state of affairs by providing a high-pressure supply to throw a fire jet over the church steeple. Our first consideration is to carry pure water into every house at a price that will appeal to the inhabitants, not necessarily at a high pressure, though as high a pressure as can be reasonably given will lead to economy of water mains. But with a pumped supply every additional foot of height means expense in fuel, and is not lightly to be undertaken.

The question of the working hours of the pumping station is one of extreme importance, especially when there is no elevated site for a large-capacity reservoir, and only a tower tank can be employed.

If the pumps are worked only ten hours per day the tank must be very largely increased in capacity, and the plant generally must be larger and more costly, involving a continual extra charge on the undertaking. One man can take charge of the pumping station, but there must be a second man as a stand-by in case of illness or accident. The well and pump will need to be larger or in some way more costly.

Now, by pumping for a day of twenty hours there will still only be two men employed; the tank and the plant generally can be minimized and the expenses generally will be kept to the smallest possible figure. As regards the pumping for ten hours, however, it must not be forgotten that the power plant can be fairly small. Spare plant there must be, but with simple machinery there is no very special reason why the so-called spare plant should not be worked regularly. In event of breakdown the remaining plant can, during repairs or overhaul, be worked for twenty hours per day. With a plant set out for a long day one puts in spare plant. With a short working day the item of spare is filled by utilizing spare hours.

When a short day is decided upon it would appear to be a fairly satisfactory policy to work, say, two-thirds or three-fourths of the plant, the remaining third or fourth alone being spare. This question of machinery is somewhat troublous with small supplies, because it is unwise to employ gas engines of too small a size, and when of full size or large enough to do the whole work, then the spare plant for the long day is just as big as the running plant.

An advantage of lon-day working, which comes to the front when it is necessary to soften the water, is that the softening plant may be made of smaller size, and a considerable saving of expense may, herefore, be made.

Pumps.

The kind of pumps to employ demands careful thought. With a dug well carried down to the water level there is nothing better than the treble-barrel pump, with three-throw crank, such a pump being balanced. But in many cases the water level is at a considerable depth below surface, and there will be no dug well. In this event—and such an arrangement is better from a safely sanitary aspect—there will be either an air-lift pump or a simple barrel pump put down the bore pipe and worked by machinery at the surface. These simple barrel pumps require to be so proportioned as to work slowly, for they are then durable and reliable, but unless there is a storage reservoir of considerable capacity, both the borehole and pump must be in duplicate.

In the most economically-devised scheme there should be a set of spare rods and bucket, and there should be appliances on hand for rapidly removing the working set. With the air-lift pump the power required is much greater than for the barrel pump, especially when the water level is far down. The air-lift is, therefore, most suitable where the lift to surface is low and there is a softening apparatus whence the softened water is raised to the tower tank by turbine pumps or by geared or belt-driven pumps worked by the same engine that works the well pump or air-lift. The air-lift has the very great advantage that the whole of the machinery is at the surface, and there need be no set relation between the position of the engine-house and the site of the well, it being so easy to carry the compressed-air pipe to any reasonable distance with very little loss of efficiency.

As regards tank capacity, this will depend upon the working hours of the pumps, and is best found by a diagrammatic representation of the rate of filling of the tank during the period of pumping, and of the rate of demand, which must be assumed according to conditions. Thus, a fair assumption is that the demand is divided into four parts and periods, three of two hours each, during which a quarter of the day's demand in each period is consumed, while the other fourth is divided over the remainder of the day, but chiefiy in the forenoon, afternoon and evening. By plotting supply curves for ten, twelve, sixteen and twenty hours, the depletion of the tank can be ascertained for every hour of the day, and it will be found that but little difference occurs as between a pumping day of fourteen or twenty hours, but below fourteen hours a considerably larger tank capacity will be found necessary. The height of the tank is also of importance. If too high, a perpetual extra charge for interest and high pumping is introduced, but the mains may be smaller. In small supplies the ends of the various mains are already larger than calculation demands, and too much pressure should not be expected. Every case must be considered by itself, for no anticipation can be made that will fit each case when it comes up. There are certain general rules that an engineer should follow as far as possible, but every rule may at some time be better disregarded than followed. Thus a supply main should not be made to serve as the rising main from the pump to the reservoir, but with a small supply and the necessity of a close economy cases might arise where this rule would quite properly be abrogated.

A small water supply is a matter of compromise. The people have for years had a meagre supply from more or less polluted wells. Finally, cases of typhus occur, the public conscience is roused, and a better supply is desired, but there is little money available. It is very undesirable to attempt a scheme of perfection at a cost that will merely serve to frighten the people and postpone the scheme indefinitely. Rather a moderate scheme should be undertaken, because any scheme which will deliver a fair flow of pure water from a half-inch tap into every kitchen sink is far and away better than the carrying of water from wells at a distance, and often in dirty pails. Moreover, every family using a well is at the mercy of any dirty person who may choose to carry water in a dirty pail. This is particularly the case where there is no well bucket.

The question of house cisterns is one that admits of much argument. If every house that has a cistern the mains can be smaller and cheaper, for the demand is spread over the day in comparative evenness.

But cisterns, especially in small houses, are apt to become dirty and neglected. The ideal cistern, could it be made, would be closed and expansible, like a concertina, and weighted so as practically to be in balance with the supply. But there is no material from which such a cistern could be practically constructed. Cisterns with ball valves are apt to cause great loss of water. A closed cistern with an air-snifting valve has the disadvantage that the air drawn into the cistern as this is drawn upon may be foul air, and there would be difficulty in maintaining a good filtering medium to each air pipe. Cisterns are thus not to be encouraged in small houses.

As regards power for pumping, there is to-day a wide choice between steam, oil engines, gas engines with town's gas, gas engines with producer gas, and electricity. Circumstances in each case may be such as to warrant the choice of some particular motive power, but generally for small water supplies it is likely that the gas engine with producer gas plant will prove by far the cheapest. For larger towns it may be that a steam plant will be considered more reliable than gas power, but this becomes every year less certain, and for small towns of 3,000 to 5,000 inhabitants the gas plant seems better than any other.

To sum up, it may briefly be said that the gravel and sand supplies from shallow depths must be employed with great circumspection, and that the bored-tube well is almost certainly a safe thing whereever made.