place every particle of sand, or other matter heavier than water, will stop until, if the depression is sufficient, a barrier is formed and the drain stopped.

In speaking of the forms of tiles, the superiority of rounded openings over those with flot bottom has been proven. The greater head of water in a round pipe gives it force to drive before it all obstructions and so tends to keep the drain clear. The water from deep drains is usually very clear, and cattle find the outlet a convenient drinking place, and pigs find it a pleasant place to wallow, and they constantly tread up the soft ground there and obstruct the flow of water. All earthy matter and chemical solutions of iron and the like, tend to accumulate by deposit at the outlet. Frogs, mice and insects of many kinds collect about such places and creep into the drains. The action of frost in cold regions displaces the earth and even masonry if not well laid; and back water, by flowing into the drains, hinders the free flow of the water. All these causes tend to obstruct drains at the outlet. If once stopped there the whole pipe becomes filled with stagnant water, which deposits all its earthy matter, and soon becomes obstructed at other points, and so beeomes useless. The outlet must be rendered secure from all these dangers at all seasons.

No crevice, however small, in a tile drain, is proof against the entrance of the roots of water-loving trees, and when roots enter a drain they grow like long, fine grass and become thickly matted together, and very soon close the drain, and those who lay tile drains near willows and ash and like cold-water drinkers must do it at peril of which they are warned, I have never known roots to obstruct pipes through which there was not a perennial stream, the flow of water in summer and in early autumn appears to furnish the attraction. Laying the tiles deep and with collars will afford the best security from all danger of this kind.

In some cases drains become obstructed by peroxide of iron. Iron exists in all animal and vegetable matter and in all soils to some extent, the iron in the soil is held in solution in water as a protoxide and is converted into pre-oxide by contact with the air either in the drains or at their outlets, and is then deposited at the bottom of the water. Common pipe drains should be full of air, which might perhaps in a feeble current be sufficient to cause this deposit. To guard against obstructions from per-oxide of iron tile should be laid deep, closely jointed or collared, with great care that the fall be continuous, and especially that there be a quick fall at the junctions of minor drains with mains and a clear outlet.

It is sometimes claimed that tiles are frequently prevented from receiving water by the filling up of the crevices between them. If water is poured on tiles in a stream it would be likely to carry into these openings enough earthy matter to fill them, but the whole theory of thorough drainage rests upon the idea of slow precolation of the passage of water in the form of fine dew, as it were through the motionless particles which compose the soil, and if drains are properly laid there can be no motion of particles of earth either into or toward the tiles. The water should soak through the ground precisely as it does through a wet cloth. The ascertained instances of the obstruction of pipes by excluding the water from the joints are very few. No doubt that clay puddled in upon the tiles when laid will have this effect, but those who have experience in tile drainage will bear witness that there is far more difficulty in excluding sand and mud than there is in admitting water.

It is thought by some persons that sufficient water to drain land may be admitted through the pores of the tiles. I have no such faith. About 500 times as much water enters at the crevices between the tile as is absorbed through the tiles themselves.

Collars on tiles have a great tendency to prevent the closing up of the crevices between them, but injuries to tile laid to proper depths are very rare.

Water Supply.

Storage Stand-Pipe

Where a sufficient elevation is not to be had for the construction of an earthen reservoir it is a common practice to erect what is known as storage stand-pipes. This is practically a small reservoir built of plate iron, riveted the same as a steam boiler, erected upon the most favorable hill or elevation and carried to sufficient height to afford the necessary head for the town supply. The thickness of the metal varies with the height of the column, and rarely exceeds half-an-inch for the lower courses and diminishing to one fourth or three-sixteenths at the top. Near the base is a man-hole for access for cleaning and repairs, and the column is provided with a fixed ladder or spiral stairway leading to the top.

To insure a perfect uniform pressure on the pumps, an internal stand-pipe of the same diameter as the force main is sometimes placed in the centre of the column, the water from the pumps being discharged from the top. The same object may also be accomplished by omitting the internal pipe and substituting a weighted valve on the discharge pipe at the bottom.

By a simple arrangement of a check valve the water during the hours of pumping is distributed directly from the pumps, the surplus being discharged into the stand-pipe. When the pumping ceases the stored water is delivered into the mains through the check valve at the base of the bottom.

By the vertical circulation of the water in the stand-pipe, together with the alternating flow in the distributing pipes, fresh water of a nearly uniform temperature is ensured at all seasons of the year. In winter, when the atmosphere is colder than the water, the natural circulation carries the colder water to the bottom, where it is received into the distributing main, while the warmer water is constantly rising to the surface, thus preventing freezing, and before the whole body can have been sufficiently reduced in temperature to form ice another supply is received fiom the pumps. By this process the cooler water contained in the column is delivered to the pipes in summer.

Useful Information—Water

Doubling the diameter of a pipe increases its capacity four times.

Friction of liquids in pipes increase as the square of the velocity.

The main pressure of the atmosphere is usually estimated at 14.7 lbs. per square inch, so that with a perfect vacum it will sustain a column of mercury of 29.9 inches or a column of water 33.9 feet high.

To find the pressure in pounds per square inch of a column of water multiply the height of the column in feet by .434. Approximately we say that every foot elevation is equal to ½ lb. pressure per square inch, this allows for ordinary fricture.

To find the diameter of a pump cylinder to move a given quantity of water per minute, 100 feet of piston being the standard of speed, divide the number of gallons by four, then extract the square root and the product will be the diameter in inches of the pump cylinder.

To find the horse power necessary to elevate water to a given height, multiply the total weight of the water in pounds by the weight in feet and divide the product by 33,000, an allowance of 25 per cent. should be added for water friction and a further allowance of 25 per cent. for loss in steam cylinder.

The area of the steam piston, multiplied by the steam pressure gives the total amount of pressure that can be exerted. The area of the water piston multiplied by the pressure of water per square inch gives the resistance. A margin must be made between the power and the resistance to move the pistons at the required speed, say from 20 to 40 per cent. according to speed and other conditions.

To find the capacity of a cylinder in gallons. Multiplying the area in inches by the length of stroke in inches will give the total number of cubic inches, divide this amount by 277.23 and the product is the capacity in gallons.

Woman Suffrage Abroad.

In the domain of local self-government women are admitted to the franchise in England, inciuding her colonies, in Sweden, Iceland, Finland and Russia. In Austria, Prussia, Saxony and Brunswick they vote in rural communes only. Further, women have the franchise in school elections in Norway.