same line the effective head is almost en tirely lost, whereas with larger pipes several effective streams can be obtained.

Fire Plags. In the estimate I have ellowed for 107 additional fire plags, which together with the 43 now in use makes 150 in all-sufficient to place one at every intersection of streets. In Boston and New York, as a general rule, they are placed 300 feet apart: When placed fut apart, the friction in the hose materially diminishes the elevation to which the water can be thrown from a pipe.

Stock Cocks.—As I am not aware of the position of the present stop cocks or of their number, I have not attempted to mark or carry out a system on the plan. Two objects should be held in view. Ist, to place them so that in emptying the mains for making, repairs or forming now connections, the consumers will be inconvenienced as little as possible, and 2nd., to subdivide the city into convenient sections so that the water can be concentrated in the case of extensive fires. In the estimate I have allowed for 110 of different sizes, in addition to the number at present in use.

By laying down the pipe of the sizes shown in the plan, fire engines would seldom be needed below Gottingen street—certainly not until the population and consequent draught on the pipes had largely increased To meet this increased draught, it would be very desirable to have a reservoir near St. Andrew's Cross, to accumulate the water during the latter part of the day and at night when the consumption is the least. This reservoir may be dispensed with for some time, but as soon as the head begins to fail from increased consumption, 1 would recommend that one be consurpted.

The small effective head that can be maintained above Gottingen street, after making allowance for friction in the pipes and hose, would render fire engines necessary for this district unless a high service system is adopted.

The distribution pipes cannot be made smaller in size, and remain permanently effective for extinguishing fires by use of the hose alone. To make them larger would be advantageoue. The loss of head in conducting water through small pipes in sufficient volume for fire purposes is very great, and it is only the surplus beyond the ordinary draught on them that can be rendered effective. To illustrate this:

Suppose an inclined pipe laid from a reservoir in the Otadel down to the harbor, with the lower end of the pipe left open, the water would then pass out with a velocity due to the total head, minus the friction of the pipe;

the whole force would be excrted in a line parallel to the axis of the pipe; there would be no verticle pressure. It would be precisely the same as water moving in an open canal where there is no pressure tending to elevate the surface. An open box would serve the same purpose as the pipe; and, if in place of the lower end of the pipe being left open, the water is drawn off by numerons diverging pipes, as in the case of city distribution, the result would be the same-there would be no vertical pressure. If, however, the end of the pipe should be partially closed, or the draught on the diverging pipes not be sufficient to carry off the water as fast as it comes down, there would then result a vertical pressure proportional to the difference between the velocity due to the whole head and the velocity due to the actual discharge-the pressure being al-ways equal to the (effective) head, minus the height due to the velocity in the pipe. The following Table shews the loss of head

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The following Table shews the loss of head in feet to overcome the friction in pipes of various diameters—one mile in length—to supply jets throwing 100 gallons per minute

| hes. | 1 Jet. | 2 Jeta. | 4 Jets. | G Jeta. | 8 Jeta. | 10°Jet |
|------|--------|---------|---------|---------|---------|--------|
| | Feet. | Feet. | Feet. | Feet. | Feet. | Feet |
| | 272.8 | 1091 6 | | | ••• | |
| | 64.5 | 258.1 | 1032.5 | | • | |
| | 30 | 33.9 | 135.8 | 305.5 | 543.2 | 848 |
| | 1.1 | 4,5 | 17.9 | 40.2 | 71.5 | |
| ~ | 0.26 | 1.0 | 4.2 | 9.5 | 17.0 | 36 |