pneumatic tank can be placed in the system.

When the well is used for storage, the pump must operate every time water is drawn. The elevated tank frequently requires considerable pipe or rather expensive supports. This type of storage lends itself readily to fire protection. The pneumatic pressure tank is somewhat limited in capacity but is easily installed in the water system.

Some idea of the size of pressure tank needed can be obtained from the following details. For a given temperature, the pressure of air is inversely proportional to the space it is forced to occupy. Thus, if a tank filled with air at atmospheric pressure (14.7 pounds at sea level) has water pumped into it until it is about six-tenths full, the gage will read about 22 pounds. When the gage reads 41 pounds, the tank will be three-fourths full. Thus, if the pressure control is adjusted to cause the pump to start at 20 pounds and stop at 40 pounds, only about 15 percent of the total capacity of the tank can be drawn without causing the pump to start. If the tank is filled with an initial pressure, somewhat more water can be drawn between the same limits of pressure.

Individual water systems seldom handle enough water to be of much value in controlling a serious fire, but any of them may be useful in putting out a fire in its early stages. If fire control is contemplated, it is well to have one or more protected reservoirs or cisterns strategically located about the farmstead. Fire-fighting pumpers may handle as much as 500 gallons a minute. At that rate the reservoir would have to hold 7,500 gallons to keep the pump going for 15 minutes. Fog nozzles will require much less water. The best answer to the question about size and location of water storage for fire-fighting purposes can be obtained through consultation with the chief of the local fire department.

A reservoir to hold 7,500 gallons should be 10 feet by 10 feet by 11 or 12 feet deep if it is square; if it is round, it should be 13 feet in diameter and 13 feet deep. The reservoir should be covered as a safety measure and to prevent it from becoming a breeding place for mosquitoes. A good light-tight cover will prevent the growth of algae.

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Safe Sewage Disposal for Rural Homes

Harry L. Garver

The sewage disposal system of a house consists of at least two parts—the plumbing inside and the drainage system outside the house.

For the average family the selection of plumbing fixtures is somewhat a matter of personal preference. The fixtures may be of colors that blend with other colors in a room. The space they will occupy will determine to some extent their size and shape. They must be properly supported. The empty bathtub weighs 300 to 500 pounds. Twenty gallons of water will add another 175 pounds. When a heavy man gets into the tub, a fairly concentrated load is placed on the floor joists. Consideration should be given to this weight in designing the house. All fixtures should be set as nearly level as possible. Faucet spouts should be set so that the openings are about 1.5 inches above the rim over which contents spill when the fixture overflows.

All plumbing fixtures must be equipped with traps, which may be part of the fixture or placed in the fixture drain. Their purpose is to prevent the free flow of gases from the sewer or septic tank. Water flowing through a pipe tends to pull air through with it. That phenomenon would pull

the water out of the trap if there were no other path for the air to enter. Then, too, if the gas pressure in the sewer system became high enough it would bubble through the water in the trap. To keep the air or gases from breaking the trap seal, a vent pipe must open into the drain a short distance from the trap on the drain side. One vent may serve the traps of a group of fixtures if they are close to the soil vent or stack—30 inches if the fixture drain is 1.25 inches in diameter; 42 inches if the drain is 1.5 inches; 5 feet for a 2-inch drain; and 10 feet for a 4-inch drain.

The soil pipe is usually continued up through the roof of the building. The part above the highest horizontal drain is known as the stack-vent. Fixtures located too far from the soil pipe to be vented properly by it may have their individual vents, which are connected to the stack-vent. Such vent connections are called loop vents.

Usually cast iron soil pipe is specified for use under a concrete floor and through the foundation wall. Outside the foundation wall, any material permitted by the local code or authority (where such authority exists) may be used. Often clay tile is used. Some use bitumenized fiber and other materials.

If your community has a public sanitary sewer into which sewage from your buildings will drain, your building drain pipe should empty into it. Most rural and farm homes are not so fortunate. In that event, the use of a septic tank is recommended as a means of sewage disposal. The drain pipe to the septic tank should slope one-fourth inch a foot. Pipe 4 inches in diameter ordinarily is recommended. The septic tank may be of steel, masonry, or monolithic concrete. Regardless of its material, it should be leakproof.

The size of a septic tank should be based upon the number of persons likely to use it. Since families change and property is bought and sold, it is difficult to design for the number of persons, so the size is usually based on the number of bedrooms. It is recommended the tank have a liquid capacity of at least 500 gallons.

Liquid capacity is measured below the bottom of the outlet pipe, which is usually 12 to 15 inches below the top of the tank. The inside dimensions usually recommended are given in the table. Disposers of food wastes increase both the liquid and solids going into the tank. The amount depends largely on the habits of the family. To insure sufficient sludge capacity, it is recommended that the capacity of the tank be increased 50 percent over that shown in the table below. If the tank is in place when the grinder is installed, it will be necessary to inspect and perhaps clean the tank oftener.

Septic tanks need not be rectangular if they are designed so that incoming sewage does not stir the contents of the tank very much. Tests seem to indicate somewhat greater efficiency with tanks having less depth of liquid and greater surface area. The matter of space and cost are factors that determine the dimensions of the tanks.

Ordinarily there is no need to add yeast, enzymes, or other starters to new or old tanks. Raw sewage contains the necessary bacteria for digestion of solids. If for any reason it is believed

Number of bedrooms	*Maximum number of persons served*	*Liquid capacity of tank in gallons*	*Recommended Dimensions*							
			Width		*Length*		*Liquid depth*		*Total depth*	
			Ft.	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*
2 or fewer...	4	500	3	0	6	0	4	0	5	0
3.....	6	600	3	0	7	0	4	0	5	0
4.....	8	750	3	6	7	6	4	0	5	0
5.....	10	900	3	6	8	6	4	6	5	6
6.....	12	1, 100	4	0	8	6	4	6	5	6
7.....	14	1, 300	4	0	10	0	4	6	5	6
8.....	16	1, 500	4	6	10	0	4	6	5	6

that a new tank is not functioning as it should, a few gallons of sludge from a tank that is known to be operating satisfactorily may help.

The septic tank should be inspected periodically and cleaned as needed. A number of proprietary products have been placed on the market that are supposed to dissolve solids in septic tanks, but none of those tested by the Public Health Service takes the place of an occasional pumping out. Some of them may be detrimental to the proper operation of the tank and disposal field.

When a person inspects a septic tank, he should not use matches or an open flame, because the gases produced by decomposing sewage may explode.

The tank should be cleaned when the scum and sludge occupy one-third to one-half of the liquid capacity of the tank. Annual inspection may be the means of avoiding serious trouble and expense with the sewage system. The amount of accumulation can be determined thus: Attach a strip of towel to a stick and push it through the inspection hole to the bottom of the tank. Rotate it once or twice and let it stand a few minutes. Sufficient sludge will adhere to the rag to give a reasonably good idea of the amount of accumulation.

Synthetic detergents do not seem to interfere with the operation of a septic tank if they are used in ordinary amounts, if the tank is as large as recommended in the table, and if it has the proper inlet tee, or baffle, so that the contents of the tank are disturbed as little as possible.

A moderate use of drain solvents, mild cleaning agents, and disinfectant solutions will not adversely affect the operation of the tank after it has been in operation long enough to have accumulated a little sludge.

Septic tanks do not destroy bacteria. Care must be taken in disposing of the sludge, scum, and the effluent from the tank. Material cleaned from the tank should be taken away from the farmstead and buried where it will not contaminate any water supply.

Since the effluent of the septic tank contains bacteria, some of which may be dangerous, a safe means of disposal must be used. The best way of doing this should be one that insures killing of the bacteria by oxidation or by action of other organisms.

The accepted way of disposing of the effluent from the septic tank is to run it through farm drain tiles laid in the top soil below the probable depth of any cultivating implement or tool, say 18 to 30 inches. Trenches should be dug 18 to 36 inches wide with a slope of 2 to 4 inches to 100 feet.

The bottom of the trench should be covered with a layer of coarse, clean gravel or broken stone to a depth of about 6 inches. Four-inch farm drain tile should be laid on top of the gravel, the sections butted tightly together. The top half of the joints should be covered with a strip of heavy asphalt paper and enough gravel added to cover the tile to a depth of about two inches. A layer of straw or a layer of untreated paper and backfill should be tramped in.

The sewer line from the septic tank to the disposal field may be glazed bell-and-spigot type of tile or terra cotta. The tile should be laid with a slope of one-eighth to one-fourth inch to the foot and should empty into a distribution box. It is practically impossible to distribute the load equally in two or more laterals by means of wyes. The size of the distribution box will depend on the number of laterals. Of special importance is the height of outlets. All laterals should start at the distribution box and all must be at the same height.

If the soil conditions or terrain are such that a disposal field is impractical, it may be convenient or necessary to resort to a seepage pit. Seepage pits must extend into porous material but they must not drain into any earth strata from which domestic or stock water is taken.

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