am informed that it was found necessary, on this account, to enlarge the main drain from 8 inches diameter to 10 inches, considerable damage having been suffered, two or three summers ago, from a flood of rain water during a severe storm.

A practical difficulty connected with the delivery of roof water to the house drain has also been experienced under certain circumstances, in the apparent carrying along by friction, and imprisonment, of a large amount of air by the descending column of water, and a consequent pressure upon the traps of connecting pipes, and even a serious interference with the flow in the main drain itself, unless relieved by ample venting. An instance was mentioned to the writer by John C. Collins, Chief Inspector of Plumbing for the New York Board of Health, in which very considerable injury to property resulted in this way, the rain water bursting out near the bottom of a leader and flooding the basement of a building. The leader ran down the rear of the building, the main part of galvanized iron, succeeded near the bottom by a cast-iron shoe connecting with the drain. In the drain was a running trap near the foot of the leader, and another near the front of the building. Two stacks of waste pipe and a stack of soil pipe joined the drain between the traps, and there was near the front of the building the usual four-inch fresh air inlet. Still, the five-inch drain appeared incapable of serving the leader in heavy rains, and water would back up 10 or 12 feet high in the leader and overflow at the top of the cast-iron shoe. That the trouble was due to the interference of imprisoned air was indicated by the fact that it was partly relieved by inserting a two-inch air vent between the leader and the first trap, and entirely overcome by a three-inch vent.

Now and then we find the roof water carried to the street sewer in an independent line of pipe, but the usual, and what is generally considered the preferable, practice is to conduct it directly into the house drain, sometimes at the back end, sometimes at the front, just inside the main trap, and again at both these or at intermediate points, according to circumstances.

On a large proportion of city buildings the rain leaders run down the outside of the walls, but yet in a considerable number they are carried down within the walls, in which case it is evidently desirable that the same care should be taken to prevent the escape of drain or sewer air through defective material and joints that would be taken with stacks of soil or waste pipe, consequently we find in the public regulations in force in large cities, requirements that the leaders shall be constructed of iron (in New York copper may also be used), if carried within the walls. In New York city it is permitted that leaders of iron or copper shall be without traps, unless the top is near a window, in which case a trap is required at the base. In Boston, however, all leaders must be trapped in new construction.

The troubles encountered in the practical service of leaders and gutters are occasioned in part by their becoming choked with leaves or rubbish, but principally by their being clogged and burst by accumulations of ice in winter. Leaves and rubbish may be largely excluded from leaders by the use of wire strainers or iron gratings, though these of course do not prevent accumulations outside and near the tops of the leaders. In the midst of a large city, however, leaves are usually strangers, and in a cold climate the trouble with gutters and leaders comes from ice. It is very common to see a tin or a galvanized iron leader brought from the roof down the face of the building and terminating in an iron "pipe shoe," as it is called. Such an arrangement will be found on the brick blocks of tenement houses on Nashua and Billerica streets, for example, in Boston, and walking through these streets it will be noticed that nearly every one of the cast-iron shoes has been split by ice. Leaders often become incased in ice to the size of a barrel, from top to bottom, while from gutters and eaves depend huge icicles which threaten the heads of passers below.

These troubles from ice cannot in all cases be conveniently and entirely avoided, but on important buildings it is perfectly practicable to escape them by proper location of leaders and gutters, by the use of pipes of suitable material and shape, and by the supplementary employment, in some cases, of steam.

On steeply pitched roofs, gutters are naturally found at the eaves, either built out or suspended, as has before been mentioned, with leaders running down on the face of the walls. But large business blocks are now very commonly built with tolerably flat roofs, a long slope from front to rear being succeeded by a short rise to the edge of the roof, the V-shaped channel between the two slopes serving as an ample gutter. Sometimes, indeed, as on the Morse and the Wilde estate buildings, on Washington street, in Boston, the roof is given a slope from both front and rear toward the centre, where the gutter channel is thus formed. In either of these constructions, the gutter being entirely upon the main part of the roof, it is natural and easy to carry down the leader within the building, and where this is done, little or no difficulty is experienced from ice. Rain, snow, and ice then take care of themselves, and the heat of the building, supposing it to be occupied, is found sufficient in this climate to prevent accumulations within the leader.

As has already been said, the regulations in large cities would prescribe for such cases iron or copper pipes, which indeed would naturally be employed. The same materials may be, and often are, utilized also for outside leaders, but galvanized iron and tin are far more common. The choice of material is important chiefly in connection with the lasting qualities of the pipe; the shape of the cross section, and the mode of making the longitudinal seam, are important as regards protection against bursting by ice.

In some parts of the country zinc was once almost exclusively employed for leaders; in other parts, tin. Tin pipes are still perhaps the most commonly used, on the whole, of all kinds, on account of cheapness in first cost; but galvanized iron pipes are considered superior, and being not greatly more expensive than tin are given the preference in good work. Either material, however, is subject to gradual corrosion from the water which comes in contact with it, more rapid corrosion from the moist salt air along the coast, and still more rapid corrosion from steam and from sewer air. In New York city, for instance, there are many leaders having untrapped connection with drain or sewer, and these leaders, whether of tin or of galvanized iron, are said to withstand corrosion generally but a very few years.

There are two principal varieties of tin in use for roofing and leader purposes. The old-fashioned or bright tin is "black iron," as it is called, or more and more commonly at the present time a mild steel, covered with a coating of pure tin. The dull tin which is now largely made, has the coating of tin with an admixture of lead. The bright tin, which alone of these varieties is safe for culinary articles, and which is often also supposed to be best suited to use on buildings, is considered by many whose experience is of value to be inferior for this purpose to a good dull or "leaded" tin. The latter