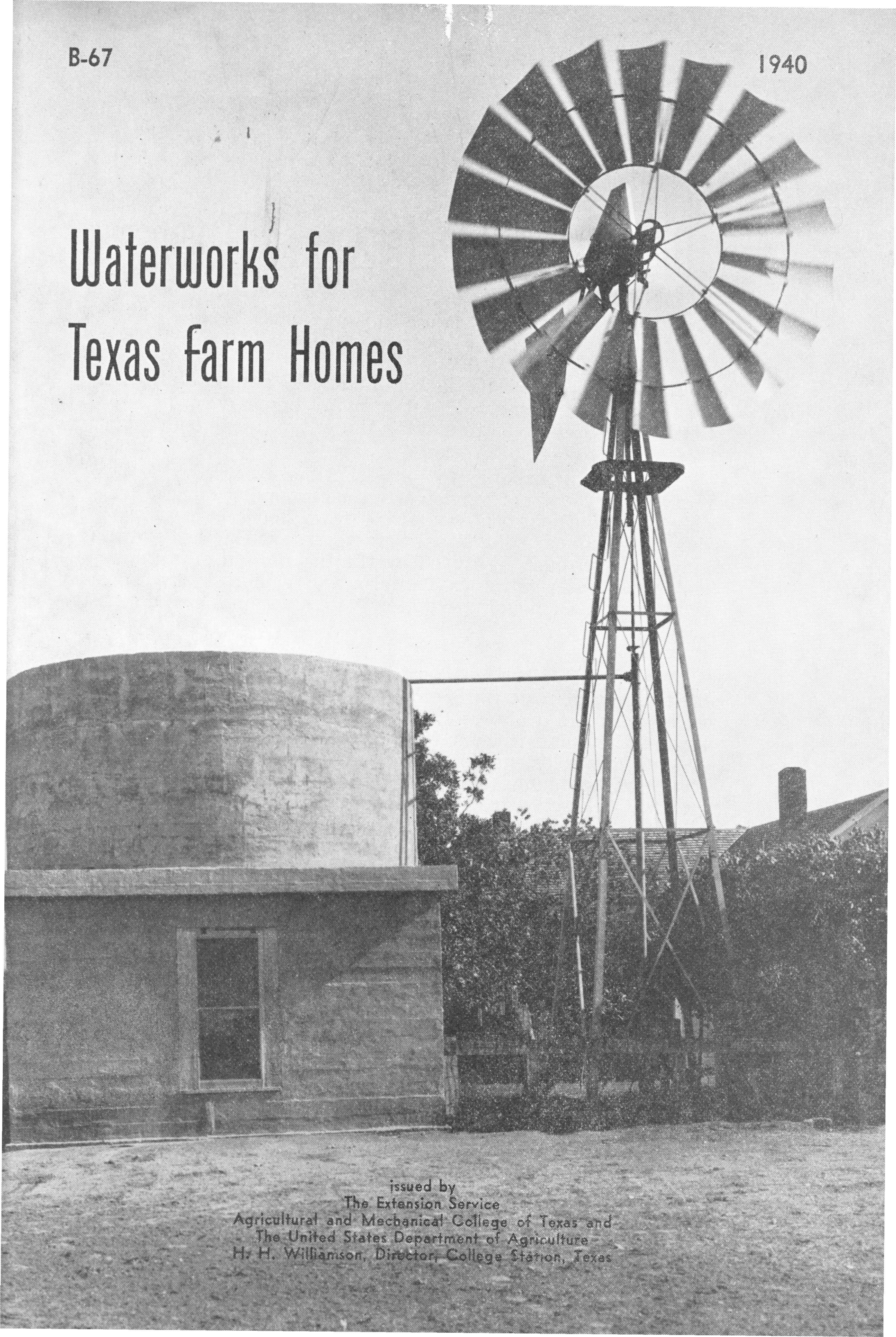
B-67

1940

Waterworks for Texas Farm Homes



issued by
The Extension Service
Agricultural and Mechanical College of Texas and
The United States Department of Agriculture
H. H. Williamson, Director, College Station, Texas

Waterworks for Texas Farm Homes

By M. R. Bentley, Extension Agricultural Engineer

WATER IS THE MOST NECESSARY and useful thing around the home, and yet in many homes very little attention has been given to making the water supply convenient.

There is a tendency to consider a farm home water system a luxury and not particularly a labor saving device. Probably the heaviest work around the farm house is carrying in the water and carrying out the waste water. This heavy work may be very much lightened by the installation of a kitchen sink with water piped to it, and a waste pipe to dispose of waste water. Such a simple water system does not cost a great deal.

One of the first considerations on a water system should be a supply of pure water. Many of the shallow, open topped wells, with the drainage from the stable and cow lot coming toward them and without the protection of a tight curb, present an unwholesome appearance and are actually dangerous. Every well should have a water tight curb extending from several feet below the ground surface to at least a foot above the surface. As a general rule the water from wells 75 feet or more in depth is safe unless contaminated by surface water. Shallow wells should also be protected from pollution by surface water. However, the water in shallow wells is often pol-

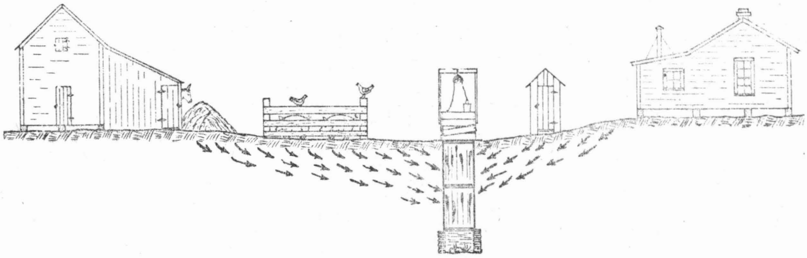


Fig. 1—Poorly curbed wells are dangerous.

luted at its source so that no protection afforded the well itself will make the water safe. In this case a water tight underground cistern may afford the only safe and desirable water supply for the house.

If there is any doubt about the purity of the water supply, it should be tested. The Texas State Department of Health at Austin, Texas, may be consulted in regard to such a test.

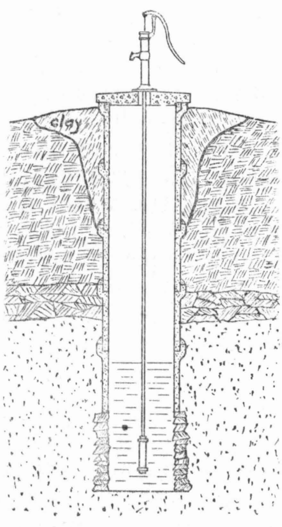


Fig. 2—A well curb of concrete or clay tile with cemented joints.

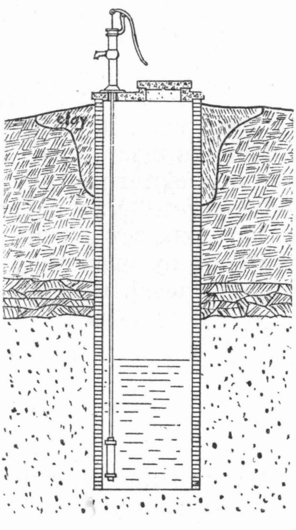


Fig. 3—A well protected by a concrete top and bricks laid in mortar.

Cisterns

Where it is necessary to use cistern water for drinking care should be taken to obtain a sufficient supply and to see that it is kept clean. Precautions should be taken to keep trash and leaves or dead birds from the house gutters out of the cistern. Also, if the top is not made tight there may be pollution from bugs and crickets rotting in the water, and there is the same possibility of surface water running in the top of the open cistern that there is in the well. Protection may be afforded by screening all openings in the cistern and making the top proof against the entrance of contaminated water.

To keep wiggle tails out of the cistern, screen all openings mosquito proof.

The required size of the cistern to insure a supply will depend on conditions, but under average conditions in Texas, a cistern 7 feet in diameter and 10 feet deep will keep the average family supplied with water for kitchen use and drinking water.

Cisterns are frequently built by digging a hole in the ground and plastering the walls with about an inch of cement mortar, using wire poultry netting for reinforcing. This method is all right in soils that do not cause the plastering to crack. Brick laid in cement mortar and plastered is commonly used as a cistern wall. Galvanized iron is quite generally used, especially for cisterns above the ground. Probably the best material for a cistern either above or below the ground is reinforced concrete. New concrete usually gives the water an undesirable taste for a time. The removal of the bad taste may be hastened by washing the walls several times and then removing the wash water.

Cistern Filters

Cistern filters are made in a number of ways. Many are little more than strainers. A filter should be built so that it will not freeze and burst. It should be so arranged that it can be easily cleaned. A good box filter may be built on top of the ground at a reasonable expense. The box should be made of some durable material, such as concrete, and have a tight cover over it. The size should be about 3 feet by 4 feet by 3 feet deep. The water from the house should pour onto a bed of sand about 2 feet thick to remove any particles from it. A layer of finely granulated charcoal about 6 inches thick under the sand will aid in removing any undesirable color, taste, or odor.

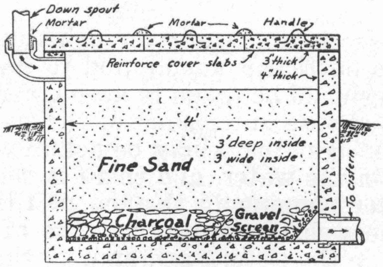


Fig. 4—Walter filter.

While a filter made in this way will give very desirable results, it will not work indefinitely without cleaning the filter materials or replacing them.

Unless the charcoal is to be replaced about once a year, better leave it out and use sand and gravel only in the filter.

A type of filter which gives very good results and requires very little care is shown in Figure 5. This consists of a partition in the cistern, through which the water must pass after it comes off the roof and before it reaches the compartment from which the water is drawn for use. This partition is built of porous brick laid in cement mortar and is not plastered. Sometimes the partition is made by building two walls of brick 6 or 8 inches apart, with the space between the walls filled with sand. In this construction no mortar is used either in laying the brick or for plastering. Unless the partition wall is properly built there is danger of it falling when water comes in on one side of it during a rain. The wall may be made strong by building it in the shape of a part of the wall of a cylinder, with the outside of the curvature to the incoming water.

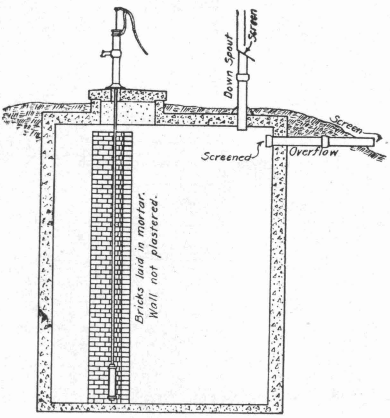


Fig. 5—Cistern with partition wall to filter the water.

Getting The Water Into The House

There are numerous ways of getting water from the well or cistern into the house other than by carrying it in a bucket. Since the expense of the water system is an important item in many cases, some of the inexpensive methods will be discussed along with the others.

Figure 6 shows an arrangement for piping the water from the well to the house where the water is drawn from the well in a bucket. The advantage of this arrangement is that men or boys of the home can draw the supply of water for the day and leave it so it is handy.

The kitchen sink may be homemade if desired or one can be bought for a few dollars. A kitchen sink of some kind should not be omitted from any arrangement that is made to put running water in the house. The hydrant on the back porch may bring the water nearer, but a big saving in labor

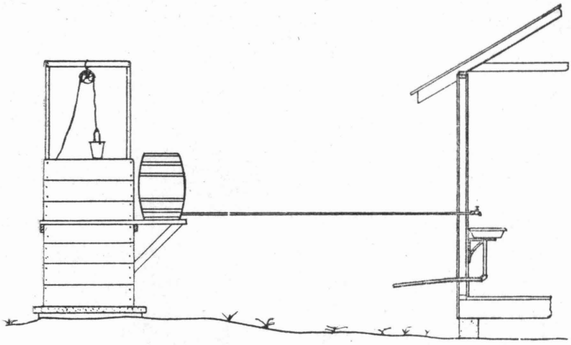


Fig. 6—Piping the water into the house at small expense.

is effected by putting the water faucet over a sink in the kitchen. An important feature of the sink is the disposal of the waste water through a pipe to the outside of the house. Carrying out waste water takes about as much time as carrying in the fresh water.

Simple Water Systems

The several different simple water systems shown are intended to suggest methods by which any farmer can put running water into his home at a small expense. There are numerous other combinations which may be worked out to fit the conditions peculiar to the individual farmstead.

Where there is an elevated tank near the house it is usually an easy matter to complete the water connection to the kitchen sink, and any other fixtures desired. Since many do not have the elevated water tank, suggestions are made for putting up the elevated tank and also for getting water into the house without the elevated tank.

Pitcher Pump And Kitchen Sink

In Figure 7 is shown a very inexpensive method of making the water supply handy when conditions permit. A pitcher pump lifts the water from a nearby well or cistern. The vertical distance from the top of the water surface to the pump cylinder must be less than 20 feet. The pump cylinder may be placed under the floor of the house to reduce this suction

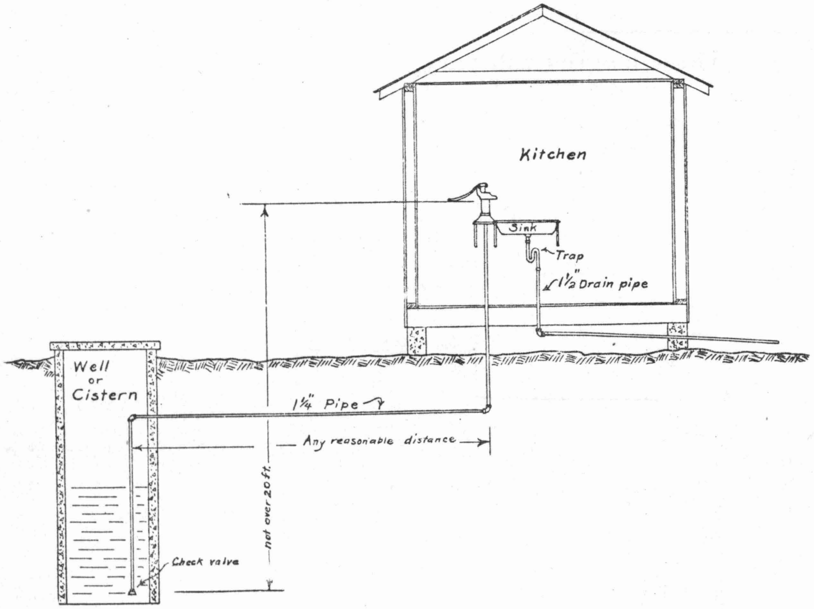


Fig. 7—System for shallow well or cistern.

lift if necessary. If the water supply is a considerable distance from the house the water cannot be lifted as much as 20 feet on account of the friction in the long pipe. A foot valve on the lower end of the pipe keeps the water from leaking back into the well while the pump is not in use. The trap under the sink is for the purpose of preventing foul odors from coming up the drain pipe and is not absolutely necessary on this system.

A list of the material necessary for this system follows. This material should not cost more than $20.00.

*30 feet 1¼ inch iron pipe (well to pump)
1 pitcher pump
1 sink
1 1½-inch sink trap
*20 feet 1½-inch iron pipe (drain)
2 wall brackets for sink
1 1¼-inch foot valve
2 1¼-inch elbows
1 1½-inch elbow

---

*These lengths will vary.

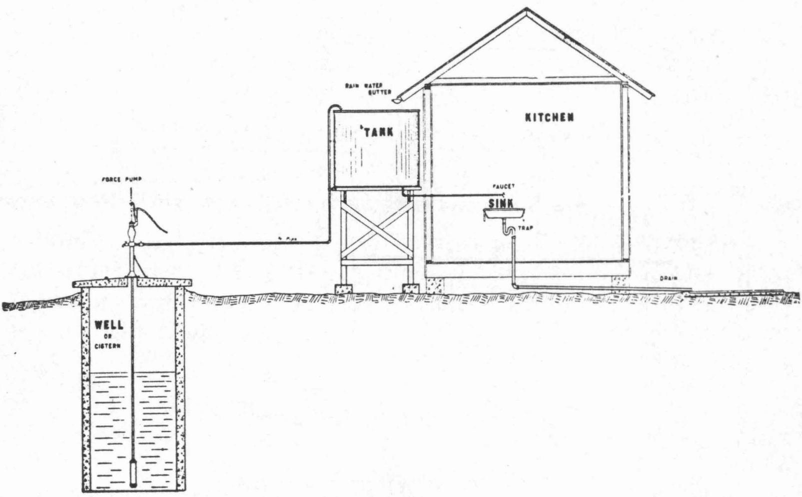


Fig. 8—System with elevated tank.

An Elevated Tank Beside The House

Figue 8 shows a cistern placed under the eaves of the house in order to catch rain water. A pipe carries the water from this cistern tank to the kitchen sink. In case the tank runs dry during a drouth, water may be pumped to the tank from a well or underground cistern. The size of the pipe from pump to tank should be 1¼-inch or 1-inch, and from tank to sink 1-inch or ¾-inch.

A list of materials for this system follows:

- 1 force pump, cylinder, and pipe in well
- *40 feet $1\frac{1}{4}$-inch iron pipe (pump to tank)
- 2 $1\frac{1}{4}$-inch couplings
- 1 sink
- 1 $1\frac{1}{2}$-inch sink trap
- *20 feet $1\frac{1}{2}$-inch iron pipe (drain)
- 2 wall brackets for sink
- 1 elevated tank lumber for tank tower
- 1 $1\frac{1}{2}$-inch elbow
- 1 $1\frac{1}{4}$-inch elbow
- *16 feet $1\frac{1}{2}$-inch pipe (tank to sink)
- 2 1-inch elbows
- 2 1-inch lock nuts with washers
- 1 1-inch faucet

***These lengths will vary.**

Elevated Tanks

Some illustrations of elevated tanks are shown by sketches. A tank is sometimes placed in the barn loft or in the house attic. A tank in the barn loft is sometimes covered with hay to prevent freezing. A tank in the barn or house should have a large overflow pipe so as to eliminate the possibility of damage by accidental overflow. Only a small tank should be placed in a house attic on account of the weight. It should be placed over a partition wall that is on a good foundation.

A commonly used elevated tank for water pumped by a hydraulic ram consists of one or two 50 gallon barrels supported on a tower. Usually a larger reservoir should be provided for a windmill because the wind may not blow all the time.

An elevated tank only ten feet above a house faucet will furnish anly about 4 or 5 pounds pressure to the water, while with a pressure tank system 20 to 40 pounds pressure is available. On account of this, a larger supply pipe is needed to bring water from a low tank to the house than is needed to deliver water from a pressure tank or a tank that is some 40 feet or more above the house faucets.

Cover the supply tank. Water tanks set outside a building should be covered, not only to keep out anything that might contaminate the water but to form a shade as well, to prevent the growth of a green scum on the water.

Outdoor Shower Bath

A shower bath such as is shown in Fig. 9 can be built at very little expense, and will be very much appreciated on the farm. This shower is built in the tower for the elevated tank so as to save pipe. The pipe from the tank is tapped and a cut-off valve set in a small pipe which carries the water overhead. The small pipe may be ½-inch or ¾-inch in size. The sprinkler on the pipe may be omitted if desired. The floor under the shower may consist of boards, covered with galvanized iron.

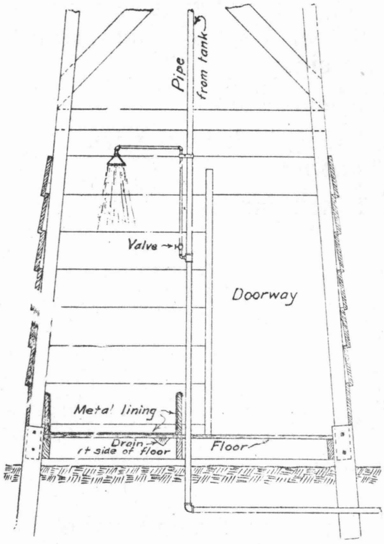


Fig. 9—Shower bath in tank tower.

A more permanent floor may be made of concrete. The waste water can usually be run off at one side of the floor and ditched away, or a drain pipe may be installed.

Power For Pumping Water

The windmill is the most generally used source of power for pumping water to elevated tanks. It is an economic source of power and has only the one big disadvantage of being useless when the wind is not blowing. Another common source of power for pumping is the gasoline or kerosene engine. When electric current is available, the electric motor is a very convenient source of power for pumping. There are some places where water may be raised to an elvated tank by means of a hydraulic ram. Where a ram can be operated it furnishes the most economical means of elevating water.

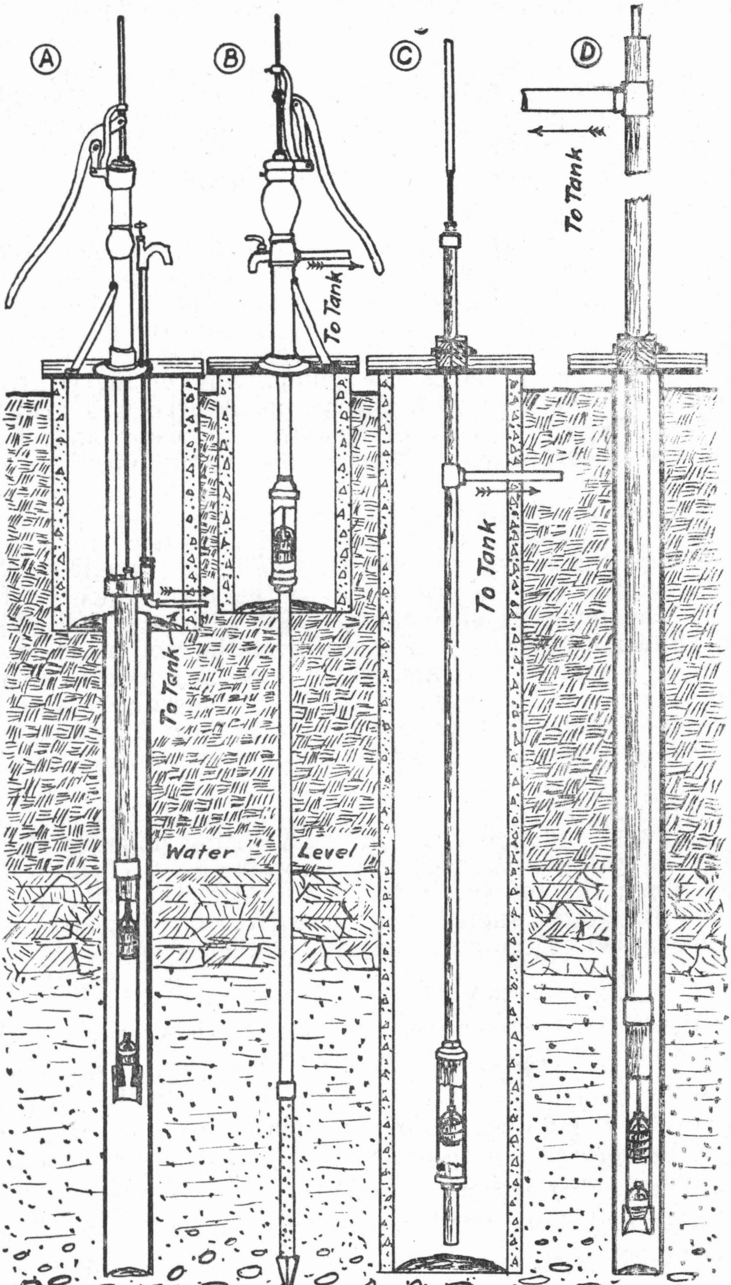


Fig. 10.—Pumps for forcing or lifting water to supply tanks, for use with a windmill or small engine.

Pumps For Use With a Windmill or Small Engine

There are a number of types of pump heads and cylinders for pumping from wells. The kind of pump and cylinder to use for getting the best results frequently depends on the kind and depth of the well and rate of pumping desired.

Figure 10 shows the most common types of pumps used with windmills and pump jacks in Texas. In Figure 10 pump A is an underground force pump. The cut-off valve is below the ground so there is no trouble from the pump freezing. The pipe leading off to the supply tank may be kept underground as it leaves the pump. Any ordinary lifting cylinder may be used with this pump. A deep well cylinder is shown. With this type of cylinder the piston and check valve may be drawn out without removing the pipe from the well.

Pump B is a very common type of force pump. The pipe to the supply tank is connected to the pump opposite the spout. The pump is shown here with a driven well. With the cylinder located as it is shown here the well must necessarily be a shallow one, and water must be found in coarse sand or gravel. This type of cylinder is generally used in all kinds of wells that are reasonably shallow. However, the cylinder is usually placed under the water as shown in well C.

In pump and well C, an ordinary lifting pump is placed under the water in the well and the water is lifted to the tee joint. From the tee the water is forced through an underground pipe to the supply tank. A stuffing box is placed over the upper end of the pipe and around the sucker rod.

One of the most common methods of raising water to elevated tanks is shown in D. This outfit consists of a cylinder under the water which lifts the water through the vertical pipe until it is high enough to run out through a tee joint and horizontal pipe to the elevated tank. A deep well cylinder is shown here. The cylinder is smaller than the pipe, so that the piston and check valve may be drawn out without disturbing the pipe.

With the pumps and cylinder shown in Figure 10 various combinations can be made other than these shown and a suitable outfit arranged for any ordinary farm well.

Equipment of this kind can usually be obtained from the local hardware dealer.

It is nearly always best to install the type of pump that has been found best suited, by the experience of others, to the wells of the locality. If the pumps in the various wells of the community are similar, hardware dealers can afford to keep repairs in stock for them.

Water Sources Other than Wells and Cisterns

In the discussion and sketches, hereafter, a well or cistern is considered as the source of the water supply but the suggested methods of getting water into the house are applicable to other sources of water, as from an earth tank, a spring, or a creek. For example, water may be pumped from an earth tank, a spring or a creek with a windmill, a gas engine or an electric motor and in most cases a shallow well type of pump may be used.

In pumping from a good spring, a creek or a flowing well, the use of a hydraulic ram should be given consideration. However, pumping with a ram is not always as practicable and economical even where flowing water is available as some other pumping device may be.

Water Supply Systems With Elevated Tank

Figure 11 shows a water supply system which is one of the most common in Texas except that the water is usually piped to the barn and not to the house. If it is piped to the house, too often it is not brought into the house to a kitchen sink. A pipe of 1-inch or ¾-inch diameter is suitable for running water from the tank to the sink. The waste water from the drain is run into underground drain tile where it may seep away without forming a mud puddle. It may be used to subirrigate a garden.

If considerable quantities of grease are permitted to enter the sink waste pipe, it is advisable that a grease trap be installed to catch the grease that would otherwise enter the underground drain tile and eventually destroy the ability of the surrounding soil to absorb the waste water.

Plans for grease traps are available from the Extension Service.

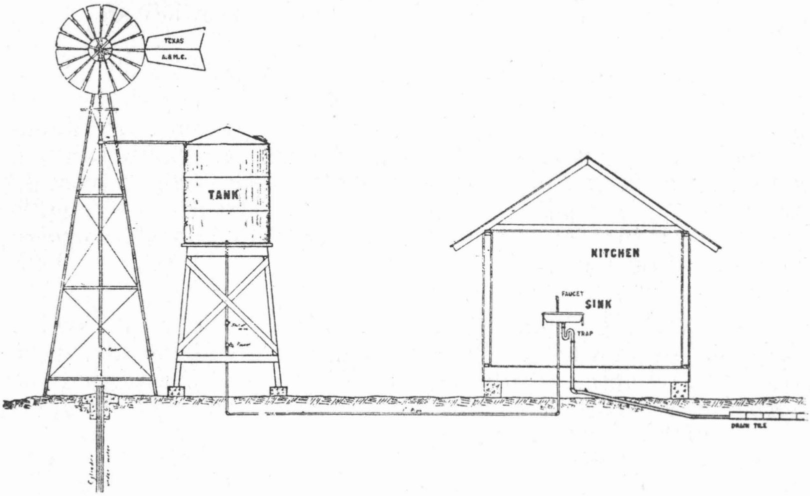


Fig. 11.—Popular water system.

Figure 12 shows a concrete storage tank with a milk cooling trough in the room below. By means of the three-way valve the water may be pumped to the milk trough, from which it overflows through a pipe to the horse trough; or by turning the valve the other way the water is pumped to the storage tank. The overflow pipe in the cooling trough consists of a short piece of pipe which will unscrew from a coupling set in the bottom of the trough.

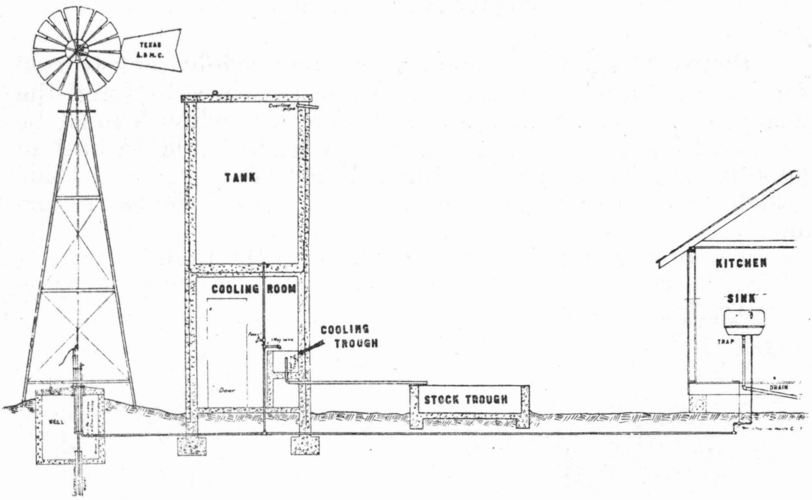


Fig. 12.—System using concrete storage tank.

Figure 13 shows how a nearby hill may be utilized to support a tank at an elevation above the house. The hill may be between the well and the house. A concrete tank built underground on a hill top makes a good reservoir as it keeps the water from freezing in the winter and cool in the summer.

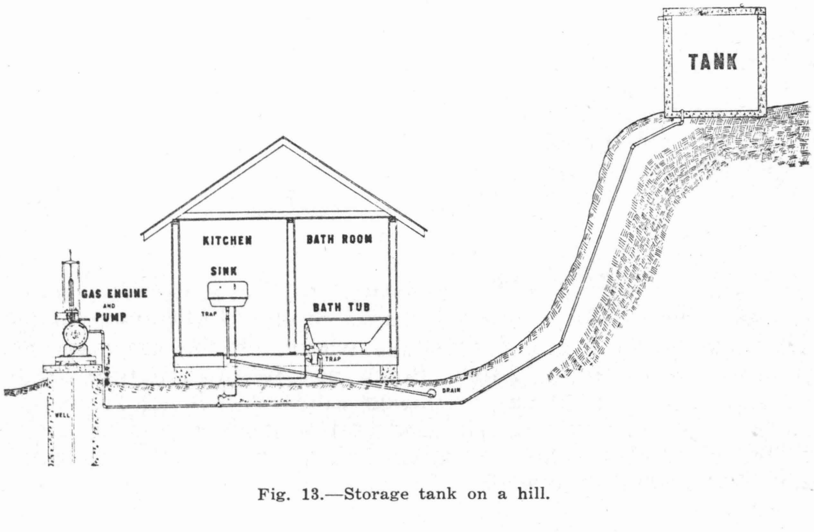


Fig. 13.—Storage tank on a hill.

Water-Air System

Figure 14 shows a system where an air-tight tank is used for water storage and for furnishing pressure to force the water to all fixtures. In sections where a windmill cannot be depended upon to pump water regularly, it would be best to plan to use an engine or electric power pump with this system unless a very large tank is used to give plenty of storage.

The pressure to force the water from the tank is furnished by the compressed air above the water in the tank. It is

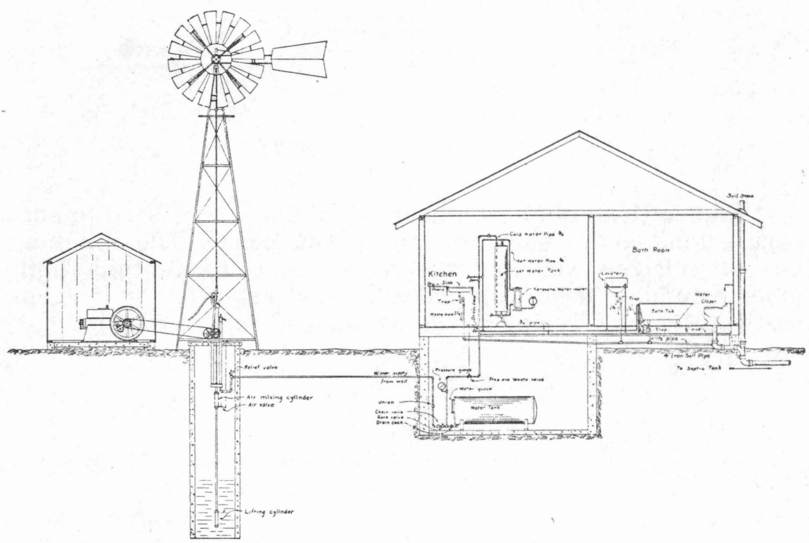


Fig. 14.—Pressure tank in basement.

necessary to replenish the air as well as the water. This may be taken care of by using a special cylinder that pumps some air into the tank along with the water, or the air may be pumped in by hand pump. Some advantages of this kind of a tank are that it can be placed where it will not freeze, a rather high pressure can be had at the faucets, and no tank tower is needed. The water and air may be put into this tank with hand pumps if desired.

An automatic control may be used with the water-air tank. The control is arranged so that when the pressure in the tank goes down to a certain point, the pump motor will be started, or the windmill will be thrown in gear. Then when the pressure in the tank is raised, the motor will be stopped, or the windmill will be thrown out of gear automatically. If a gas engine is used for power, it may be stopped automatically when the pressure in the tank has been raised to a certain point.

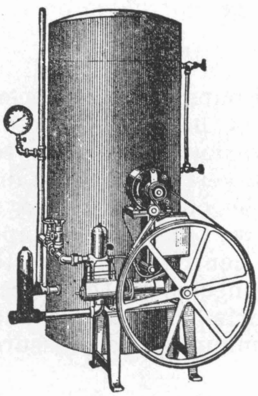


Fig. 15.—Automatic pressure system for shallow wells.

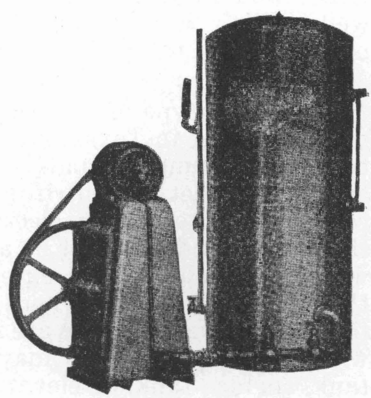


Fig. 16.—Deep well automatic pressure system.

Electrically Operated Pumps

Where electric power is available, automatic control of the pumping is quite simple. If one wishes to pump with an electric motor into an elevated tank, a float switch may be installed in the elevated tank so as to cut the motor on and off as needed.

In figure 15, an automatic electric outfit is shown that is suitable for a shallow well or cistern where the vertical lift is less than 14 to 20 feet depending on the elevation above sea level. The greater suction lift is possible at sea level.

In figure 16, a deep well outfit is shown. With this type of outfit the motor operates a sucker rod that may be connected to any such pump as is shown in figure 10. Such outfits as these are designed to pump some air into the pressure tanks as is necessary for their proper operation. The pressure switches used with the outfits are ordinarily set to cut the motor off when the tank pressure goes up to 40 pounds and to cut the motor on when the tank pressure falls to 20 pounds.

In recent years automatic electric outfits have been designed to use a centrifugal pump for pumping. Such a pump set at the ground level is suitable only for a well or cistern less than 20 feet deep. Since a centrifugal pump will not pump air, it would not be suitable in a well where the water in the well is likely to be pumped down below the foot valve on the bottom end of the pipe.

Another type of electrically operated pump that has been on the market in Texas only a few years is the jet or injector type. This pump is made for wells of various depths up to around 200 feet. A centrifugal pump on a vertical shaft is directly connected to an electric motor. The outfit sets above the ground and need not be at the well. Two pipes, or one pipe with two conduits in it, extend from the centrifugal pump to the water in the well where they are connected to the injector and foot valve. There are no moving parts below the ground with these pumps. They may be used to pump into a pressure tank, surface tank, or elevated tank.

Motor Size for Electrically Operated Pumps

The required size of the motor will depend on the quantity of water to be pumped, the depth of the well and the distance the water is to be pumped away from the well. A minimum size of well pump motor of one-sixth horsepower would be suitable for a well less than 20 feet deep where a pumping rate of about 2½ gallons per minute is satisfactory and where the tank is at or quite near the well.

With a deep well outfit a minimum sized motor would be ¼ H.P. and for some situations a much larger motor would be needed.

Fresh Water System

Where electric current is available an electric motor may be so controlled that it will pump water direct from the well, whenever a faucet is opened. An automatic electric switch is controlled by the pressure in the pipes. The opening of a faucet reduces the pressure and starts the motor. When the faucet is closed the rise in pressure in the pipes immediately stops the motor from pumping.

This system might be used without the installation of a pressure tank if used only for drinking and cooking water. However, if the same electric pump it to be used to pump water for the bathroom there should be a pressure tank used with the fresh water pumping feature.

The Hydraulic Ram

A ram is very cheap as to first cost and requires practically no attention or upkeep. Its use is, of course, limited to places where a stream of water is flowing or to flowing wells. Also some fall must be obtained between the water supply and the ram within a reasonable distance, except in the case of artesian flow. The ram is operated by what is commonly known as "water hammer." It utilizes the power from a large amount of water falling a short distance, to lift a part of the falling water to a greater height.

Rams will operate where a flow of water of two gallons or more per minute may be obtained, and a fall of two feet or more is available. The height to which the water may be raised will depend on the available fall through the drive pipe and the proportion of the flow that is to be delivered. Where a ram can be operated to furnsh a home water supply, the water may be delivered to an elevated tank, or into an airtight tank on the ground or in the basement of the house. If the water is delivered to a pressure tank, the water would be forced to the faucets by air pressure in the tank as in the case of the water-air systems.

A ram will deliver from about one-sixth to one twenty-fifth of the water that enters the drive pipe. To get an approximate estimate of the quantity of water in gallons per minute that will be pumped by a ram, multiply the number of gallons of water per minute available, by the number of feet of vertical drop that can be obtained down to the ram, and divide this product by twice the vertical height in feet to which the water is to be lifted.

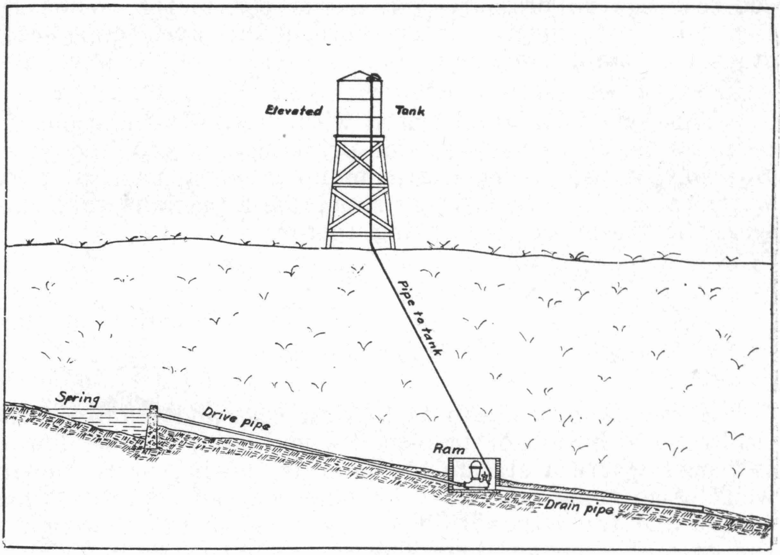


Fig. 17.—Hydraulic ram lay-out.

Plumbing And Fixtures In House

Figure 18 shows a set of plumbing fixtures and pipe connections. A water heater burning kerosene is more convenient in Texas than a water heater in a wood or coal stove, since such a stove is not used much except in the winter. Note that the pipes are sloped to drain at stop cocks when shut off in freezing weather. The supply pipes going to the fixtures may be reduced from 1-inch or ¾-inch main pipe, to ½-inch pipe. This system having a water closet, it is necessary that a sewage disposal system be provided. The sewer pipe is usually 4-inch cast iron pipe until the sewer line is carried a few feet from the building. A bill of material of the pipe and fixtures shown is given as an aid to obtaining an estimate of the cost of such an outfit.

1 kitchen sink with fittings
1 bath tub with fittings
1 lavatory with fittings
1 water closet with fittings
1 hot water tank with fittings
1 kerosene heater with fittings
50 feet ¾-inch galvanized iron pipe
55 feet ½-inch galvanized iron pipe

1 faucet for hot water tank
3 1½-inch elbows
2 1½-inch tees
2 ¾-inch stop and waste cocks
15 feet 4-inch cast iron soil pipe
12 feet 3-inch cast iron soil pipe
1 4-inch cast iron quarter bend
1 roof flashing
5 ¾-inch tees
4 ½-inch tees
8 ¾-inch elbows
3 ½-inch elbows
4 ¾ x ½-inch reducers
1 bath tub trap
25 feet 1½-inch waste pipe
1 4x3-inch cast iron reducer
1 4x4-inch cast iron tee branch for 1½-inch inlet
1 4-inch cast iron quarter bend tapped
10 pounds lead wool
5 pounds oakum
2 pounds putty

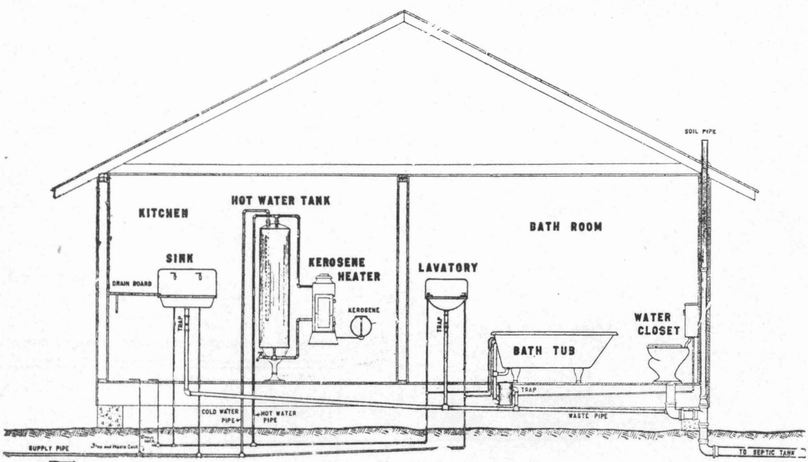


Fig. 18.—Pipe and fixtures in house.

Protection of pipes against freezing. All water pipes should be buried 12 inches or more in the soil wherever practicable. Stop and waste cocks should be placed in exposed pipes so that the water can be cut off and the pipes drained during freezing weather.

Pipes connected to an elevated supply tank may be protected against ordinary freezing temperatures by packing sawdust, cottonseed hulls, or paper in a tube about 8 inches or more on each side made from boards. Wrapping the pipes with paper to a thickness of an inch or more will give considerable protection.

Salt may be put in the waste pipe traps and water closet bowls to protect them against freezing.

Sewage Disposal System

After water has been piped into the house many desire to include with the fixtures, the water closet.

When this fixture is included, attention must be given to the safe disposal of the waste water from the house. About the only practical means of doing this is by running the waste water through a septic tank and then into a bed of disposal tile.

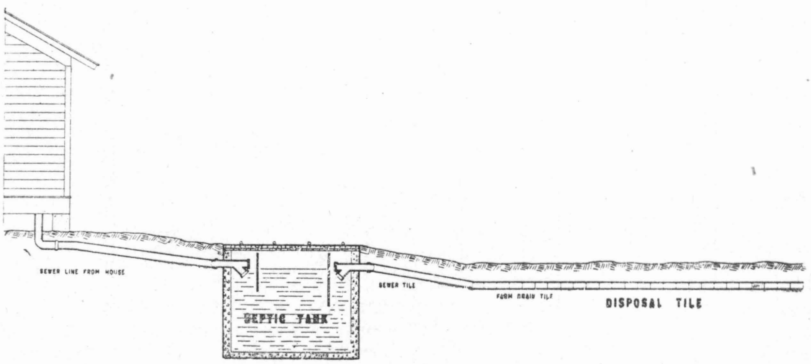


Fig. 19.—Sewage disposal system.

Figure 19 shows a sewage disposal system with a one chamber septic tank. The sewage is brought into and carried a few feet from this tank in sewer tile with tight joints. Then the sewage goes into open jointed tile where it passes out into the soil. The septic tank is merely a water tight box where the sewage should remain under a natural scum until the solids in it decompose.

The open jointed tile should run under the ground within a foot or so of the surface so that sewage may be acted upon by the air and sunlight.

A bill of material necessary for this system is given in order that one may figure on the cost of putting in a sewage disposal system:

Material For a Septic Tank For 8 Persons

20 sacks of cement
1½ cu. yds. of sand
3 cubic yds. of gravel or crushed stone
375 feet of ¼-inch rods for reinforcing (woven wire may be used instead of rods)
2 sewer tile Y's, 4-inch.

Tile To And From The Septic Tank

100 feet (may vary) sewer tile, 4-inch (house to tank)
20 feet of 4-inch sewer tile (tank to disposal tile)
200 feet of 4-inch farm drain tile, open joints (usual minimum requirement for 8 person tank)
5 pounds of oakum (for sewer tile joints)
Small quantity of cement mortar

Complete plans for one-home sewage disposal system may be obtained by writing the Extension Service, A. and M. College, College Station, Texas.

Further information on Farm Home Water System may be obtained from Farmers' Bulletins, Nos. 1426, 1448 and 1460.


Coupling


Union


Reducing Coupling


Tee


90° Elbow


45° Elbow


Lock Nut


Bushing


Nipple


Stop and Waste Cock


Plug


Cap


Compression Hose Bibb


Fuller Plain Bibb


Globe Valve


Check Valve


S Trap


Bath Tub Trap

Cooperative Extension Work in Agriculture and Home Economics, Agricultural and Mechanical College of Texas and United States Department of Agriculture Cooperating.
Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.

25M—3-40