the gravity method or the pump method.

In the first case advantage is taken of the difference in weight between equal volumes of cold water and hot water, or of cold oil and hot oil if oil is the liquid used. For example, at a temperature of 39 degrees Fahrenheit a cubic foot of water weighs sixty-two and one-half pounds, while at 212 degrees Fahrenheit a cubic foot weighs only fifty-nine and one-half pounds. The hotter the water the less a certain volume of it weighs. If we have, then, a gas engine cylinder connected to a tank as shown in Figure 1, the water in the engine jacket will become heated, its weight will be less than an equal volume in the tank and consequently the heavier water from tank will flow in by gravity through pipe and push the lighter water out. Since the tank is of large capacity and exposed to the air, the water therein is always cooler than that in the jacket and circulation continues.

Care must be taken to see that an air vent is placed in the highest point of pipe A, otherwise a bubble of air or steam may form at that point and prevent circulation. A case of this kind recently came under the writer's notice. The vent pipe was not placed in the highest part of the pipe and the cylinder became hot enough to burn the paint. The water should be from four to six inches higher in the tank than the end of the pipe A to insure circulation. If the water falls below the pipe there will be no circulation.

In the second method a pump is used to force the water from the tank through the cylinder. A small rotary pump driven by the engine shaft is generally used. This method insures better circulation. In many cases the water is delivered from the discharge pipe in the form of spray which falls thence into the main reservior. By this method radiation of the heat from the water is much more rapid and a smaller quantity of water is required. It is generally conceded that the temperature of the jacket discharge water should be just below the boiling point or in the neighborhood of 180 degrees in order to obtain the best efficiency from the engine. If the jacket water is very much colder the gases in the clyinder lose their heat and consequently their expansive power too rapidly and the engine lacks power.

Oil boils at a higher temperature than water and it is not uncommon in engines cooled with oil to run with the oil in the jacket much hotter than 212 degrees. If the engine is well made this is an advantage rather than a disadvantage because the gases do not lose their heat to the jacket so rapidly, and a larger quantity of their heat is available to do work on the piston. The limit of heat in the jacket is reached when lubrication of the piston becomes difficult and it has a tendency on account of the heat to expand and stick in the cylinder.

Another method of cooling which has been proposed and which is used in an auxiliary way to some extent, is to introduce water directly into the engine cylinder. This may be accomplished in one or two ways; either by introducing it in the form of a fine mist or spray during the aspirating stroke, the compression of the mixture will turn the