

water mains and service pipes which are the outcome of poor construction. I have heard people say that freezing of pipes cannot be avoided, but I do not believe such statements, and if reasonable care is observed, there need be no difficulty of that kind. Since 70 per cent. of the water pipes laid never freeze, then why cannot the balance of 30 per cent. be made to resist severe weather. In several newspapers we have read during the last very severe winter that a fire occurred in a town and the firemen were badly hampered because the fire hydrant was frozen. After large sums of money have been spent to ensure security, the article is useless at the very moment its services are necessary. The citizens are living in false security, and their property may be all consumed and even their lives may be sacrificed because it takes time, a long time, to thaw out the fire hydrant before it can be used to quench the fire, and in that case the coroner would say that it was accidental death and no enquiry necessary, when the fact of the case would really be that the person had come by his or her death on account of the carelessness or want of knowledge of the person who set the hydrant. If the party who was responsible for properly fixing the hydrant were committed for manslaughter, there would be very few frozen fire hydrants. Every winter a large number of families suffer, because the private pipe supplying their dwelling is frozen solid, and to relieve them and thaw out their pipes small boilers on wheels are supplied, probably by the ratepayers, and a staff of men takes them from house to house, and thaws the pipes out by dividing the pipe at some convenient point, and working a small copper tube into the interior of the affected pipe, and blowing in steam, until the blockage is removed; but if the pipe fitter has laid the pipe in a snake fashion, and the small tube cannot be forced round the bends, then the services of the steam boilers are useless. We should insist that work be done by persons who thoroughly understand their business, and make them responsible for the work they do, or have a fully-qualified official to inspect the work and pass it, and thus avoid the necessity of thawing appliances, and the heavy expense of repairing damages done by frost to pipes containing water.

Perhaps a few suggestions and some practical examples of how to ensure pipes from freezing, and the causes of freezing may be interesting. Water attracts frost, as well as other things, and the slightest dampness will carry a current of frost down to a metal pipe. By placing an open vessel of water in a room it will attract and absorb the frost, and in this way frost can be kept out of cellars.

By keeping this in mind when laying pipes and fixing hydrants, we may prevent the risk of freezing if reasonable judgment and care be afterwards observed in the management. I believe brass and copper will convey and carry frost along quicker than other metals; this is proved, because it is found that in most of the street mains that freeze and crack, the freezing first began at the brass bend, screwed into the crown of the main pipe, and attached to the private service pipe, and when water once begins to crystallize, it increases the crystallization right and left in the main pipe quickly, drawing the frost by way of the brass bend, similar to the tree getting its nourishment through the small root-

lets; on this account we should endeavor when fixing water pipes containing water to disconnect the pipe from frost currents in a similar way, that electricians prevent electricity from being wasted or coming in contact with foreign bodies. This may be done in various ways, first by encircling the metal pipe with stagnant air completely void of circulation, because air is an excellent non-conductor; second, by burying in pitch, rosin, brimstone or wax, or covering the pipe with an air-tight stocking of rubber, gutta percha or dry paper with a waterproof coat of varnish on the outside, to prevent it becoming damp. If a pipe is properly insulated it will not freeze. Another important point is not to fix a pipe in a position where a strong current of air, however small the current may be, can strike it direct, especially at a bend or coupling; for instance, a house pipe is often brought up through the kitchen floor from the cold basement; if the hole in the floor is a little larger than the pipe, the chilled air will rush through the aperture round the pipe, and freeze it. Pipes will stand a considerable amount of cold without crystallizing their contents, if the air that surrounds them is nearly motionless. They always freeze first where the currents of air are the most rapid, however small a stream the current may be; so if it is possible to lay a main or a service pipe so that it cannot be approached by dampness, or where a circulation of air cannot come in contact with it, then it must be safe from frost. Some engineers will not allow the filling over a water-pipe to be pounded down solid, except the traffic of the road demands solidity, because the air between the particles of earth placed loosely over the water main forms a non-conductor, and cuts off the current of frost from descending to the pipe. Even in well pounded earth, that covers the water mains, there is some air, and no doubt it prevents the frost from descending to the pipes a little, and together with the heat that is absorbed from the earth that is attacked with frost by the lower stratum immediately under the frosted surface, is no doubt the cause why the dampness in the soil cannot convey the current of frost down to the main water-pipes if laid at a suitable depth.

It is unwise to allow a metal pipe containing water to touch other metal or damp stone or brick, if such metal, stone or brick communicates in any way with the cold atmosphere outside, because such metal will convey the frost similarly to a wire that conveys electricity. I think that the custom of fixing a bent brass union on the crown of a water main, to deliver a private supply, might be done away with, with advantage, and in the place of tapping the pipe at the crown, the pipe main might be tapped on one side, and in place of using copper bends and connections, annealed or malleable iron fittings should be used, because they cannot attract the cold so quickly as brass, and it is often the case that the water in the mains is constantly on the move forward, therefore cannot readily be attacked by frost: while the water in the brass bend and service pipe only moves when water is drawn into the house, and the contents of the pipe being afterwards motionless, is easily crystallized, and then starts the water in the main crystallizing, and in that way great mischief is done. This method would lower the house service connection as much below the crown of the water main, as the brass bend extends above the water main, under the present rule,