and the pressure at the top of the required 15 lb will make the total reduction 49.4 lb, leaving a balance of 25.6 lb which may be used up in friction. If the distance from the

Table 6. Typical Calculation of Pipe Sizes on Down-Feed Riser with Flush Valve Water-Closets and Urinals

Riser No. 3. (See Fig. 4)

Floor of Bldg.	Fixtures on Floor	Gpm per Fixture	Maximum Fixtures Gpm	Probable Use (per cent)	Probable Fixtures Gpm	Probable Riser Gpm	Allowable Drop Lb per 100 Ft	Pipe Size In.
1st	1 S. S.	4	4	100	4	4	30	¾
2nd	3 W. C.	50	150	80	120			
	1 Lav.	3	3					
	2		7	100	7	127	30	2
3rd	0 W. C.	0	000					
	3		150	80	120			
	2 Lav.	3	6					
	4		13	70	9	129	30	2
4th	3 W. C.	50	150					
	6		300	40	120			
	1 Lav.	3	3					
	1 S. S.	4	4					
	6		20	55	11	131	30	2
5th	0 W. C.	0	000					
	6		300	40	120			
	1 S. S.	4	4					
	7		24	53	13	133	30	2
6th	0 W. C.	0	000					
	6		300	40	120			
	1 S. S.	4	4					
	8		28	51	14	134	30	2
7th	0 W. C.	0	000					
	6		300	40	120			
	1 S. S.	4	4					
	9		32	50	16	136	30	2½
8th	0 W. C.	0	000					
	6		300	40	120			
	1 S. S.	4	4					
	10		36	48	17	137	2	3

street main to the bottom of the riser, which will be assumed to be the farthest one on the horizontal line, is 100 ft, and if the fittings are sufficient to add another 100 ft, as well as the 80 ft of vertical distance up the riser, the total equivalent run will be 280 ft, which will be taken as an even 300 ft. Then the allowable drop per 100 ft will be

$$\frac{25.6 \text{ lb} \times 100}{300} = 8.5 \text{ lb}$$

and the sizes shown in Fig. 5 are based on this amount of drop. Of course the other

risers will have the same maximum flows at the bottom as they formerly had at the top, namely 202 and 137 gal, respectively, for Risers No. 2 and 3. Combining these maximum flows in the same manner as pursued in the down-feed system it is seen that the maximum flow between Riser No. 2 and Riser No. 3 is 296 gpm, and between Riser No. 3 and the street main, 297 gpm which at a drop of 8.5 lb gives the main sizes indicated. It will be noted that in determining the maximum flow in an up-feed riser

Table 7. Size of Distribution Main for Down-Feed Systems (See Fig. 4)

Riser No.	Fixtures	Gpm per Fixture	Maximum Fixtures Gpm	Probable Use (Per Cent)	Probable Gpm	Allowable Drop (Lb per 100 Ft)	Size of Main (Inches)
	16 W. C.	50	800				
	8 U.	40	320				
	24		1120	15	168		
1	22 Lav.	3	66				
	3 S. S.	4	12				
	25		78	40	31		
					199	2	4
	35 W. C.	50	1750				
	5 U.	40	200				
	64		3070	8	245		
2	23 Lav.	3	69				
	48		147	35	51		
					296	2	5
	6 W. C.	50	300				
	70		3370	7	236		
	4 Lav.	3	12				
3	6 S. S.	4	24				
	58		183	33	61		
					297	2	5

it is necessary to begin at the top floor and work down instead of beginning at the bottom floor and working up as was done in the down-feed sizing.

SIZING UP-FEED AND DOWN-FEED HOT WATER SYSTEMS

Hot water supply systems, when of the circulating type, have a few differences to be considered although the same general principles of sizing apply to these lines as to the cold water lines. Owing to the fact that there are no flush valves on the hot water piping and also because many plumbing fixtures have no hot water connections, the sizes of the hot water piping in general will be considerably less than the cold water piping in the same building. On the other hand it is almost invariably required that a gravity circulation be kept up in such hot water lines and this often has a considerable influence on the size. There are three methods of arranging circulation lines, as follow:

1. By using the plain up-feed with a return carried back from the top of the riser and paralleling it.
2. By carrying a supply riser up in one location thus supplying fixtures on up-feed, then crossing over at the top and coming down past another collection of fixtures and supplying these by a down-feed.
3. By carrying all of the water to the top of the building and dropping risers wherever needed, feeding all hot water on a down-feed system.