AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

EXTENSION SERVICE

Methods of Sewage Disposal for Country Homes

BY

O. M. BALL and HUGH CASSIDAY

JUNE, 1914

POSTOFFICE
College Station, Brazos County, Texas

VON BOECKMANN-JONES CO., PRINTERS, AUSTIN, TEXAS

BLANK PAGE IN ORIGINAL

METHODS OF SEWAGE DISPOSAL FOR COUNTRY HOMES

O. M. Ball and H. Cassiday,
DEPARTMENT OF BIOLOGY.

Sewage may be defined as the solid and liquid refuse from the laundry, kitchen and bathroom. It is water in which soap, vegetable and animal matter, urine, feces, etc., are suspended or dissolved. These household wastes are not in themselves harmful, but they teem with microorganisms, some of which destroy the organic matter of the sewage, while others are capable of producing disease. The disease-producing bacteria get into the sewage from the sick in the household.

Unless proper care is taken of the sewage these disease-producing bacteria will soon pollute the soil about the home, and thus water used for drinking purposes may become infected. A striking example of infection from sewage was shown in the famous Broad Street well in London. During an outbreak of cholera in this city in 1854 there was an enormous concentration of cases in a very limited area supplied by this well, over 600 fatal cases occurring during a period of six weeks. In a workhouse in the midst of this district but having its own well, there were only 5 deaths. Upon investigation, it was discovered that a privy vault and cesspool in a house adjoining the Broad Street well discharged through a leaky drain which ran within two feet of the well. There were 4 fatal cases of cholera in this house at the time of the outbreak.

HOW THE SEWAGE IS PURIFIED.

Sewage disposal by the use of the septic tank is the outgrowth of several methods which have been tried out and abandoned. This method is based upon two fundamental processes. In the first the organic matter is destroyed by the bacteria of decomposition mentioned above; in the second the bacteria are eliminated by filtration. To accomplish these results the raw sewage is brought into a tank or basin and stored until the suspended and dissolved organic matter is decomposed. Then the bacteria are removed by a filter bed or an irrigation system.

DESCRIPTION OF THE TANK.

The septic tank has two parts, the tank proper and the filter bed or the irrigation system, as the case may be. In the tank proper there are one or more chambers in which the bacteria begin the work of decom-

position which is completed in the filter bed or irrigation system. The sewage is collected in the first chamber and allowed to stand for some hours, during which the solid organic matter first settles to the bottom, then gradually disappears as it undergoes destruction by the bacteria. Since these organisms do their work best in an atmosphere free from oxygen, this chamber must be as nearly air-tight as possible.

Thence the effluent, as it is now called, passes into the second chamber, if there be one, for further decomposition, or it may go directly into the drainage system. After passing through the first tank or tanks the sewage is nearly free of solid substances and is also practically harmless as far as the disease-producing organisms are concerned, since most of these have been destroyed in the tank. Therefore, if so desired, the effluent may be run onto the soil and used for irrigation purposes with comparative safety.

The septic tank, when properly constructed and not overloaded, will work automatically and will deliver an effluent about 80 per cent pure. The efficiency of the tank will depend upon the load or amount of sewage carried in the water and the length of time the sewage remains in the first chamber. The longer the time allowed, the more complete will be the decomposition.

SELECTION OF A SITE FOR THE TANK.

The septic tank should be placed on a slightly sloping ground at least 100 feet from the house and never nearer than 50 feet and never nearer than 100 feet to any well, in order to avoid possible contamination of the latter from the tank or sewer. The tank should be set 1 or 2 feet lower than the house in order to give a fall to the sewers leading from the house. The tile drain system may be placed under the front lawn, if no better location is available, without risk of infection or disagreeable odors. The tile drains or irrigation system should be open tile drains placed about 2 feet below the level of the top of the tank and sloping slightly outward.

A grease trap should be placed at a suitable point between the kitchen drain and the tank, since grease will not decompose in the tank.

METHODS OF INSTALLATION.

The two plants here described and illustrated are of the double chamber type and are designed for homes of from 4 to 9 persons and 11 to 15 persons, respectively. They are constructed of reinforced concrete.

The plant for 4 to 9 persons is 12 feet long, 4 feet 8 inches wide and 5 feet 8 inches deep, and has a capacity of 400 gallons in the first chamber and 314 gallons in the second. The material required is $3\frac{1}{2}$ cu. yd. of concrete, mixed as follows: $5\frac{1}{2}$ bbl. of cement, $1\frac{1}{2}$ cu. yd. of sand and $3\frac{1}{2}$ cu. yd. of rock. For reinforcement, 460 linear feet of $\frac{1}{4}$-inch round or square bars are required.

The larger plant is 19 feet long, 4 feet 8 inches wide and 4 feet 8 inches deep and has a capacity of 314 gallons in the first chamber and 914 gallons in the second. The material required is $4\frac{1}{2}$ cu. yd. of concrete, mixed as follows: 7 bbl. of cement, 2 cu. yd. sand and $4\frac{1}{2}$ cu. yd.

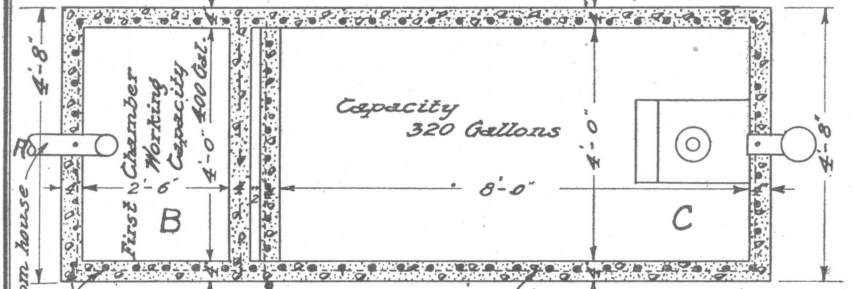
SEWAGE DISPOSAL

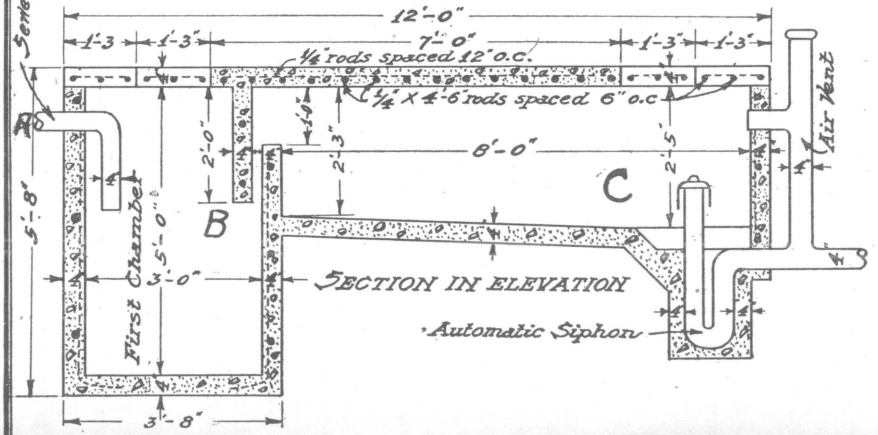
FOR RURAL HOMES.

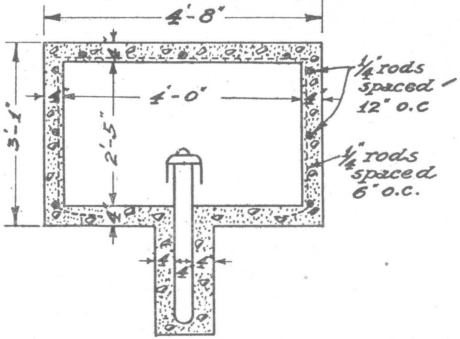
BULLETIN BY THE DEPARTMENTS OF
BIOLOGY & CIVIL ENGINEERING,
A. & M. COLLEGE OF TEXAS.
COLLEGE STATION
MARCH 1914.

FOR 4 TO 9 PERSONS

Material for $3\frac{1}{2}$ cu.yds. 1-2-$4\frac{1}{2}$ Concrete
$5\frac{1}{2}$ barrels of cement
$1\frac{1}{2}$ Cubic yards of sand
$3\frac{1}{2}$ cubic yards of rock
460 lin. feet of $\frac{1}{4}$ inch round or square bars. If round, 80 pounds, if square 100 lbs.







SECTION THROUGH SIPHON.

DeL. Wright & Ocock

rock, and for reinforcement 800 linear feet of ¼-inch round or square bars.

A 4-inch vitrified pipe (A) with a fall of not less than 1 per cent connects the house to the tank. The joints should be well cemented and water-tight, and the end of the line should be turned down 1 foot below the surface of the sewage in the first chamber.

The excavation for the tank should be slightly larger than the plans call for. The sides must be smooth and the bottom should take the shape shown in the drawings. The concrete in the floor of the tank is not reinforced and therefore may be poured immediately. Set the automatic siphon in place, pour the floor and before it hardens set the reinforcements for the sides. These can be held in place by any convenient means at hand.

Leave the floor rough around the edges but make it as smooth as possible inside. On the inclined floor of the chamber (C) use just enough water to make the concrete of the consistency of thick mud, so that it will not run toward the lower end. After the floor has hardened sufficiently, construct the forms for the walls. Use 4-inch blocks for spacers and bore gimlet holes opposite each other through the walls and wire the two sides together. After the concrete is poured, the spacers may be taken out, as the concrete will hold the forms apart.

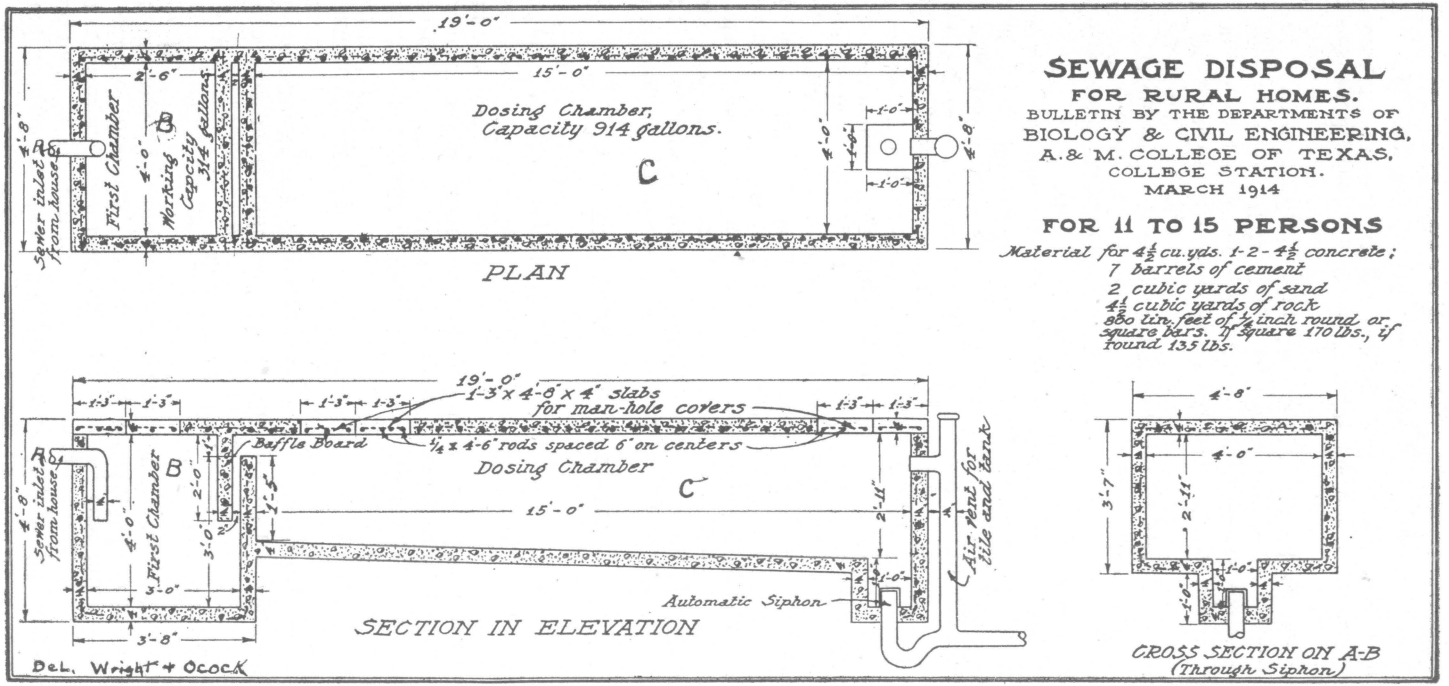
The reinforcing bars may be held in place in the forms by wires. Set the vertical reinforcing bars 6 inches apart and the horizontal 12 inches. The reinforcing bars must be placed in the center of the forms. After the walls have hardened, remove the forms and cut all wires flush with the surface of the concrete. If the reinforcing bars are shorter than the walls, lap them 12 inches.

Before pouring the walls, clean the surfaces of the joints and coat with a thin mixture of pure cement and water. While pouring the concrete, work it toward the inside of the forms, so that the inner walls will finish smooth. Leave the upper edges rough.

When the walls have set, place the forms for the top in position and block them up from the floor. Set the transverse reinforcing bars 8 inches apart and the longitudinal ones 12 inches. The reinforcing bars must be placed about 1 inch from the bottom of the slab forming the top. Make the forms for manholes 2 feet 6 inches wide, and 4 feet 8 inches long, and the concrete slabs for the manholes in two sections, each 1 foot 3 inches wide, 4 feet 8 inches long and 4 inches thick. Two metal rings, placed about 1 foot from each end, should be fastened into the covers to facilitate removal.

The character of the soil will determine the method of laying the drain pipe line. If the soil is sandy and loose, 4-inch farm tile may be used. Dig trench (D) about 24 inches deep, fill in with 4 inches of gravel or cinders, lay the tile, leaving ¼ inch between each piece. Cover with not more than 4 inches of gravel or cinders and complete with earth. The line must not have too much fall, or the lower end will become waterlogged. The fall should not be more than 1 inch in 60 feet. The lower end must be plugged or closed with concrete.

If the soil is heavy or clay, make the trenches at least 6 inches deeper and fill in as before. But, in such soil, it will be necessary to lay a drain off pipe. This line (E) should be laid halfway between the drain



SEWAGE DISPOSAL
FOR RURAL HOMES.

BULLETIN BY THE DEPARTMENTS OF
BIOLOGY & CIVIL ENGINEERING,
A. & M. COLLEGE OF TEXAS,
COLLEGE STATION.
MARCH 1914

FOR 11 TO 15 PERSONS

Material for 4½ cu. yds. 1-2-4½ concrete;
7 barrels of cement
2 cubic yards of sand
4½ cubic yards of rock
980 lin. feet of ½ inch round or square bars. If square 170 lbs., if round 135 lbs.

Fig. II

pipes and at least 8 inches below, preferably deeper. The upper end of this line must be plugged or closed and the lower end should open into a ditch or stream. This line may have a 1 per cent fall.

One foot of drainage line should be provided for each gallon of effluent discharged in sandy soils and two feet for each gallon in heavy or clay soils.

ESTIMATE OF COST.

We can offer no specific estimate of the cost of the plants here described, since the freight rate on different materials will vary in different localities.

The automatic siphon described above may be procured from the Pacific Flush Tank Co., Chicago, Ill.; F. Stary & Sons, Cedar Rapids, Ia., and Merrit & Co., Camden, N. J., at a cost varying from $15 to $25 delivered. The vitrified pipe manufacturers have 4-inch bell or spigot type "seconds" that may be bought cheaper than farm tile, and these may be used.

These types of plants can be built for $75 to $125, depending upon the kind of materials used and the cost of labor.

THE "KENTUCKY SANITARY PRIVY."

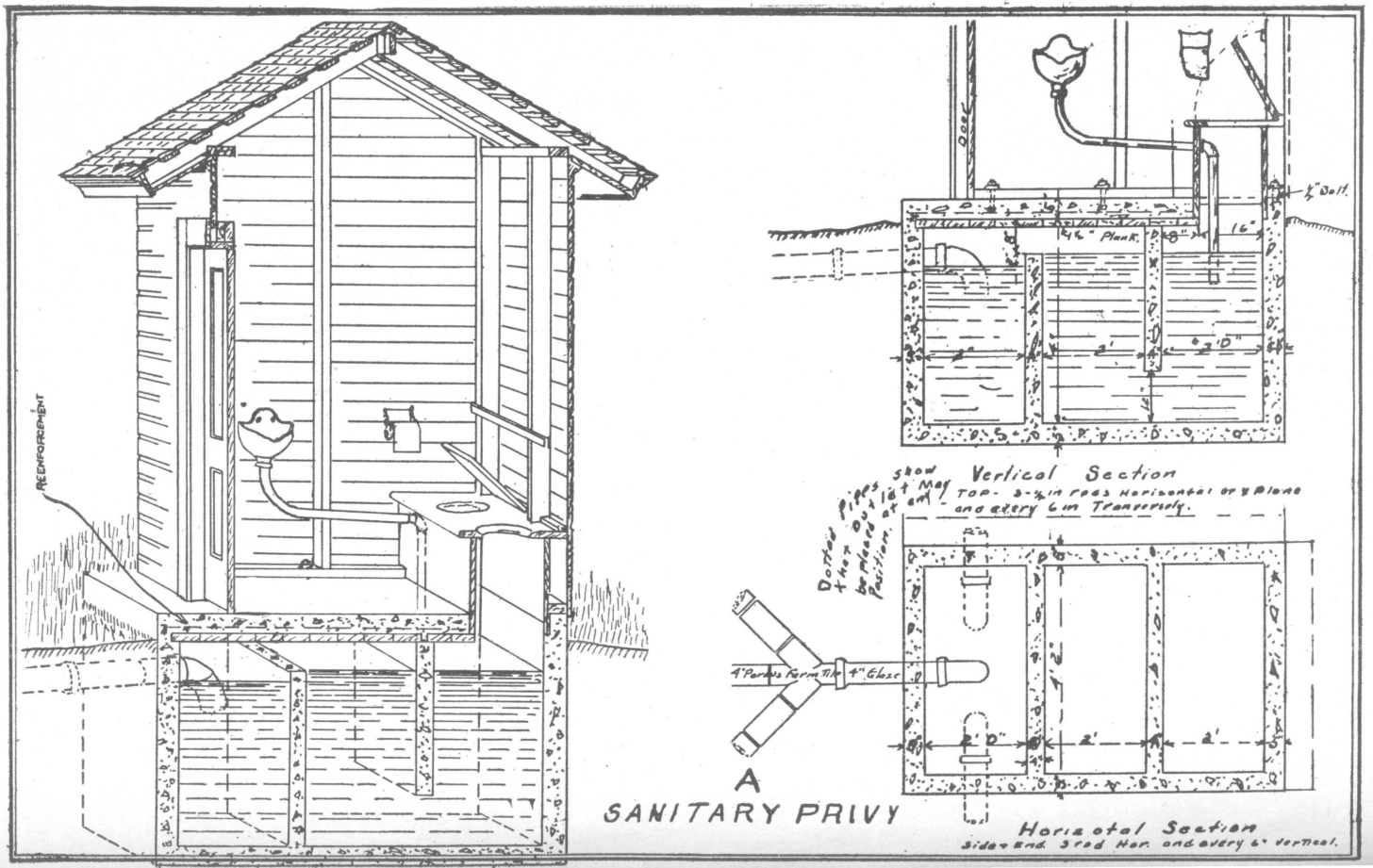
This is a sewage disposal plant designed by the Kentucky Board of Health for use in rural homes where no water supply is available. It is a combination of the common privy and a septic tank.

The plant consists of two parts; the first is the privy, the second the septic tank. The house is built of wood and should be fly-proof, in order to avoid danger of the spread of disease-producing organisms in this way. The size of the house may vary, but 5 feet square and 7 feet high as the eaves is suggested. For a house of this size 120 linear feet of 2x4, 1 bundle of shingles, 125 sq. ft. of drop-siding or ship-lap, 15 feet of 18-inch board for seat, 1 galvanized iron urinal, as shown in drawing and a toilet paper holder are required.

The tank is constructed of concrete. Its outside dimensions are 7 feet 6 inches long, 5 feet wide and 5 deep. It consists of three chambers: first, the settling chamber, second the septic tank and last the dosing chamber. The material required is 2.6 cu. yd. of concrete, mixed as follows: .8 cu. yd. sand, .4 cu. yd. cement and 1.6 cu. yd. rock. For reinforcement, 275 linear feet of ¾-inch round or square bars are required. The method of installation is the same as described above. Note that the wall between the settling chamber and the septic tank proper is a hanging wall.

A tile elbow about 18 inches long leads from the dosing chamber to drain. The second joint of drain should be placed in position before pouring the concrete. The character of the soil will determine the method of laying the drain pipe line, which should be done as described above.

This type of disposal plant can be built for $25 to $35, depending upon the kind and cost of the materials used. The lumber for the house will cost from $12 to $15, the concrete for the tank from $10 to



A
SANITARY PRIVY

$15. These estimates are based on the supposition that the plant will be made by home labor.

Directions for Use.—Fill the tank with water until it runs out through the drain pipe. Drop into the settling chamber, through the seat, two or three shovelfuls of fresh stable manure. This is necessary in order to introduce the desired bacteria of decomposition. Thereafter 5 gallons of water per day per seat should be poured in. No further attention is necessary.