CHAPTER XVI.

Calculating Areas of Pipes and Ducts

Finding Area of Pipe

The rule for finding the area of a pipe of any diameter is to square the diameter and multiply by the decimal .7854. Thus to find the area of a pipe of 32 in. diameter we have $32 \times 32 = 1024 \times .7854 = 804.25$ square inches. This same result is obtained by referring to the table on areas.

In blower work when a branch is added to a pipe it becomes necessary that the part following should have the combined area of the two. In other words, the diameters of the two pipes being known, the diameter of the third pipe must be such so as to contain their combined area. This unknown diameter can be found without computing by use of a table of areas and circumferences. The method is made clear in connection with Fig. 210, where the first pipe A is assumed to be 20 in., to which a branch C of 12 in. diameter is connected by means of the scalene joint B, thus making the third pipe D equal to 23 5/16 in., which contains the combined area of the 12 and the 20 in. pipes. This computation will be found in the table herewith, which contains inches and fractional inches. The table is computed from 10 in., advancing by eights to 2 ft. 1¾ in. The reader is advised to obtain a full table of circumferences and areas from ⅛-in., advancing by eighths to 100 in. or

TABLE OF CIRCUMFERENCES AND AREAS OF CIRCLES TO NEAREST FRACTIONAL MEASUREMENTS

Dia. in inch.	Cir. in Ft.	Cir. in In.	Area in Sq. inch.
10 in.	2	7 3/8	78.540
10 1/8	2	7 3/4	80.515
10 1/4	2	8 1/8	82.516
10 3/8	2	8 1/2	84.540
10 1/2	2	8 7/8	86.590
10 5/8	2	9 3/8	88.664
10 3/4	2	9 3/4	90.762
10 7/8	2	10 1/8	92.855
11 in.	2	10 1/2	95.033
11 1/8	2	10 7/8	97.205
11 1/4	2	11 1/4	99.402
11 3/8	2	11 3/4	101.623
11 1/2	3	0 1/8	103.869
11 5/8	3	0 1/2	106.139
11 3/4	3	0 7/8	108.434
11 7/8	3	1 1/4	110.753
12 in.	3	1 5/8	113.097
12 1/8	3	2	115.466
12 1/4	3	2 1/2	117.859
12 3/8	3	2 7/8	120.276
12 1/2	3	3 1/4	122.718
12 5/8	3	3 3/4	125.185
12 3/4	3	4	127.676
12 7/8	3	4 3/8	130.192
13 in.	3	4 3/4	132.732
13 1/8	3	5 1/4	135.297
13 1/4	3	5 5/8	137.886
13 3/8	3	6	140.500
13 1/2	3	6 3/8	143.139
13 5/8	3	6 3/4	145.802
13 3/4	3	7 1/8	148.489
13 7/8	3	7 1/2	151.201
14 in.	3	7 7/8	153.938
14 1/8	3	8 3/8	156.699
14 1/4	3	8 3/4	159.485
14 3/8	3	9 1/8	162.295
14 1/2	3	9 1/2	165.130
14 5/8	3	9 7/8	167.989
14 3/4	3	10 1/4	170.873
14 7/8	3	10 3/4	173.782
15 in.	3	11 1/8	176.715
15 1/8	3	11 1/2	179.672
15 1/4	3	11 7/8	182.654
15 3/8	4	0 1/4	185.661
15 1/2	4	0 5/8	188.692
15 5/8	4	1	191.748
15 3/4	4	1 1/2	194.828
15 7/8	4	1 7/8	197.933
16 in.	4	2 1/4	201.062
16 1/8	4	2 5/8	204.216
16 1/4	4	3	207.394
16 3/8	4	3 3/8	210.597
16 1/2	4	3 3/4	213.825
16 5/8	4	4 1/4	217.077
16 3/4	4	4 5/8	220.353
16 7/8	4	5	223.654
17 in.	4	5 3/8	226.980
17 1/8	4	5 3/4	230.330
17 1/4	4	6 1/8	233.705
17 3/8	4	6 1/2	237.104
17 5/8	4	7 3/8	243.977
17 1/2	4	6 7/8	240.523
17 3/4	4	7 3/4	247.450
17 7/8	4	8 1/8	250.947
18 in.	4	8 1/2	254.469
18 1/8	4	8 7/8	258.016
18 1/4	4	9 1/4	261.587
18 3/8	4	9 3/4	265.182
18 1/2	4	10 1/8	268.803
18 5/8	4	10 1/2	272.447
18 3/4	4	10 7/8	276.117
18 7/8	4	11 1/4	279.811
19 in.	4	11 5/8	283.529
19 1/8	5	0	287.272
19 1/4	5	0 1/2	291.039
19 3/8	5	0 7/8	294.831
19 1/2	5	1 1/4	298.648
19 5/8	5	1 5/8	302.489
19 3/4	5	2	306.355
19 7/8	5	2 3/8	310.245
20 in.	5	2 7/8	314.160
20 1/8	5	3 1/4	318.099
20 1/4	5	3 5/8	322.063
20 3/8	5	4	326.051
20 1/2	5	4 3/8	330.064
20 5/8	5	4 3/4	334.101
20 3/4	5	5 1/8	338.163
20 7/8	5	5 1/2	342.250
21 in.	5	5 7/8	346.361
21 1/8	5	6 3/8	350.497
21 1/4	5	6 3/4	354.657
21 3/8	5	7 1/8	358.841
21 1/2	5	7 1/2	363.051
21 5/8	5	7 7/8	367.284
21 3/4	5	8 1/4	371.543
21 7/8	5	8 3/4	375.826
22 in.	5	9 1/8	380.133
22 1/8	5	9 1/2	384.465
22 1/4	5	9 7/8	388.822
22 3/8	5	10 1/4	393.203
22 1/2	5	10 5/8	397.608
22 5/8	5	11	402.038
22 3/4	5	11 1/2	406.493
23 in.	6	0 1/4	415.476
23 1/8	6	0 5/8	420.004
23 1/4	6	1	424.557
23 3/8	6	1 3/8	429.135
23 1/2	6	1 3/4	433.737
23 5/8	6	2 1/4	438.363
23 3/4	6	2 5/8	443.014
23 7/8	6	3	447.690
22 7/8	5	11 7/8	410.972
2	0	6	452.390
2	0 1/4	6	4 7/8	461.864
2	0 1/2	6	4 7/8	471.436
2	0 3/4	6	5 3/4	481.106
2	1	6	6 1/2	490.875
2	1 1/4	6	7 1/4	500.741
2	1 1/2	6	8 1/8	510 706
2	1 3/4	6	8 7/8	520 769

to 10 ft. Following the first column in diameters of the table herewith to 20 in., we find the area equals 314.160, to which is added the area of the 12 in. branch C, which is 113.097. 314.160 + 113.097 = 427.257 sq in. Now following the table of areas to the number nearest to 427.257, we find 429.135, whose diameter would equal 23⅜ in. We therefore reduce this and make the diameter of the third pipe D 23 5/16 in. as shown.

Another method used to find the unknown diameter is by means of the steel square as shown in Fig. 211. On ascertaining the diameter of the two pipes 12

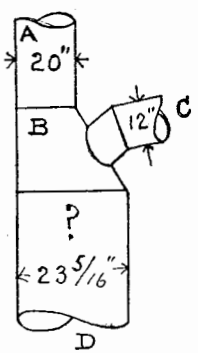

Fig. 210—Finding the Unknown Diameter

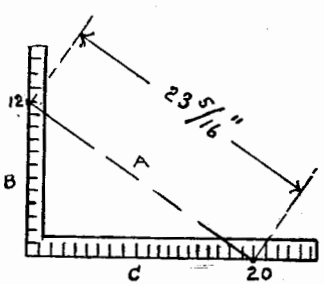

Fig. 211—Finding the Unknown Diameter with the Steel Square

and 20 in. respectively, simply lay the two-foot rule at 12 and 20 on the square, and the distance between will measure 23 5/16 in. This method saves considerable time and is based on the principle that the hypotenuse A contains the square of the altitude B and base C combined.

When the sizes of two given square pipes are known,

the third square size is determined as shown by the diagram Fig. 212. Assume that the first branch is 10 in. square and the second branch 7 in. square. The square of 10 is 100 and the square of 7 is 49,

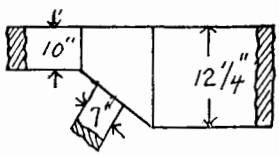

Fig. 212—Finding the Unknown Size of Square Pipe

or a total of 149. The labor of extracting the square root may be avoided by consulting a table of square roots, in which look for the number 149, the square root of which is 12.207 or 12¼ in practical work, as shown in the diagram.

Computing Additional Areas

When ceiling ducts in ventilation work are constructed with various branches, all of a given height

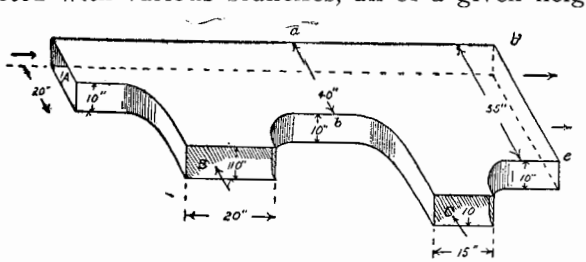

Fig. 213—Computing Areas in Ceiling Vent Duct

the additional dimensions, which must be added to the main duct so that it will contain the additional area of the branch previously added, may be com-

puted, as shown in Fig. 213. A shows the first inlet, which is 10 × 20 in., to which a branch has been added as shown by B, also 10 × 20. As the height 10 in. remains the same throughout the duct, then two times 20 equals 40 in., the width of the duct from **a** to **b.** To this size duct is added another branch 10 × 15 in. as shown by C. Then 40 + 15 = 55 in.. or the width of the duct from **d** to **e.**