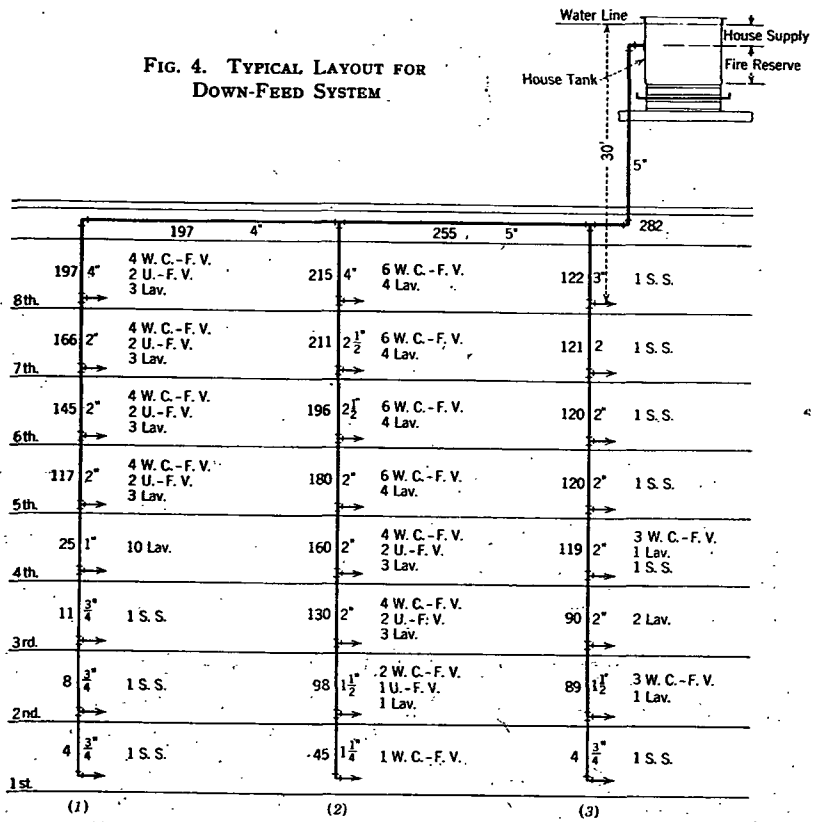
able difference in elevation between the overhead mains and the bottom of an open type house tank is 20 ft, and flush valves specially adapted to operate on about 7 lb pressure must be used. In many installations gravity tank closets are used on the top story.

Example 4. Suppose an installation has a house tank in which the water line is 20 ft above the level of the top fixtures to be supplied and that the length of run to the farthest fixtures on this level is 400 ft with the pipe fittings adding another 200 ft, making an

FIG. 4. TYPICAL LAYOUT FOR DOWN-FEED SYSTEM



equivalent length of 600 ft. What would be the size of main coming out of the tank where a probable flow rate of 400 gpm may be expected, of the horizontal main where a probable flow rate of 200 gpm may be expected, and of the riser down to the fixture level where the probable flow rate is approximately 100 gpm?

Here the level of the water in the house tank is 20 ft above the faucet of the highest fixture and the gravity pressure will be 0.43 lb × 20 ft = 8.6 lb and, if a total pressure drop of 1 lb is assumed, the pressure on the farthest fixture under times of peak load will be 8.6 lb − 1 lb = 7.6 lb while the drop per 100 ft of equivalent run will have to be $\frac{1 \text{ lb} \times 100}{600} = 0.1667$ lb.

Referring to Fig. 2 it will be noted that where the flow through the main is 400 gpm, an 8-in. pipe would be required; that where the flow is reduced to 200 gpm, a 6-in. pipe would be sufficient; and that where the flow is 100 gpm in the riser branch and riser, a 5-in. size would be correct. Of course these are somewhat excessive flows and the head from the tank is small so that large sizes are to be expected. It would be necessary to carry a 5-in. riser down to the branch of the top floor, then reduce to 4 in. for the branch to the floor below the top, and below this the pipes could be sized for a 30 lb drop per 100 ft. In such a case, tank closets should doubtless be used on the top floor.

Had the tank been set 10 ft higher, the head available for friction, while still giving the same pressure at the top fixtures, would have been 0.43 lb × 10 ft or 4.3 lb greater and this, with the 1 lb drop used previously, would give a total allowable drop of 1 lb

TABLE 5. TYPICAL CALCULATION OF PIPE SIZES ON DOWN-FEED RISER WITH FLUSH VALVE WATER-CLOSETS AND URINALS

(*Riser No. 1. Fig. 4*)

Floor of Bldg.	Fixtures on Floor	Gpm per Fixture	Maximum Gpm on Floor	Maximum Gpm on Riser	Usage (per cent)	Probable Flow in Riser Gpm	Allowable Drop Lb per 100 Ft	Pipe Size In.
1st	1 S. S.	4	4	4	100	4	30	¾
2nd	1 S. S.	4	4	8	100	8	30	¾
3rd	1 S. S.	4	4	12	92	11	30	¾
4th	10 Lav.	3	30	42	58	25	30	1
5th	4 W. C. 2 U. 3 Lav.	45 30 3	180 60 9 249	291	40	117	30	2
6th	4 W. C. 2 U. 3 Lav.	45 30 3	180 60 9 249	540	27	145	30	2
7th	4 W. C. 2 U. 3 Lav.	45 30 3	180 60 9 249	789	21	166	30	2
8th	4 W. C. 2 U. 3 Lav.	45 30 3	180 60 9 249	1038	19	197	2	4

+ 4.3 lb = 5.3 lb which, divided by the 600 ft equivalent run gives a drop per 100 ft of $\frac{5.3 \times 100}{600} = 0.9$ lb.

With this drop, the sizes according to the chart (Fig. 2) are 6 in., 5 in., and 4 in., respectively. If the run is reduced to 200 ft instead of 600 ft, the allowable drop will be $\frac{5.3 \text{ lb} \times 100}{200} = 2.7$ lb per 100 ft. This gives 5 in., 4 in., and 3 in., respectively, for the flows of 400, 200, and 100 gpm.

From Example 4 it is evident that, while the down-feed system possesses certain economies in size for the riser portion, it is quite likely to involve large distribution main sizes, especially when the tank is not elevated to a considerable degree.