back against the flow of steam, and if it is not certain that the velocity is below the critical limit, the pipe should be provided with a separate drip.

The following tables for the carrying capacities of pipes as used in steam heating installations with the exception of dry returns have been determined by Unwin's formula for the flow of steam in pipes which reads as follows:

$$W = 87.5\sqrt{\frac{P\ C\ d^5}{L\left(1+\frac{3.6}{d}\right)}}$$

where

W = Weight of steam flowing through the pipe in lb. per min.
P = Difference of pressure between the two ends of the pipe.
C = Density of steam in lb. per cu. ft.
d = Actual inside diameter of pipe.
L = Length of pipe in feet.

This formula with the capacity expressed in sq. ft. of radiation on the basis of each sq. ft. of radiation with connected piping condensing 0.3 lb. of steam per hour will be as follows:

$$R = 17{,}400\sqrt{\frac{P\ C\ d^6}{L\ (d+3.6)}}$$ where R = Sq. ft. of radiation.

Capacities of dry returns have been calculated by the Chezy formula for flow in open conduits which is expressed in the form

$$Q = a\ c\sqrt{r\ s}$$

where

Q = Discharge in cu. ft. per sec.
a = Wet area of pipe in sq. ft.
r = Hydraulic mean depth (areas of wet cross-section divided by the wet-perimeter.)
c = Constant from Kutter's formula.
s = Slope or grade.

In the tables for one-pipe, two-pipe and vapor systems without the use of thermostatic traps the tables have been calculated on the basis of the water occupying one-eighth the area of the pipe while for vapor systems using thermostatic traps the capacity is based on water occupying three-sixteenth the area.

All supply mains, branches to riser, when dripped, where steam and condensation flow in the same direction, and supply risers (with the exception of up-feed one-pipe risers), are based on a pressure drop of 1 oz. per 100 ft. length of pipe or equivalent.

All supply mains, branches to risers, not dripped where condensation and steam are flowing in opposite directions and up-feed one-pipe risers are based on a velocity of 16 ft. per second.

Branches to radiators 5 ft. in length or less are based on velocities from 10 to 19 ft. per second depending on the size of branch while branches to radiators 5 to 10 ft. in length are based on a velocity of approximately 10 ft. per second.

Wet returns are calculated on a drop of ½ oz. per 100 ft. length of pipe or equivalent.

Radiator valve sizes for one and two-pipe gravity systems are based on standard practice.

An allowance must be made for ells and fittings in the line of flow by adding the number of feet given in Table 27 to the straight run of pipe plus 25 ft. for entrance to last radiator to obtain the total equivalent length.

TABLE 27. FLOW OF STEAM IN PIPES

P = Loss in pressure in lb.
d = Inside diameter of pipe in inches
L = Length of pipe in feet
D = Weight of 1 cu. ft. steam
W = Lb. of steam per min.

$$W = 87.5\sqrt{\frac{P\ D\ d^5}{\left(1+\frac{3.6}{d}\right)L}}$$

$$P = .000131\left(1+\frac{3.6}{d}\right)\frac{W^2 L}{D\ d^5}$$

Press Loss in Oz.	Col. 1 $87.5\sqrt{\frac{P}{100}}$	Inside Dia. Pipe	Col. 2 $\sqrt{\frac{d^5}{1+\frac{3.6}{d}}}$	Steam Press By Gage	Col. 3 $\sqrt{D}$	Length Pipe in Feet	Col. 4 $\sqrt{\frac{100}{L}}$
1	2.175	1	0.522	0.0	0.193	20	2.240
2	3.076	1¼	1.177	0.3	0.195	40	1.580
3	3.767	1½	1.828	1.3	0.201	60	1.290
4	4.350	2	3.709	2.3	0.207	80	1.120
5	4.863	2½	6.109	5.3	0.223	100	1.000
6	5.328	3	11.183	10.3	0.248	120	0.912
7	5.754	3½	16.705	15.3	0.270	140	0.841
8	6.152	4	23.630	20.3	0.290	160	0.793
10	6.878	4½	32.098	30.3	0.326	180	0.741
12	7.532	5	43.719	40.3	0.358	200	0.710
14	8.138	6	69.718	50.3	0.388	250	0.632
16	8.700	7	105.35	60.3	0.415	300	0.578
20	9.727	8	150.33	75.3	0.452	350	0.538
24	10.655	9	205.37	100.3	0.507	400	0.500
28	11.509	10	271.16	125.3	0.557	450	0.477
32	12.290	12	437.51	150.3	0.603	500	0.447
40	13.756	14	733.90	175.3	0.645	600	0.407
48	15.069	16	925.19	200.3	0.685	700	0.378
80	19.454	.....	.....	.....	.....	800	0.354
160	27.512	.....	.....	.....	.....	900	0.333
320	38.863	.....	.....	.....	.....	1000	0.316
480	47.652	.....	.....	.....	.....	1400	0.267

Column 1 × 2 × 3 × 4 = lb. steam per min. will flow through a straight pipe for a given condition.

Example.—1 oz. drop — 2-in. pipe — 1.3 lb. press. — 100 ft. long — 2.175 × 3.709 × 0.201 × 1 = 1.615 lb. per min., then 1.615 × 60 — 20 per cent = 77.28 lb. per hr.