water supply is larger every year, such increased cost, compared with the subsequent trouble and expense, and often positive danger of a deficient water supply, is very small. Thus, a 10-inch pipe costs but 26 per cent. more than an 8-inch pipe, while its discharging capacity is increased 75 per cent. A 12-inch pipe costs but 23 per cent. more than a 10-inch pipe, while its discharging capacity is 58 per cent. greater. A 16-inch pipe costs but 41 per cent. more than a 12-inch pipe. while its discharging capacity is 105 per cent. greater.

In making the above calculations of the amount of water used for fire streams, I have taken the amount of water delivered through a 1-inch nozzle, as this is the smallest size that can be used for an effective fire stream. For a very heavy fire a larger nozzle than 1-inch would be more effective, and I think most fire departments are equipped with several nozzles of large size.

Distribution Mains.—My remarks as to the main pipe line apply also to the distribution pipes through the streets, in that they are apt to be built of too small pipe. Four and 6-inch pipe cut down the pressure very quickly when passing a large quantity of water. Take for example, the amount of water required for two fire streams at 160 gallons per minute each, equal to 320 gallons per minute, and suppose it to be passed through a 4-inch pipe. The loss of head from friction in the pipe will amount to 110 feet head per 1,000 feet in length. Under the same conditions a 6-inch pipe would lose from friction 20 feet per 1,000 feet of length. Considering the enormous friction loss in 4-inch pipe, it must be apparent that for fire purposes a 4-inch main is entirely too small, and that its use should be confined to large services. **It should never be used as a part of the distribution system.** As illustrating how quickly cast-iron pipe deteriorates, the writer was shown some years ago a section of 4-inch pipe, cut out in installing a hydrant branch. This pipe had been laid about fourteen years previously. It was manufactured by R. D. Wood & Co., of Philadelphia, and was as good a specimen of pipe originally, as regards both metal and coating, as the writer had even seen. When this pipe was cut out and examined carefully, it was found to have only 65 per cent. of its original area. All water mains can, of course, be cleared of incrustations by scraping, which increased their capacity by enlarging the orifice again. This process is, however, expensive, and in the majority of our Nova Scotia towns has not been resorted to so far. The only difference in cost between 6 and 4-inch mains is in the cost of the pipe, since the cost of excavating and laying both sizes is practically the same. As illustrating the advantages of using 6-inch instead of 4-inch, I may say that a 6-inch pipe costs only 46 per cent. more than a 4-inch, while the capacity is 176 per cent. greater than that of a 4-inch.

Cast-iron Pipes.—Cast-iron pipes are often made needlessly heavy. The writer believes in heavy weight pipe, but thinks at the same time that manufacturers take advantage of the customer and send too much overweight. A 5 per cent. variation in weight, up and down, is quite sufficient, and the manufacturers should be quite content with that amount of leeway.

There is no valid reason why any town requiring cast-iron pipe for use in its water system should have to accept pipe 10 per cent. and over in weight, and pay for the excess in metal, when the proper amount of material would give equally good results, and yet our different towns are buying pipe in carload lots, and almost invariably do this very thing. The coating of pipes properly is very important, and the manufacturers are apt to shirk unless closely looked after. All foundries use a tar bath for coating pipes, although the composition varies greatly. Very often the crude tar as it comes from the gas works is used, and the lighter products of distillation are driven off, either by the heating of the tar in the dipping-tank or by the heat of the pipe itself. The temperature of the material in the bath, and that of the pipe itself, are the important things; if both these are right, the coating will be good. The tar coating in the bath will not dry if applied to a cold pipe, and if the pipe is too hot when it is dipped the distillation has been carried too far, and the coating is brittle.

This coating of the pipes does not seem to be done with enough care, and the matter is so vital to the life of the pipe that it should be looked to carefully. It is usual for pipe specifications to contain a clause requiring good coating of the pipes, but as far as the writer's knowledge goes it is never rigidly enforced, and the result is that pipe are used in many systems that should not properly be put in.

Special Castings.—These are usually made by the local foundry, and are paid for by the pound. The result is that there is a great temptation to put in as much metal as possible, and it is not uncommon to find these castings 40 per cent. over weight. In all specials the branches and changes of direction should be made with easy curves, so as to lessen the friction of the water. A great many patterns for special castings are not of ideal design as regards the shape of the waterway, and almost universally the thickness of them is such as to make the casting needlessly heavy. The unfortunate thing is that any extra metal put in a pipe casting must be put on the outside, since the inside diameter cannot be interfered with, and the extra thickness often causes trouble. How many water superintendents are there who can vividly remember attempting to get a special casting into the bell end of a pipe of standard dimensions, only to find at the last moment that the extra metal put in at the foundry prevented its entering unless the end of the special was first chipped off with a cold chisel to make it fit.

Besides the useless metal usually paid for in special castings, there is another defect that is almost universal, namely, the protective coating applied to them. Usually special castings are made in such small quantities that the expense of fitting up properly for coating the specials is prohibitive, and the result is that a make-shift bath is prepared with which it is wholly impossible to apply a proper, tough coating. In some cases even, instead of dipping the heated casting in a prepared bath of proper temperature, the makers attempt to apply the coating with a brush, with the result that nothing is accomplished in the way of protecting the pipe.

A mistake is often made of having specials cast of unusual pattern so as to fit particular cases. This is particularly true of "Y" branches, and it would seem to be unnecessary, as all cases can be met with standard branches and sixteenth bends, and the cost of such special patterns saved to the town.

Hydrants.—As regards fire protection, these are, of course, of very vital importance. They must always be in order and ready for instant use, and, since such onerous duties are imposed on these parts of the system, great care should be taken with their manufacture and maintenance. My belief is that we do not bestow enough care on the selection and maintenance of fire hydrants, and not nearly as much as their importance demands. In the hurry and excitement of a fire, hydrants are very apt to receive rough usage, and to withstand this they require to be made very strong and heavy; spindles and packing nuts especially should have ample strength to withstand abuse. They should have large valve opening and good sized barrel, and easy curves at the bottom and at nozzles, to prevent loss of head by friction. They should drain quickly, and the drip should be completely closed while water is being drawn from the nozzles. The drip orifice should be of good size and bushed with composition, and each hydrant should be drained so as to take off the water escaping from the barrel of the hydrant when the drip is opened. The brass hydrant nozzles should preferably be screwed into the post of the hydrant, instead of being leaded in as at present, and if there could be a coarser thread adopted for the hose coupling, I am of opinion that it would be a great improvement, as I see no reason why the firemen should be obliged to take four or five turns to couple hose when one and a half turns of a coarser thread would be quite as good and amply strong.

The design of the hydrant post does not necessarily affect its efficiency, nor yet would a more artistic design add very materially to the cost of the hydrant. On the whole,