the incoming stream, directed along and down the end wall from the corner, will create little disturbance to interfere with the operation of the tank. Any gases forming in the tank will pass out to the house vent stack through the sewer connecting the house and septic tank.

The capacity of the settling chamber is made such that a total flow of liquid of from 150 to 300 gallons daily may be received. Under farm conditions it is estimated that the daily water consumption for all house purposes will be from 20 to 30 gallons per capita. Using these figures, the tank will care for six persons with ample overload capacity. It is recommended that the tank be made not larger than shown for average conditions. The depth is made such that one foot is allowed for the accumulation of sludge. A notch is made in the top of the division wall between this and the siphon chamber for the purpose of venting both chambers as well as the tile line. Absence of light and air favor the decomposition processes taking place in this chamber, so this chamber, as well as the rest of the tank proper is covered with reinforced concrete slabs which should in turn be covered with not more than a foot of earth.

The amount and flow of sewage from the settling chamber corresponds closely to the amount and flow into it, since the level remains the same as the liquid passes through. As the liquid enters and leaves the tank the blanket or scum which forms on the surface may accumulate until several inches thick, but it is of no consequence as long as it does not obstruct the passage of liquid.

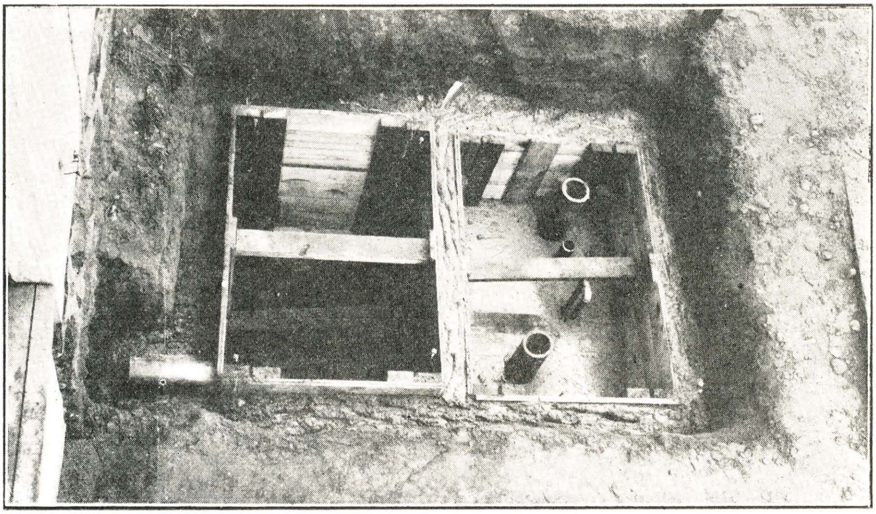

Fig. 2.—Tank under construction. Concrete nearly all placed. Note the inlet tile is set against the forms.

THE SIPHON CHAMBER

The liquid from the anaerobic and settling chamber flows into the siphon chamber as it is forced out by incoming sewage. The function of the siphon chamber is little more than that of a storage chamber. It is of a size to hold approximately the amount of sewage which will be discharged from the settling chamber in 12 to 24 hours. In it is placed the siphon which discharges automatically, and in a few minutes time, the accumulated liquid into the areating tile system. A safety overflow pipe, which stands higher than the siphon discharge line, is also provided. The siphon may be located at any place in the second chamber, and the outlet may run in any direction from this chamber except, of course, toward the settling chamber. By installing the tank with the siphon outlet at the least possible depth beneath the surface of the ground, it is possible to install the tank on ground which is nearly level and keep the areating tile at the proper depth.

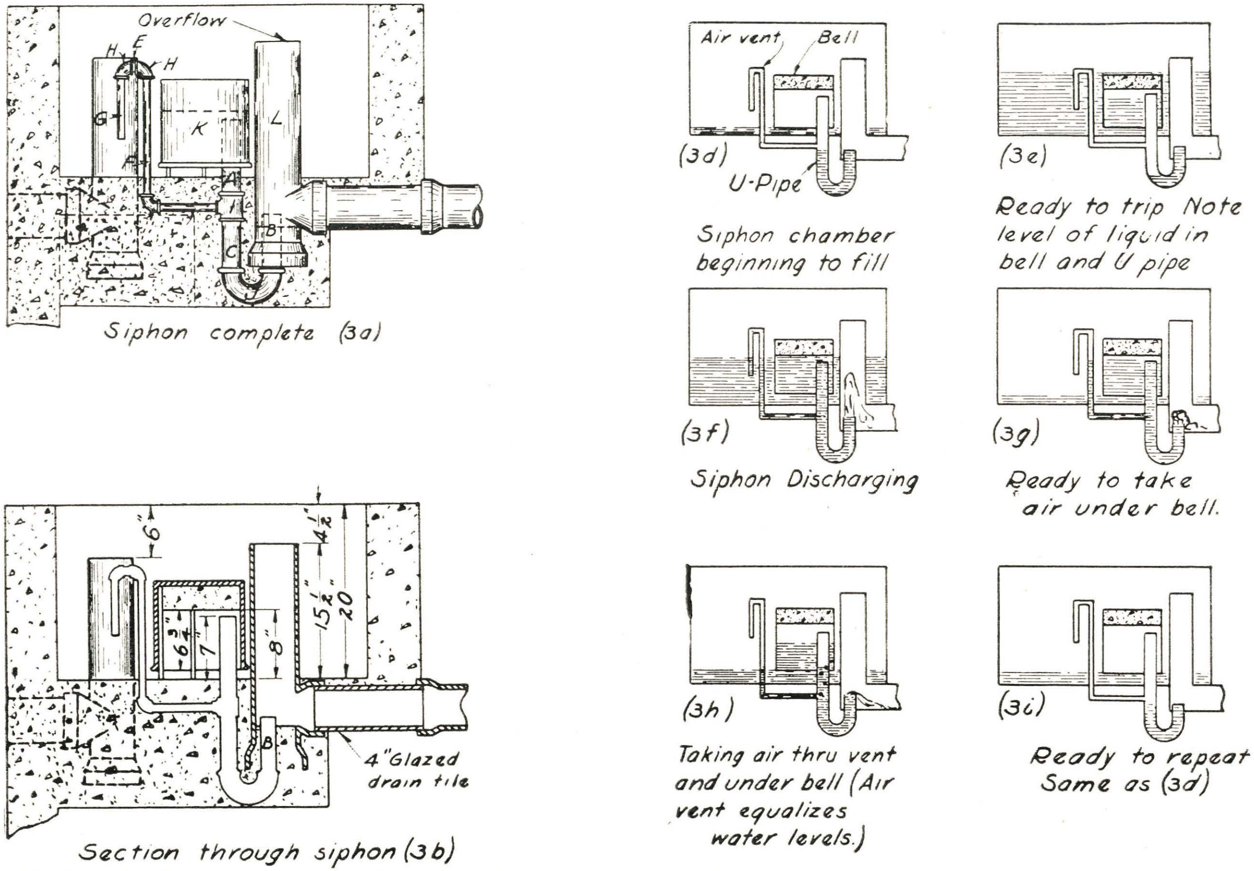

Fig. 3.—The siphon fills the aerating tile at intervals insuring effective distribution. The operation of the automatic siphon is shown in the diagram.

THE SIPHON

The function of the automatic siphon is to discharge the contents of the siphon chamber at intervals depending upon the time in which the chamber fills. The siphon performs an important part of the work because it discharges a volume of liquid at one time sufficient to force the liquid to all parts of the tile system, thereby insuring complete distribution. In tanks which do not have the automatic siphon, effective distribution is not always secured. Failure of the siphon to operate or absence of the siphon simply reduces the efficiency of the sewage decomposition in the soil.

Since the siphon discharges intermittently, a considerable time for aeration of the soil elapses after each discharge so that the most favorable conditions for bacterial action are approached.

The operation of the Michigan Septic Tank Siphon is as follows:

The lower part of U-pipe is filled with liquid, and as the level rises in the tank, air is trapped under the bell and in the vent pipe. As the liquid continues to rise the trapped air, being compressed, keeps the level of the liquid in the bell below the top of U-pipe, (Fig. 3-e). When the liquid reaches the bend in the lower part of the U-pipe, the trapped air rushes around the bend and expels some of the water from the short end of the pipe which releases the pressure and allows the siphon to start, (Fig. 3-f). Siphonic action continues until the level of the liquid reaches the lower edge of the bell. Air is then drawn underneath the bell and the siphon stops, (Fig. 3-g). Liquid does not pass through the small vent "G" (Fig. 3-a), but up under the bell and down the pipe "A". The air vent "G" has practically no effect on the operation of the siphon until air is taken under the bell and the siphon stops. Air then enters the vent, (Fig. 3-h), and allows the liquid under the bell to drop back to the same level as that outside the bell. The venting of the bell insures that the conditions under which the bell begins to fill are the same in every case and, therefore, reliability of performance.

The siphon may be made up by the local hardware dealer or plumber. If it is not desired to have it made locally, manufactured siphons of standard design ready to install may be purchased from plumbing supply houses.

An illustration of a standard manufactured siphon is shown in Figure 4. The chief advantage of the manufactured siphon lies in its ease of installation, there being little chance for error in setting it. It might be added that manufactured siphons which have a draft of not over 13 inches may be used with this design of tank without any other changes. For siphons having more than this depth of draft the siphon chamber will need to be deepened.

It is thought by many that a bent pipe from the second chamber will serve the same purpose as the automatic siphon. This arrangement does not discharge large volumes of liquid intermittently and perhaps the only advantage which it has over a plain opening in the wall is that it takes the liquid from below the surface, thereby, preventing surface scum from passing over into the tile system.

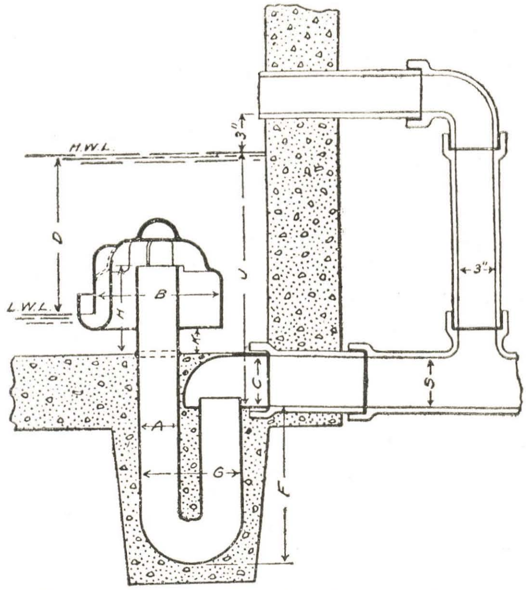

Fig. 4.—A manufactured siphon installed.

THE AERATING SYSTEM

Having undergone the decomposition performed by anaerobic bacteria, the sewage is subjected to the action of aerobic bacteria which are the minute organisms which grow in the presence of air. The action of this type of bacteria mineralizes organic matter. Abundant examples of this action may be found in the soil. Manure and vegetable matter plowed under soon disappear. Well-drained, porous soils which receive sufficient moisture to aid the decomposition process quickly change these forms of organic matter to a form available for plant food. This action is partly due to the above-mentioned microscopic organism in the soil.

The final disposal of sewage through a tile system laid a few inches below the surface of the ground, is only a means of securing favorable working conditions for these soil organisms and the design of the system must be made on that basis. The essential thing is to dispose of the liquid in such a way as not to interfere with the air requirements of the soil organisms. To accomplish this, the tile are kept close to the surface of the ground and distributed over a considerable area. If the liquid can be distributed intermittently so that time is allowed for aeration between charges, it has been found that the action will be more effective. The automatic siphon accomplishes the intermittent distribution.

The tile system is not the only way in which the sewage may be distributed, but it seems to be the one best adapted to the farm. In practice, ordinary 3-inch or 4-inch glazed drain tile are used. They are placed with the bottoms 12 to 20 inches below the surface of the ground, and laid on a grade of 1 inch in 50 feet from the tank. In irregular ground, the tile lines are made to fit the irregularity of the slope and still keep the required grade. In open porous soil one foot of tile may be allowed for each gallon of liquid discharged per day. On this basis it will be seen that for six persons with a daily water consumption of 25 gallons each not less than 150 feet of tile will be required. In less porous soils a greater allowance is often necessary. In unfavorable conditions, the tile are sometimes laid in two lines, each of sufficient length to act as a complete distribution line, with a switch arranged so that the sewage may be directed into either line. This arrangement permits periods of rest in case one line becomes water-logged or "sewage sick" from too great quantities of liquid. In other words more complete aeration is permitted.

Purity of Effluent

While the processes undergone in the septic tank and tile system may very greatly reduce the number of disease germs which might be found in it, it is not to be assumed that the septic tank system will guarantee freedom from danger as a source of contamination. The tank and the sewers leading to and from the tank should be made water-tight for a safe distance from the house and well. The aerating tile system should be so placed that it is not a source of danger. It is difficult to set a limit for the distance from the well, but perhaps in no case should the aerating tile system be placed less than 100 feet from the water supply, and then only when there is no possibility of surface drainage from the aerating tile to the house or well.

Location of the Aerating Tile System

The aerating tile system may be located near the tank or some distance away depending upon two factors: The character of the ground, the location of the well. It is advisable for the tile system to be placed as far away from the well as possible. One hundred feet is the least distance recommended. When the aerating tile system is located some distance from the tank to avoid the well, and the sewer passes within questionable distance of the well, sewer pipe with cemented joints should be used to carry the sewage past the well to the aerating tile system.

Drainage

The ground selected for the aerating tile system should be as sandy and as loose and porous as possible. Gravel, sand, and sand loam, or well underdrained clay loam serve very well.

In heavier soil, the aerating tile plot should be drained by tile laid at a depth of 2½ to 3 feet, parallel to and a few feet from the aerating tile. Sometimes the aerating tile can be laid in two lines about 10 to 20 feet apart with a drain tile below and midway between. In extremely heavy soil, or where it is desired to discharge the effluent into a drain tile line, the drain tile are uncovered and the trench is then filled with loose sand, gravel or cinders to a depth which will permit the aerating tile to be laid directly over the drain tile at the proper depth. This is considered better than tapping into the drain tile which is sometimes done, as it eliminates any possible danger of clogging of the drain tile.

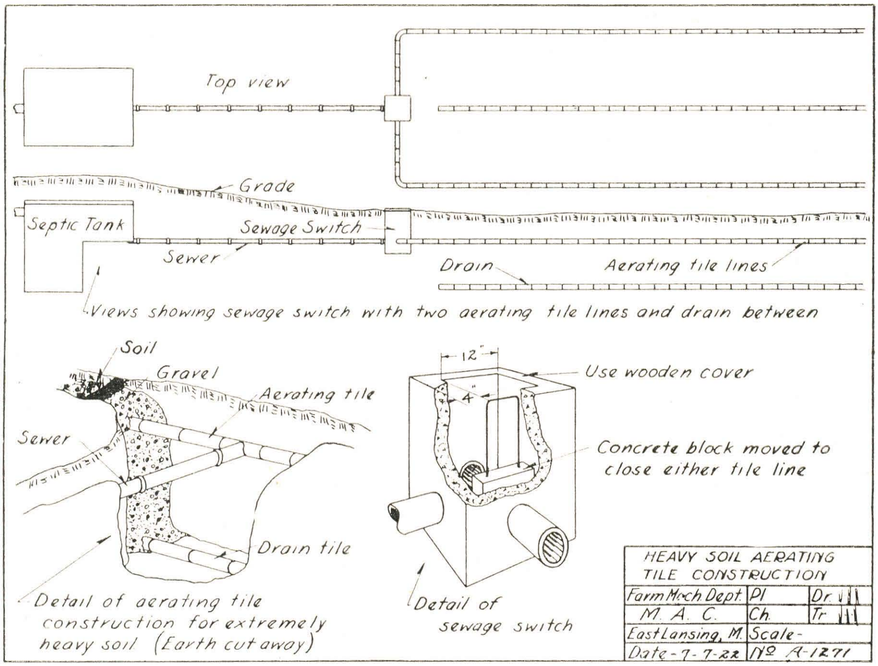

Fig. 5.—Porous well drained soil is necessary to final disposal of sewage. It is sometimes necessary to use drain tile and trenches filled with sand and gravel.

Aerating Tile on Hillsides

The diverting box shown in Fig. 6 may be used when several tile lines are to be used on a hill. As the box fills the first branches are filled, and as they become full, the overflow goes to the tiles farther down the hill. The construction prevents the liquid from rushing first to the lower part of the tile system at each discharge of the siphon.

Double Aerating Tile System

Another device sometimes used where unfavorable conditions prevail is the construction of a double line of aerating tile, each with sufficient length to handle the effluent of the tank. A sewage switch is then constructed, as in Fig. 5, which is used to direct the liquid alternately into the separate tile systems. Using one line of the system at a time, prevents the ground becoming water-logged, and gives the system not in use time to recuperate and develop favorable conditions for bacterial action. The switch is thrown once or more each month.

The Cess Pool

The cess pool should not be classed with the septic tank and tile system. The cess pool is a single chamber constructed with a sand or porous bottom which is intended to retain the solids and allow the liquid to filter through. For some time after installation, septic action

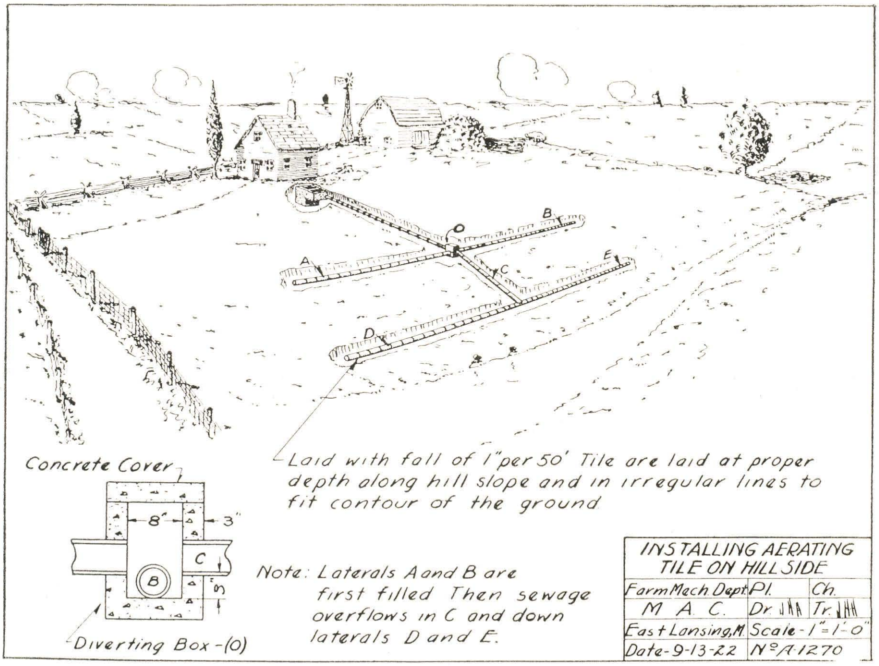

Fig. 6.—Shows how aeration tile may be laid on a hill slope, using a diverting box to get good distribution.

may keep up. In time, however, the porous bottom becomes clogged with sludge and the liquids cannot escape. Even when the liquid part does pass through it is not completely decomposed, the depth at which it enters the ground being so great that little or no bacterial action can take place to further the decomposition. Perhaps the worst danger of the cess pool is that this unpurified liquid may find its way through gravel or rock strata and contaminate the water supply.

Location of Septic Tank

The tank may be located at any convenient distance from the house, but when placed close to the house the sewer, with its possible troubles of clogging and freezing, is practically eliminated. On level ground the tank should be placed adjacent to the basement wall with the top practically level with the surface, in order that the aerating tile system will not be too far below the surface of the ground. Where the land is level, it may be necessary to mound the earth over the tank. It might be added that where the lay of the ground will permit, the better arrangement is to have the tank farther from the house with the top of the cover 6 to 12 inches below the surface and the outlet tile carried to a point where the aerating tile can be laid at the proper depth.

The Sewer

The sewer which carries the liquids from the house to the septic tank, or from the siphon chamber of the septic tank to the aerating tile system, becomes an important part of the disposal system. Pipe used in the house for carrying sewage should, of course, be of cast iron. Between the house and the septic tank, vitrified sewer tile should be used and the joints sealed with cement mortar. If the aerating field is at some distance from the tank, and especially if the pipe leading to it is within the danger zone, or about 100 feet from the well, the joints of the sewer should be cemented. The grade of the sewer should be uniform, laid to a line, and have a fall of perhaps one inch in ten feet. Each tile should be carefully laid to secure an even bottom. A swab of rags or board scoop shaped to fit the pipe should be drawn through each section of pipe after laying, to remove any cement which may have reached the inside of the pipe. These precautions will reduce the tendency to clog.

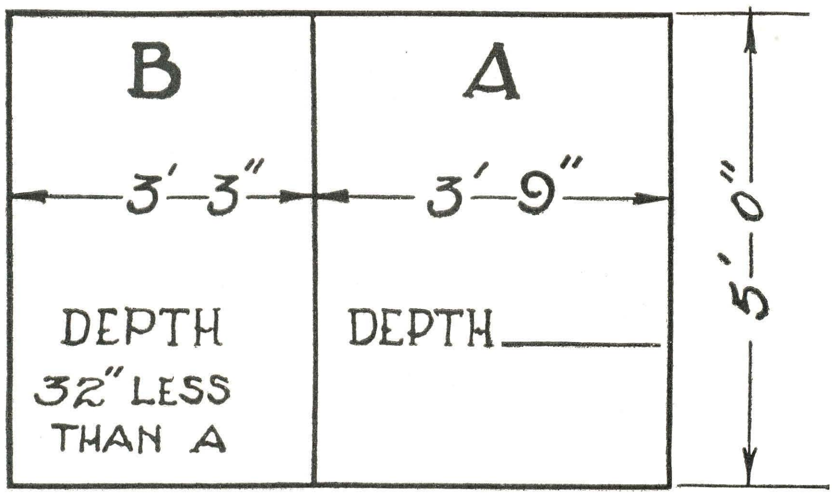

Fig. 6A.—Shows dimensions for excavating for septic tank. Depth of settling chamber depends upon depth tank is placed below ground level. Depth of siphon chamber is 32 inches less than that of settling chamber.

Excavation

Where earth is to be used for the outside form, excavation should be started for the outside dimensions of the tank, care being taken to square the corners and keep the walls plumb as the work proceeds. Time spent in making the walls true and plumb will be amply repaid in the saving of concrete and unnecessary labor used to fill up irregular spaces. The walls may be plumbed with a carpenter's level, or by means of a string tied to a stone which will serve as a plumb-bob. The excavation should be laid out on the ground as a rectangle using a string or boards to mark the boundary of the excavation.

Forms

The forms for the two chambers consist of two rectangular bottomless boxes, which may be built up in any way desired, but which can be built and used most satisfactory after the plan of the "take down" forms shown in Fig. 10.

These forms will be found economical of both labor and material, and have the further advantage that since they do not have to be rebuilt each time they are used, several tanks may be built with one set of forms, thereby reducing the cost of each.

Concrete

The proportions of cement and gravel should be 1:5, if bank run gravel is used. By bank run gravel is meant the material as taken from the pit which contains grains or pebbles of all sizes. The best concrete is made from gravel in which the size of pebbles is properly graded

Fig. 7.—If a mixer is not available concrete may be mixed to best advantage on a platform.

from fine to coarse, with about half as much sand as gravel. Sizes not over 1½ inches in diameter may be used for this work. Sand is the material of such size as will pass through a screen having one-fourth-inch mesh or openings, and gravel is the material which will not pass through the same screen. Bank run gravel can be tested at the pit with a screen and pail. Material which is more than 2/3 sand is not desirable.

For proportioning, build a bottomless box to use for measuring the gravel. A bag of cement may be counted as a cubic foot, and the box should be made large enough to hold gravel for a one or two bag mix. Where the sand and gravel are separate, the box should be made large enough to hold the gravel for a one or two bag mix and the sand can be measured in the same box.

Mixing on a flat surface with a shovel will be found faster than in a box. A board platform 8 feet by 10 feet, an old barn door, or flat surface of boards, will serve. The material should be thoroughly mixed dry, and water added. After adding water, mix thoroughly to quaking consistency, or until it will slump down when piled high.

Part II

DIRECTIONS FOR BUILDING

Location of Tank

Select a site which can be reached conveniently with the sewer, which is as far from the well as possible, and which is high enough to get fall to the aerating tile field. A site close to the house will reduce the length of the house sewer.

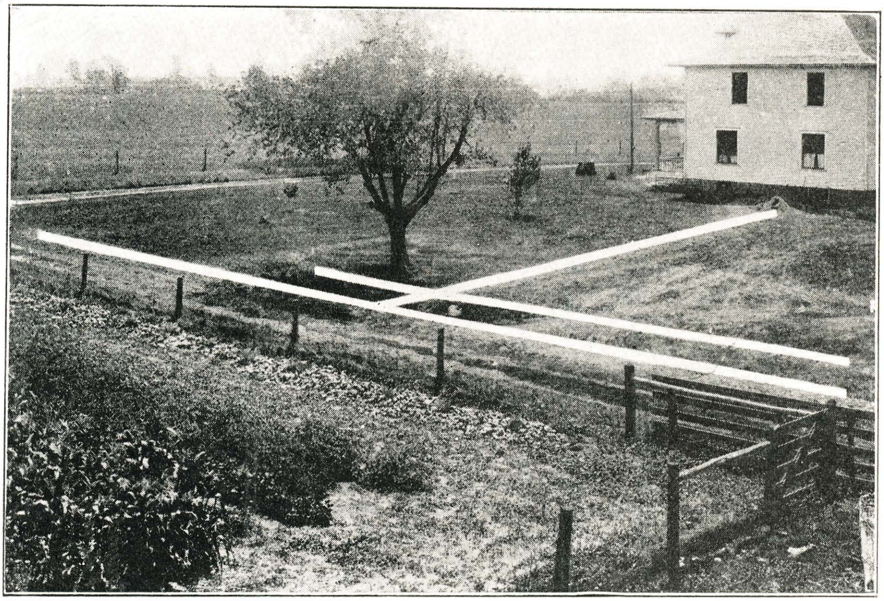

Fig. 8.—The white parallel lines show the location of the aerating tile. The septic tank in this instance is adjacent to the house.

Location of Aerating Tile Field

Place in porous ground (sand, sand loam, or light clay loam) which has good drainage and which is at least 100 feet from the well. A meadow or cultivated plot will answer. The garden is not recommended.

Levels

If a better instrument for leveling cannot be obtained, a carpenter's level may be set upon a box, post, or stake with a board nailed on top. A wooden wedge placed under one end of the level may be used to bring the bubble to the center. By sighting along the top of this level, with the bubble in the center, a level line is obtained. Use a 10-foot pole

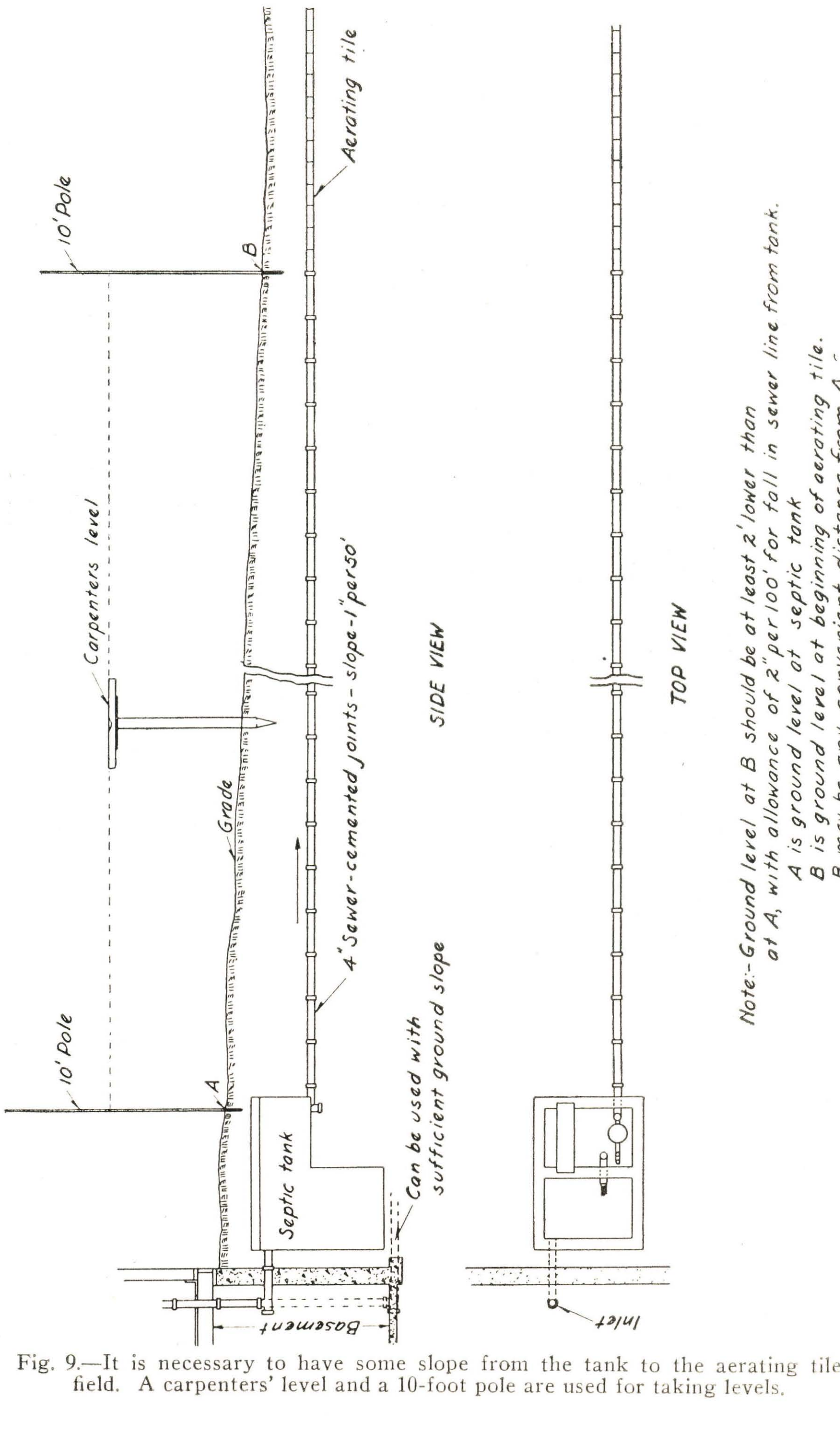

Fig. 9.—It is necessary to have some slope from the tank to the aerating tile field. A carpenters' level and a 10-foot pole are used for taking levels.

and carpenter's rule for measuring heights. The necessary slope or fall in the ground from the tank to the proposed beginning of the aerating tile, is given in the following table for different depths of the tank below the surface. This amount of slope is necessary to bring the aerating tile to the proper depth below the surface of the ground. More slope than that given as necessary in the following table is desirable.

Top of cover slabs	Necessary slope in ground from tank to beginning of aeration tile line	
6″ above ground (tank to be mounded over)	12″	Add one inch for each fifty feet of tile in sewer from tank to aerating tile.
Level with ground (tank mounded over)	18″	
6″ below ground	24″	
1′ below ground	30″	

Leveling for Tank and Tile Field

Set the level up midway between the tank and aerating tile field and find the slope from the ground level at the tank to the ground level at the aerating tile field by finding the difference between pole readings at these two points. The difference in pole readings will be the ground slope and should be equal to or more than the amount shown in table for corresponding depth of tank. If sufficient slope is not found, try a new location for the aerating tile field which will better meet conditions.

To obtain the grade for the aerating tile, set a stake driven to ground level at the beginning of the aerating tile field. Set the 10-foot pole on this stake and take a level line reading on the rod, sighting over the level. Move the 10-foot pole to a new place along the proposed tile line. Another level line reading is then taken and should be the same as the first with one inch added for each 50 feet the pole is distant from the first stake. It may be necessary to move the pole up or down the hill slope to obtain this figure. Drive a stake at this point and continue to take other readings in the same way until a location is found for the entire aerating tile line. This line may be curved or irregular which does not matter as long as the grade and depth of tile are kept right.

Setting Grade Bars

Set 6-foot stakes on each side of the proposed tile at the tank and at intervals of 50 feet along the sewer and aerating tile line, and nail a crossbar 6 feet above the outlet at the tank. Again using the level and making an allowance for the necessary fall in the aerating tile of 1 inch in 50 foot, nail crossbars on the other stakes. Stretch a string over the crossbars which will be 6 feet above the bottom of the ditch. In digging, the depth of the ditch is gaged with a 10-foot pole held with the 6-foot mark on the string.

Excavating

Stake off the ground for the outside dimensions of tank. Excavate earth to the required depth for siphon chamber, keeping side plumb

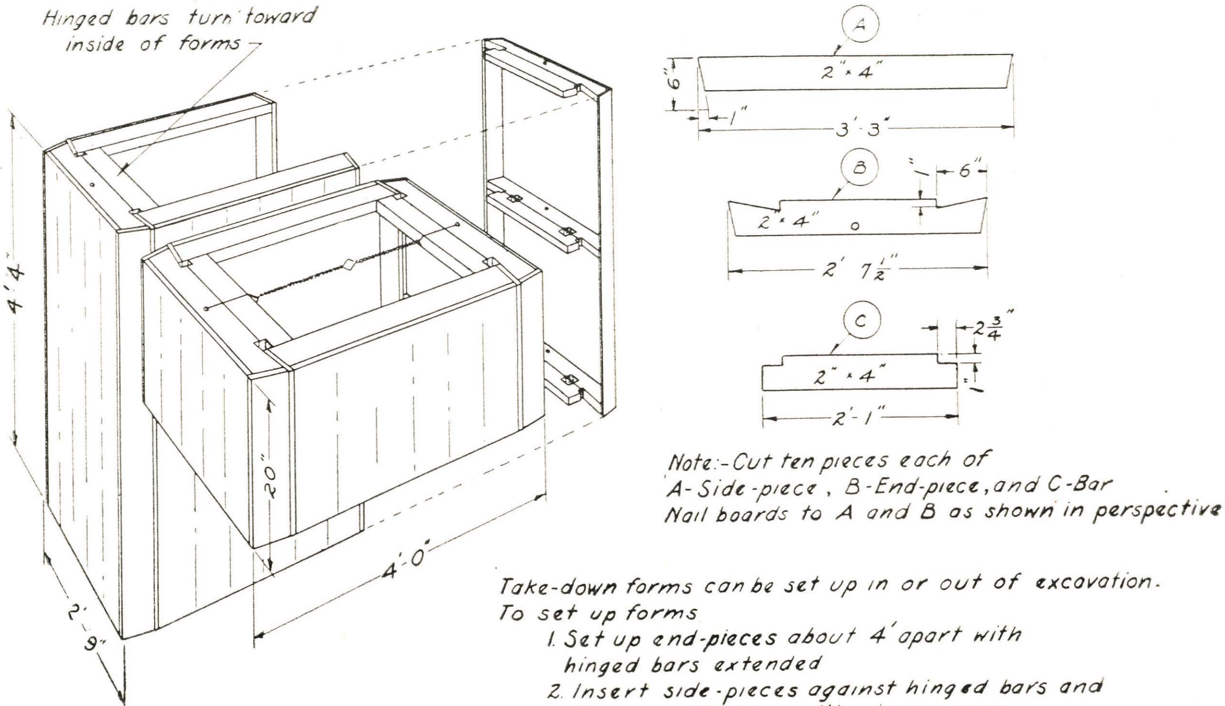

Fig. 10.—The "take down" forms make it possible to build several tanks with one set of forms.

with level or plumb-bob. Measure for width of settling chamber and continue excavation for this chamber to the necessary depth.

Forms

Build forms to specifications. Mix concrete for settling chamber floor quite dry, place and tamp well so that it will carry forms. Place forms and tie together, and place a few shovelfuls of concrete around bottoms to hold them in place.

Filling Forms

Mix concrete to quaking consistency, or wet enough to slump down when piled high. Place evenly in forms and work in place with a board 6 inches wide and 6 to 10 feet long. Fill forms to level of floor in siphon chamber. The siphon chamber floor should then be placed using a dry mix and tamping.

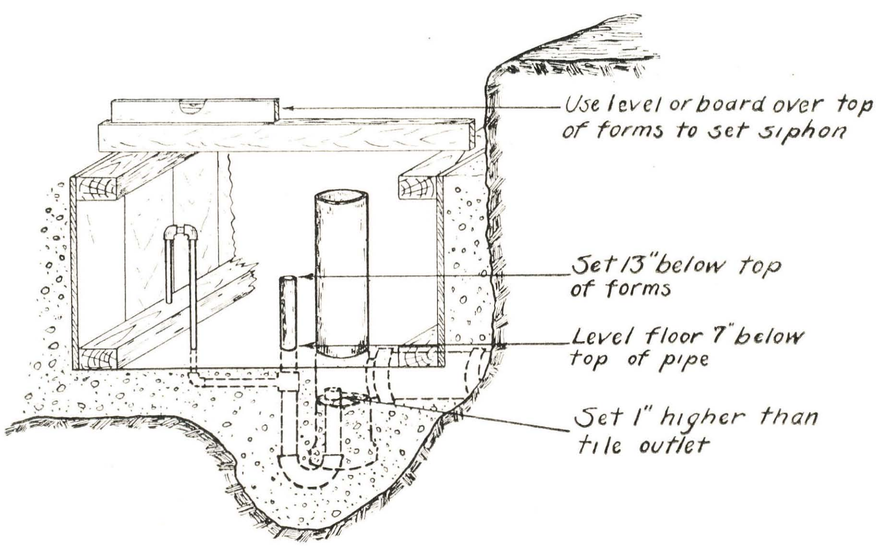

Fig. 11.—The three important dimensions for setting the siphon are indicated in the above cut.

Setting Siphon

Before completing the floor for siphon chamber, set siphon, safety overflow, overflow trap and drain tile outlet. Observe dimensions for setting the siphon as indicated in Fig. 11. Cover the T-tile and siphon pipe to prevent being filled with concrete. Use wooden float to level floor of siphon chamber. Fill forms to top of siphon chamber and level off.

Also connect inlet sewer pipe to extend through wall of tank against form. The top of this pipe should be level with top of tank and the end should be against side wall of tank.

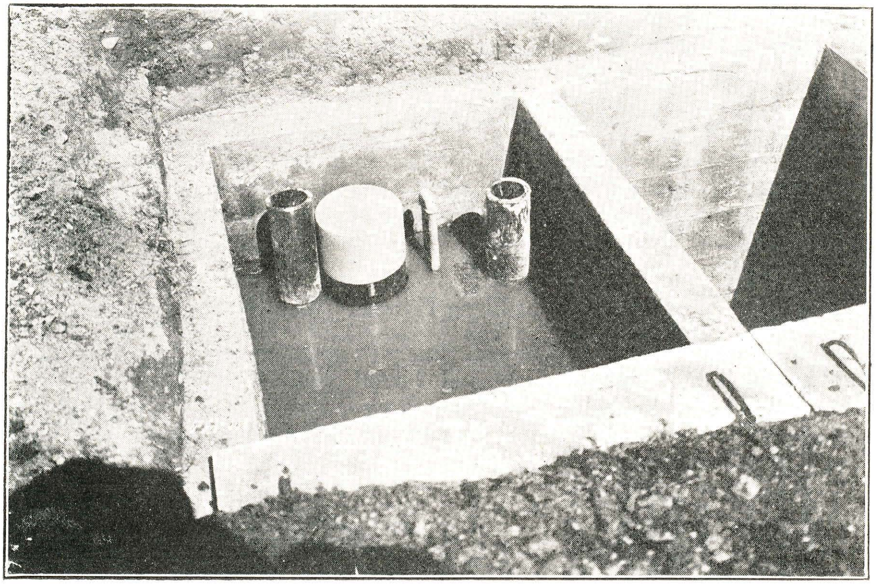

Fig. 12.—Siphon chamber showing left to right, safety overflow, siphon, air vent, and overflow.

Removing Forms

The forms should be left in place for two days or longer in warm weather, and at least a week in cold weather, as concrete sets more slowly in cold weather. In removing forms, care should be used to prevent cracking the concrete. The "take down" forms shown in Fig. 10, can be removed by turning the hinged bars until they are free, jarring the forms until they are loose, when they can be lifted out. The side forms can then be loosened and lifted out.

Siphon Bell

This is made from a three gallon crock which must be 9½ inches inside diameter. This crock is set on a level board and filled with cement and sand, proportions 1:2, to within 6¾ inches of the top and leveled off. The rods which serve as legs are then inserted in the concrete. They are made long enough to extend 1¼ inches above the crock.

Finishing Tank

Wash the interior of both chambers with a wash of cement and water, mixed to a consistency of cream and spread on with an old broom or whitewash brush. Two coats should be applied and kept moist while setting. Plastering the interior with cement and sand, 1:2, with a small amount of lime added, is also an excellent means of water-proofing it.

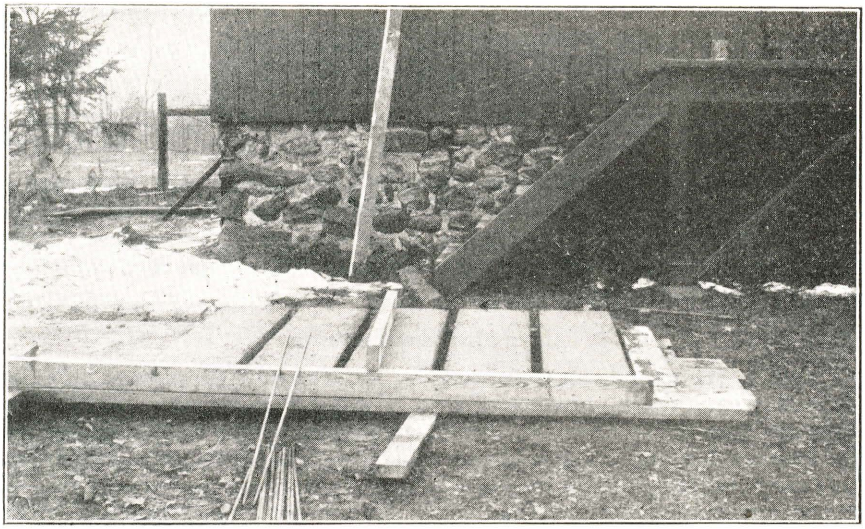

Fig. 13.—The top slabs may be made on a platform. A frame of 2" x 4" is made with which slabs are cast. The top slabs may be also cast in the tank forms which is, perhaps, the simpler way.

Top Slabs

The concrete top slabs may be molded in the side sections of the "take down" forms, using an inch board for a separator which is removed as soon as the slabs begin to harden, or the top slabs may be made in forms as shown in Fig. 13. Place these forms on a floor or solid ground which has been made level. To place reinforcing in either case, fill forms half full of concrete and lay in reinforcing rods 3 inches from each side of the slabs and 1 inch from the bottom. Place bent iron handles or old horse shoes in the slabs to assist in handling and finishing concrete. Keep slabs wet and do not handle for two weeks.

Aerating Tile System

Construct the sewer from the tank to the aeration field. All joints should be filled with cement and sand, 1:2, for at least 100 feet from tank and well. Use a scoop shaped to fit the tile to pull out cement which may have dropped in at the joints.

Laying Tile

Using the string stretched over the grade bars and a measuring stick to determine the depth of trench, construct the tile lines, laying in the tile with loose joints. In sandy ground cover the top half of the joints with tar paper or roofing to prevent sand falling in. Cover with earth.

Putting Tank in Operation

Pour a pail of water in the two-inch pipe of the siphon, then set the siphon bell previously made over this pipe. If possible, fill the siphon chamber with water until the siphon trips or operates which indicates that it is in working order.

Cover the tank with the top slabs, placing them in the same order as made. The tank may then be covered with six inches or more of earth either by mounding it up or simply filling up to the surface. A month's use may be required to put the tank in good operating condition.

Accuracy Required

Extreme accuracy is not needed in dimensions. The siphon requires most care, and measurements should not vary from the dimensions given more than one-fourth inch either way.

Care and Maintenance

Trouble will usually be indicated by stoppage of the sewer. Periodic inspection and care, however, will be found more satisfactory than allowing trouble to develop. An examination of the tank and aerating tile system for the accumulation of sludge should be made once each year by removing one or two slabs, and by digging up one or two tiles in the aerating system. The tank should not need cleaning oftener than once in four years, and the aerating tile system at longer intervals.

To remove the sludge, a cheap pump or pail may be used. To clean the siphon, the bell is lifted off and any obstruction in the U-pipe removed with a wire. The air vent may be tested by turning the air vent pipe (G—Fig. 3a) up and pouring water through it.

Larger Systems

The standard tank, as shown, is designed to serve not more than 6 people continuously. Where more than this number are to be accommodated, the capacity of the tank may be increased by adding to the length of the tank and tile system for tanks of greater capacity. The rule suggested is as follows: Add 6 inches to length of chambers, and 25 to 75 feet of aerating tile for each additional adult above 6 persons. If for more than 15 persons the tank should be of special design. The design of sewage disposal systems for creameries, summer hotels, camps, and schools should have special study of the conditions in each case. Information may be had on these from the Michigan State Board of Health, Lansing, Michigan, or from the Agricultural Engineering Department, Michigan State College of Agriculture and Applied Science, East Lansing, Michigan.

BILL OF MATERIAL

For the construction of a tank the following material will be required:

3 yards of gravel.
4 barrels of cement.
25 pieces of round iron, 3/8″ x 3′ 6″.
150 feet of four-inch glazed drain tile.
2 four-inch sewer pipe Tees.

Sufficient four-inch sewer pipe to connect the tank with the house. In some cases the tank is placed adjacent to the house so that very little sewer pipe will be required.

Form Material

5 pieces 2" x 4" x 16' southern pine, dressed 4 sides.
17 pieces 1" x 6" x 12' matched flooring.
20 3" strap hinges.
3 lbs. 6's nails.

To construct the siphon the following material will be required (the letters indicate the pieces shown in Fig. 3-a).

A, 1 piece 2" black pipe 9" long threaded one end.
B, 1 piece 2" black pipe 6" long threaded one end.
C, 1 piece 2" black pipe 6" long threaded both ends.
D, 1 piece 3/4" black pipe 8" long threaded both ends.
E, 1 piece 3/4" black pipe 2" long threaded both ends.
F, 1 piece 3/4" black pipe 13½" long threaded both ends.
G, 1 piece 3/4" black pipe 8" long threaded one end.
H, 3 pieces 3/4" black elbows.
I, 1 piece 2" x 2" x 3/4" cast tee.
J, 1 piece 2" return bend open pattern.*

The bell or the siphon (Fig. 3-a) is a three-gallon butter crock partly filled with concrete supported by three 3/8-inch iron rods inserted in the concrete in the crock. A 10-quart galvanized pail may be substituted for the crock, but will not be found as durable.

Concrete should be put into the bottom of this crock until the unfilled portion measures 6¾ inches deep. The 3/8-inch iron rods used for legs should project 1¼ inches above the crock. The crock must be as near 9½ inches inside diameter as possible.

EXPENSE

The actual outlay for all materials for the tank, sewer, and aeration tile should not exceed $50. Two men should make the forms, excavate, place the concrete, and lay the tile, in from two to three days.

WHAT TO DO

1. Obtain a working knowledge or requirements and construction of septic tank.
2. Determine location of tank and tile-field with level.
3. Secure material called for in the bill of materials.
4. Build forms and excavate for tank.
5. Set forms, place concrete, and set siphon.
6. Make top slabs.
7. Dig trench and lay distributing tile—cover tile.
8. Two days to one week later remove forms and test siphon.
9. Cover tank and put in operation.

*Note: A 2 inch cast elbow and a 2 inch street elbow, or 2 inch cast elbows and a 2 inch close nipple may be substituted for the return bend. The return bend, however, is better. Only the open pattern can be used.

Storm sash 15-25
Weatherstrip 10-15
insulation 30-45

Av. 6 room house 22 X 34

2,000 square ft. of wall surface
1,000 " " " roof
500 " " " radiation

10 tons of coal

320
1.50
16000
320
\$80 saved on radiation or coal