MICHAEL BRODER
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Storage of Suspensions

It is recommended that suspensions be stored in vertical, mild steel or plastic tanks equipped for air sparging. Tank size of about 12 feet diameter by about 20 feet tall (16,000 gallons) is very satisfactory. Thickness of the metal is about 1/4 inch. Life of the steel tank can be extended by coating the inside with a material such as an epoxy base paint.

The tanks may have flat bottoms or cone bottoms. Although cone bottom tanks are more expensive than flat bottom tanks, it is easier to resuspend materials that settle in the cone of the tank. When suspensions are not of good quality, solids sometimes settle and collect on the bottom at the outside walls of a flat bottom tank where they cannot be resuspended with air sparging. This problem can be avoided with cone bottom tanks.

The foundation for a storage tank should be about 2 feet deep and made of 1/4-inch crushed rock or gravel. The gravel should be well compacted. Concrete may be used also. The flat bottom of a steel tank should be coated on the outside with asphalt or epoxy resin paint before it is placed on the foundation. The location should be well drained so that the tank bottom does not ever stand in water.

If a separate centrifugal pump is to be used for transferring the suspension into and out of storage, the pump should have a 5-inch inlet and a 4-inch outlet and be equipped with a 30-hp motor. A more powerful motor may be required if pumping is against a high head, such as a long run of pipe or an exceptionally high elevation. The transfer lines should be 4-inch pipe; the pipe may be black iron or PVC schedule 80 plastic. The plastic pipes should be equipped with expansion joints and should be well supported. A typical support is shown in figure 1.

Sparging

Recommended designs for air spargers for flat bottom tanks are shown in figures 2 and 3. A sparging system for a cone bottom tank is shown in figure 4. An air compressor powered by a 3-hp electric motor or gasoline engine is adequate. The air reservoir (300-gallon tank) is pressurized to 100-125 pounds per square inch. Then, the control valve for regulating the air discharge is opened wide to allow all the air to discharge through the tank to give the suspension a rolling type mixing. The reservoir is recharged then to sparge the next tank. The reservoir may be connected to as many tanks as desired, and one tank at the time is sparged.

Sparging Schedule

The primary purposes of sparging are to prevent the gel in the suspension from becoming too strong, to control syneresis (formation of clear liquid layer on top of the suspension), and to prevent growth of large crystals in the suspension.

For the purposes of controlling gel strength and syneresis, sparging each tank once or twice a week is adequate. "Sparging" means discharging the air from the fully charged reservoir once into one tank.

To prevent excessive crystal growth, other factors have to be considered. Crystal growth in suspensions occurs mainly as the result of cooling the suspension. As the temperature decreases, the amount of salt in the solution phase decreases by crystallizing on the surfaces of the existing crystals. If cooling is uniform throughout the tank, growth of all crystals will be uniform, and none of the crystals grow excessively. However, if the cooling is not uniform, such as getting colder next to the tank wall, the crystals in the colder part of the suspension will grow. They will be fed by the warmer, more concentrated solution phase by diffusion of salt through the liquid to the colder more dilute solution. By this means, selective crystal growth occurs, and excessively large crystals may form next to the cold tank wall. The remedy is to sparge the tank frequently when the suspension is cooling. When the air temperature drops in the fall and winter, the suspension should be sparged once or twice daily until the temperature of the suspension is about the same as the temperature of the outside air. This frequent sparging will cause the temperature throughout the tank to be uniform while cooling and prevent excessive growth of crystals. When the daily average air temperature is about the same as the temperature of the suspension and remains about constant of rises, the routine schedule of sparging once or twice a week may be resumed.

The suspension always should be sparged immediately before withdrawing suspension from the tank to make the suspension more fluid and to correct any syneresis (mix in any clear liquid layer) that may have occurred.

During winter in those regions where temperatures frequently are below 0°F, sometimes a suspension becomes frozen to a solid mass. However, when the outside temperature remains above 40°F for a period of about a week, the suspension will become fluid and can be sparged. If earlier use is required, heating coils such as those shown in figure 5 may be used to warm the frozen suspension when the outside temperature is well below freezing. Tests with these heating coils have shown that about 40 gallons of fuel oil is required to fluidize 100 tons of material within the tank.

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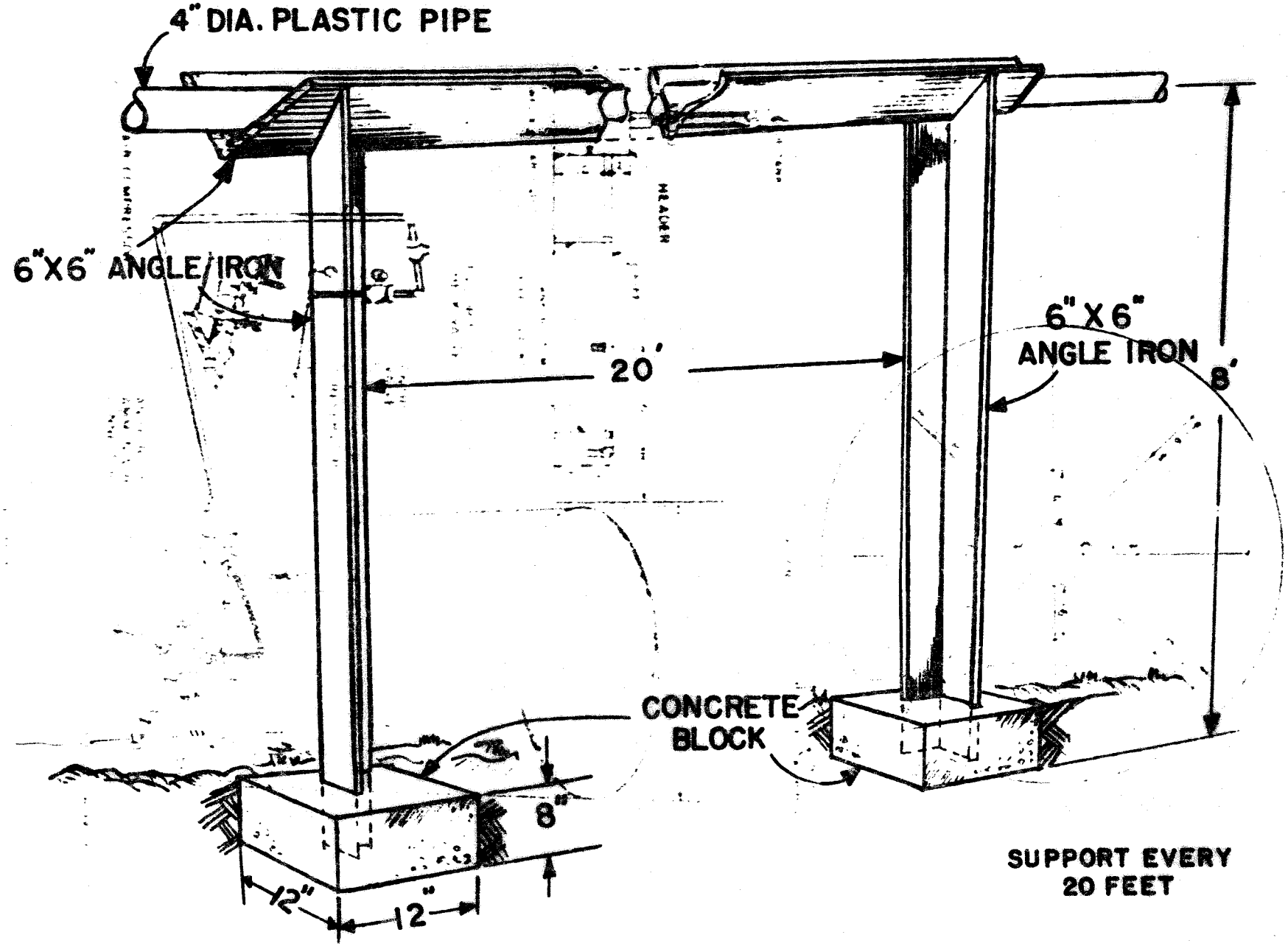

FIGURE 1

SUPPORT FOR PVC PLASTIC PIPE

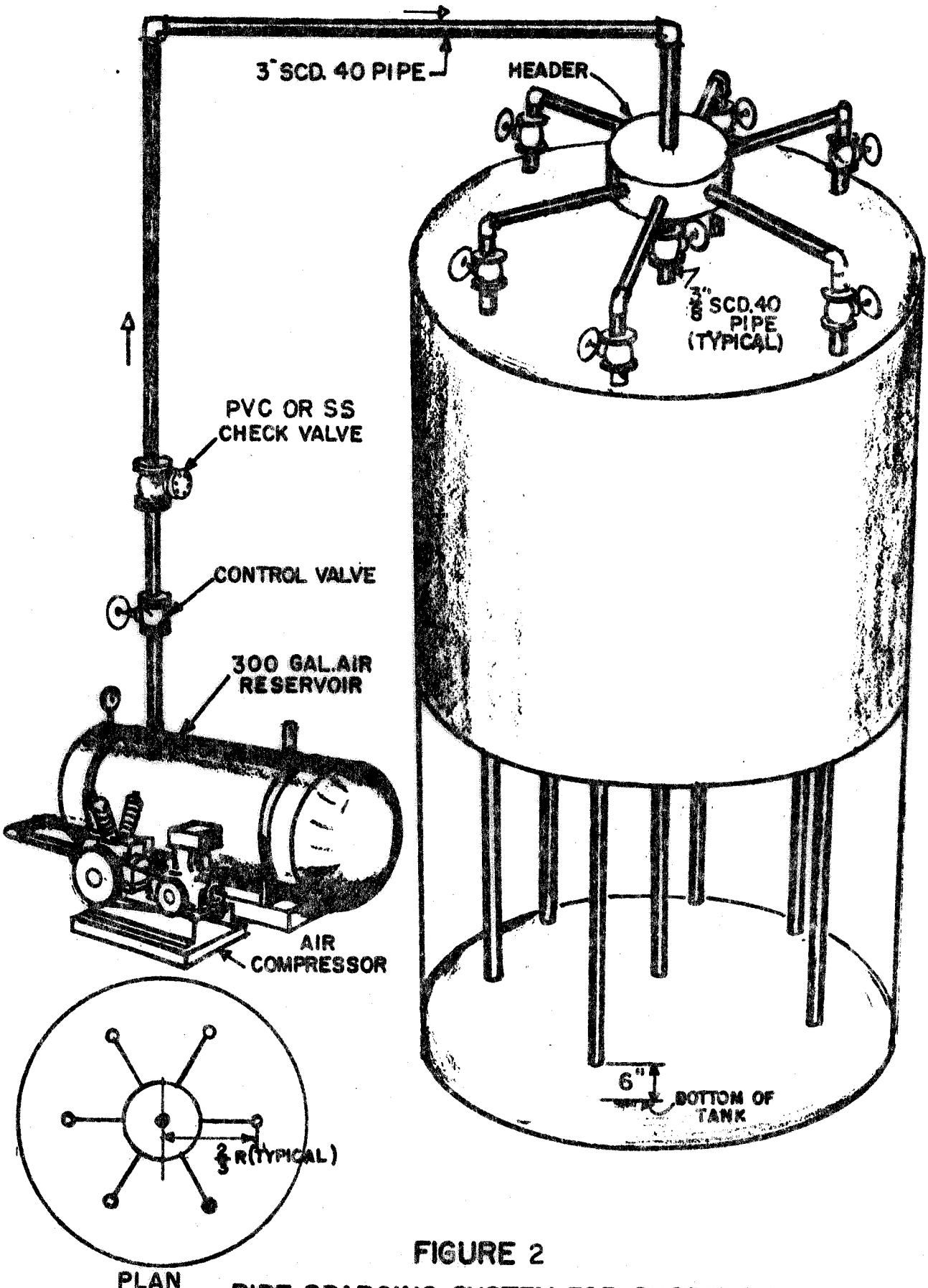

FIGURE 2

PIPE SPARGING SYSTEM FOR SUSPENSIONS

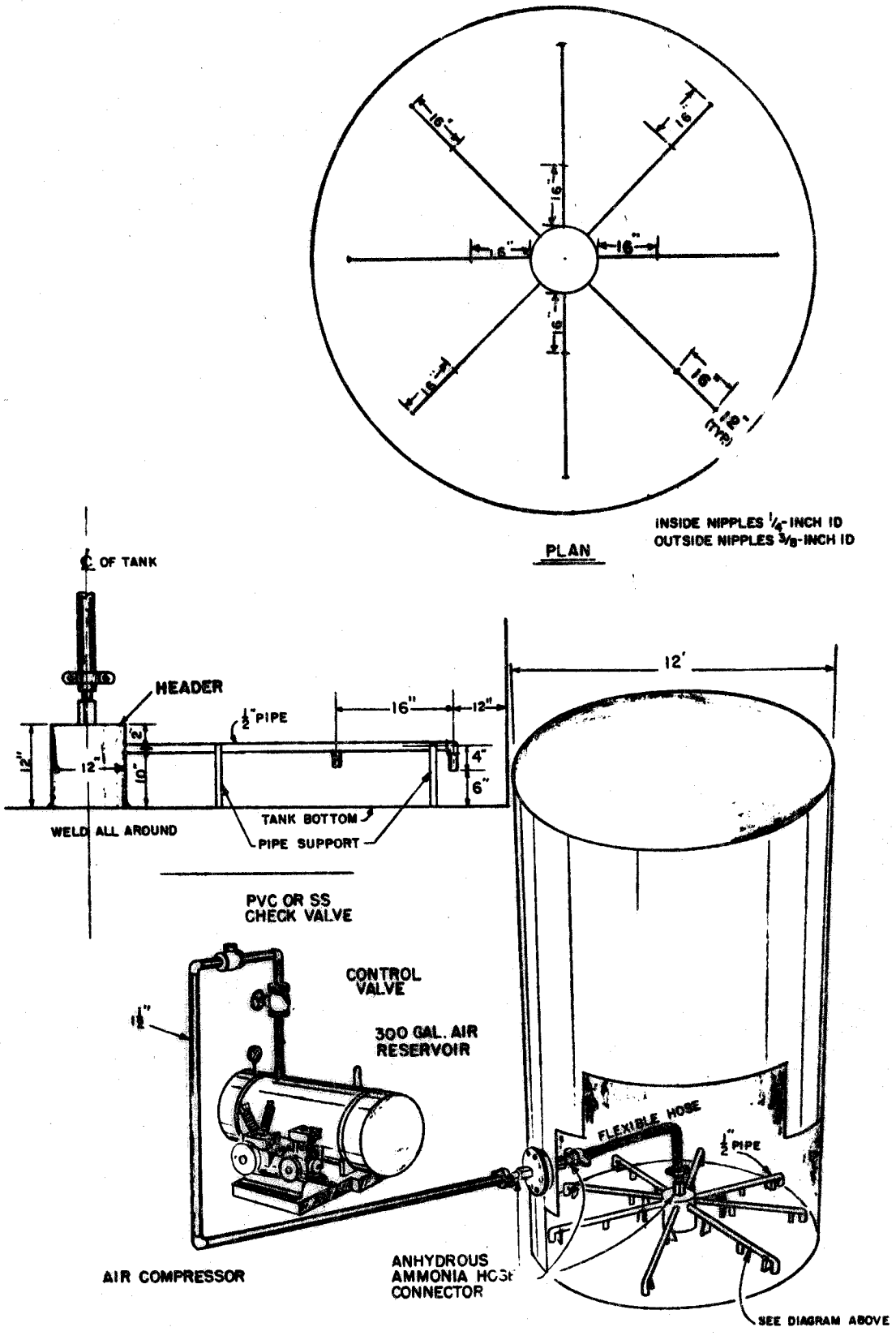

FIGURE 3

PIPE SPARGING SYSTEM FOR SUSPENSIONS

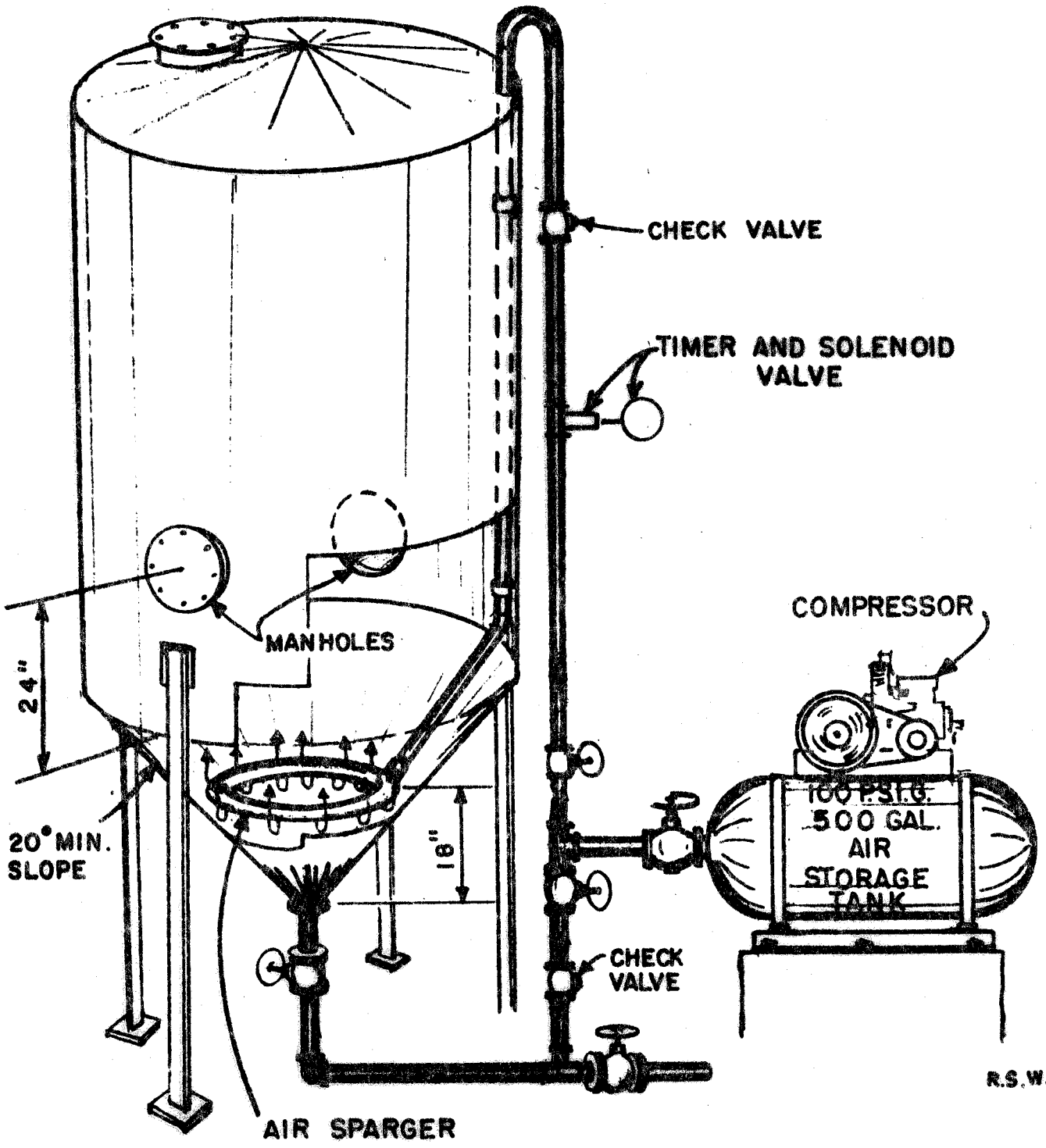

FIGURE 4

CONE BOTTOM SUSPENSION STORAGE TANK
WITH AIR SPARGER SYSTEM

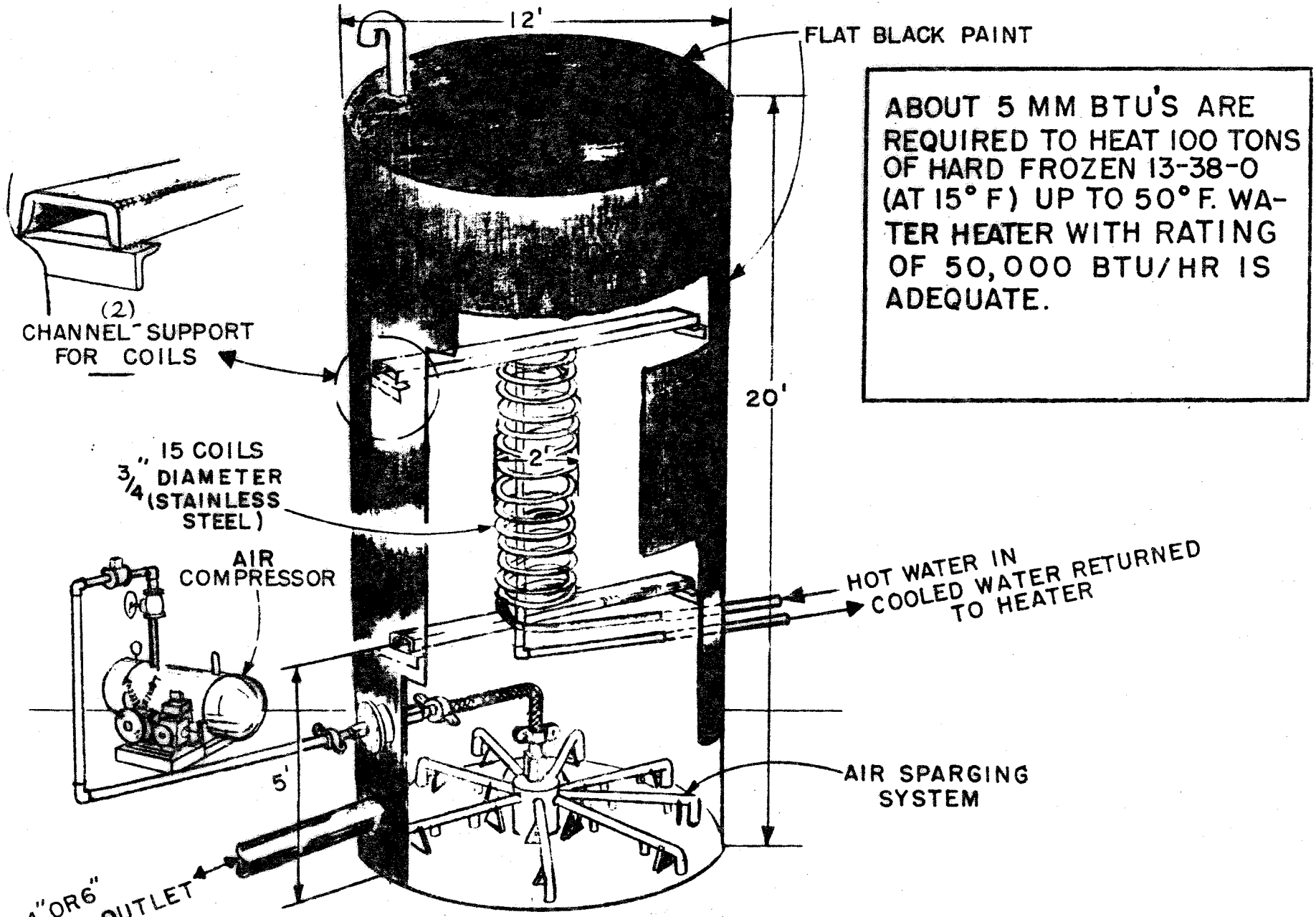

FIGURE 5

COLD WEATHER STORAGE TANK FOR 13-38-0 BASE SUSPENSION