Care should be taken sufficiently to throttle the branches especially at points of high pressure so that the discharge will approximate the amounts given in Table 1.

Unless the flow of water is throttled properly, broken fittings may result from excessive water hammer in addition to draining the pressure in the riser. The throttling should preferably be done by pipe sizing

TABLE 1. BRANCH PIPE SIZES AND QUANTITIES FOR VARIOUS FIXTURES

TYPE OF FIXTURE	PIPE SIZE (IN.)	DESIRED DISCHARGE (GPM)	PROBABLE DISCHARGE (GPM)
Lavatory	½	4	5
Bath	¾	15	14
Shower, Rain Head	½	8	5
Shower, Needle	1	30	28
Tank, Urinal	½	6	5
Tank, W. C.	½	8	5
Urinal Flush Valve	¾	30	14
Urinal Flush Valve	1	30	28
W. C. Flush Valve	1	30	28
W. C. Flush Valve	1¼	30	49
Slop Sink, etc	1	15	14

TABLE 2. EQUIVALENT PIPE SIZES[a]

(Number of ½-in. pipes accommodated by a single pipe at the same friction loss per unit of length based on $D^{5/2}$ using nominal sizes)

PIPE DIAMETER	CAPACITY OR FACTOR VALUE
½	1
¾	2.7
1	5.5
1¼	9.7
1½	15.3
2	32
2½	55
3	86.5
3½	127
4	178
5	310
6	490
8	1000

[a]The nominal size of pipe was used in the preparation of this table on account of the fact that the flow in several existing installations approached the values in the third column of Table 1 and which values follow closely along the estimated values of $D^{5/2}$ when the nominal sizes are taken.

rather than by means of control valves, since the latter concentrate all the resistance at one point which, with the necessary high velocity, causes a hissing, noisy system. To avoid the water hammer, air chambers should be installed just before the fixtures, or a pressure-reducing or flow-regulating valve should be installed on the branch.

Failure to consider the friction consumed by the meter has been the cause of unsatisfactory operation of the system in many cases. The

friction loss through the meter is sometimes as much as that throughout the remainder of the system. Its value can always be obtained from the makers of the particular meter used.

SIZING OF MAINS AND RISERS

The uncertainty of the flow in the risers leaves some uncertainty as to the pressure that will prevail at any branch take-off and precludes the sizing of the branch pipe with any degree of precision. This has led to the adoption of fixed sizes for the various fixtures. These sizes, together with the rate of flow desirable for the fixture and the probable amount of discharge that will result with the average length of branch, are given in Table 1. The discharge quantities which were taken from the equivalent values for the various diameters given in Table 2, follow closely the flow

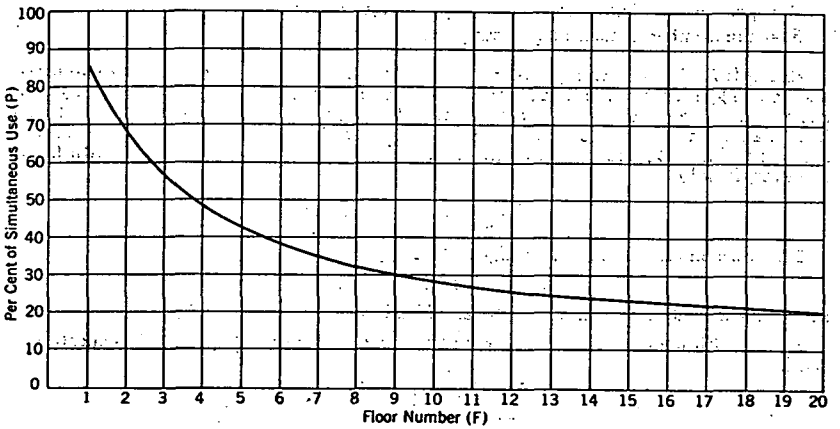

FIG. 1. CHART SHOWING RELATION BETWEEN FLOOR NUMBER AND PER CENT OF SIMULTANEOUS USE OF INSTALLED FIXTURES FOR PROPORTIONING MAINS, RISERS, AND HEADERS. (THE FLOOR NUMBER IS TAKEN AS THE FLOOR NEAREST THE GROUND FOR DOWN-FEED SYSTEMS, AND THE HIGHEST FLOOR FOR UP-FEED SYSTEMS)

through a pipe with an equivalent length of 25 ft for a friction loss of 30 lb per square inch.

It is well to keep the following points in mind while designing the water supply piping:

1. Liberal sizing of mains and risers is advisable.
2. Liberal sizing of the branches may cause trouble.
3. When liberal sized branches are used the risers, mains and tanks must be increased accordingly.
4. With proper care the risers and mains need not be made so large as to make the cost excessive.
5. To base the design on an *assumed* probability of simultaneous use may be dangerous.

Probability of Simultaneous Use

The risers and mains must be sized to accommodate the discharge from all the branches with due consideration to the probability of simultaneous