Flanged fittings are generally used in the best practice for connecting all piping above 6 in. in diameter. While screwed fittings may be used for the larger sizes and are satisfactory under the proper working conditions, it will be found difficult either to make or to break the joints in these large sizes.

The dimensions of elbows, tees and crosses for 125 lb cast-iron screwed fittings are given in Table 5, whereas the dimensions for 125 lb cast-iron flanged fittings are given in Tables 6 and 7.

A special type of joint known as the *Sarlun* joint consists of a lip which is provided for welding to make the joint fluid tight, while mechanical strength is provided by bolted flanges. Another type of pipe joint, the *lap flange*, is made by using loose flanges on lengths of pipe whose ends are lapped to give a bearing surface for a gasket or metal joint.

TABLE 4. LENGTH OF EXPANSION OFFSETS AND BENDS FOR PROPER EXPANSION OF PIPE

TOTAL EXPANSION IN INCHES[a]	FEET OF PIPE AND OFFSET OR U-BEND FOR DIFFERENT DIAMETERS OF PIPE									
	2″	3″	4″	5″	6″	8″	10″	12″	14″	16″
1	11	13	15	17	19	21	23	25	27	30
2	15	18	21	23	26	29	32	35	38	42
3	18	22	26	29	32	36	40	43	48	52
4	21	26	30	34	37	42	47	50	56	58
5	24	30	34	38	41	47	53	57	63	65
6	27	33	37	41	45	52	58	63	69	71
7	30	36	40	44	48	56	62	68	74	----
8	32	39	43	47	52	60	66	72	----	----

[a]This column shows the total expansion the offset will take care of without a cold strain. Although some engineers allow an increase of 40 per cent in the allowable expansion if the pipe is given a suitable initial cold strain when made up, it is regarded as better practice not to allow for it.

The length of pipe in the expansion piece should be the same whether in the form of a single right-angle offset or double offset or U-bend.

The lengths of arms are figured for 12,000 lb per square inch tension for wrought iron pipe. If steel pipe is used this is good for 16,000 lb per inch so that the arm will take care of ⅓ more expansion.

VALVES

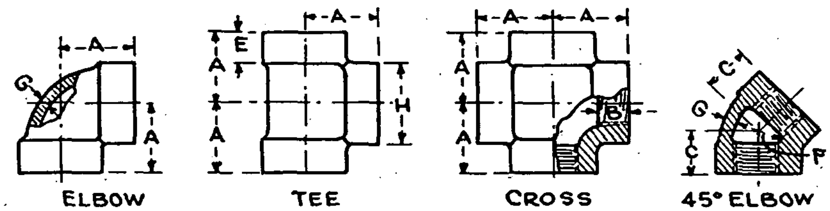
Valves are made with both threaded and flanged ends for screwed and bolted connections just as are pipe fittings.

The material used for valves of small size is generally brass or bronze for low pressures and forged steel for high pressures, while in the larger sizes either cast-iron, cast-steel or some of the steel alloys are employed. Practically all iron or steel valves intended for steam or water work are bronze-mounted or trimmed, and valves for acids, ammonia and corrosive gases are of iron throughout.

Brass, bronze, and iron valves are generally designed for standard or extra heavy service, the former being used up to 125 lb and the latter up to 250 lb saturated steam working pressure, although most manufacturers also make valves for medium pressure up to 175 lb steam working pressure. The more common types are gate valves or straightway valves, globe valves, angle valves, check valves and automatic valves, such as reducing and back-pressure valves.

A special class of valves is required for controlling the steam and hot water supply to radiators. These valves are of brass, usually of the angle type, modified to suit the service requirements, and are often arranged with graduated heads and lever handles in order to indicate the relative opening of the valve port in any position.

TABLE 5. TENTATIVE AMERICAN STANDARD DIMENSIONS OF ELBOWS, 45 DEG ELBOWS, TEES, AND CROSSES (STRAIGHT SIZES) FOR 125 LB CAST-IRON SCREWED FITTINGS



NOMINAL PIPE SIZE	A	C	B	E	F		G	H
	CENTER TO END, ELBOWS, TEES AND CROSSES	CENTER TO END, 45 DEG ELBOWS	LENGTH OF THREAD MIN.	WIDTH OF BAND, MIN.	INSIDE DIAMETER OF FITTING		METAL THICKNESS, MIN.	OUTSIDE DIAMETER OF BAND, MIN.
					Min.	Max.		
¼	0.81	0.73	0.32	0.38	0.540	0.584	0.110	0.93
⅜	0.95	0.80	0.36	0.44	0.675	0.719	0.120	1.12
½	1.12	0.88	0.43	0.50	0.840	0.897	0.130	1.34
¾	1.31	0.98	0.50	0.56	1.050	1.107	0.155	1.63
1	1.50	1.12	0.58	0.62	1.315	1.385	0.170	1.95
1¼	1.75	1.29	0.67	0.69	1.660	1.730	0.185	2.39
1½	1.94	1.43	0.70	0.75	1.900	1.970	0.200	2.68
2	2.25	1.68	0.75	0.84	2.375	2.445	0.220	3.28
2½	2.70	1.95	0.92	0.94	2.875	2.975	0.240	3.86
3	3.08	2.17	0.98	1.00	3.500	3.600	0.260	4.62
3½	3.42	2.39	1.03	1.06	4.000	4.100	0.280	5.20
4	3.79	2.61	1.08	1.12	4.500	4.600	0.310	5.79
5	4.50	3.05	1.18	1.18	5.563	5.663	0.380	7.05
6	5.13	3.46	1.28	1.28	6.625	6.725	0.430	8.28
8	6.56	4.28	1.47	1.47	8.625	8.725	0.550	10.63
10	8.08	5.16	1.68	1.68	10.750	10.850	0.690	13.12
12	9.50	5.97	1.88	1.88	12.750	12.850	0.800	15.47
14 O.D.	10.40	....	2.00	2.00	14.000	14.100	0.880	16.94
16 O.D.	11.82	....	2.20	2.20	16.000	16.100	1.000	19.30

All dimensions given in inches.

CORROSION

Experiments in research laboratories have demonstrated that the amount of corrosion found in piping and closed water systems is almost directly proportional to the amount of oxygen in solution, and varies with the temperature and rate of flow. The composition of the water also has a bearing on the rate of attack. All reliable data on this subject indicate that the composition of the iron or steel as regards carbon, phosphorous,