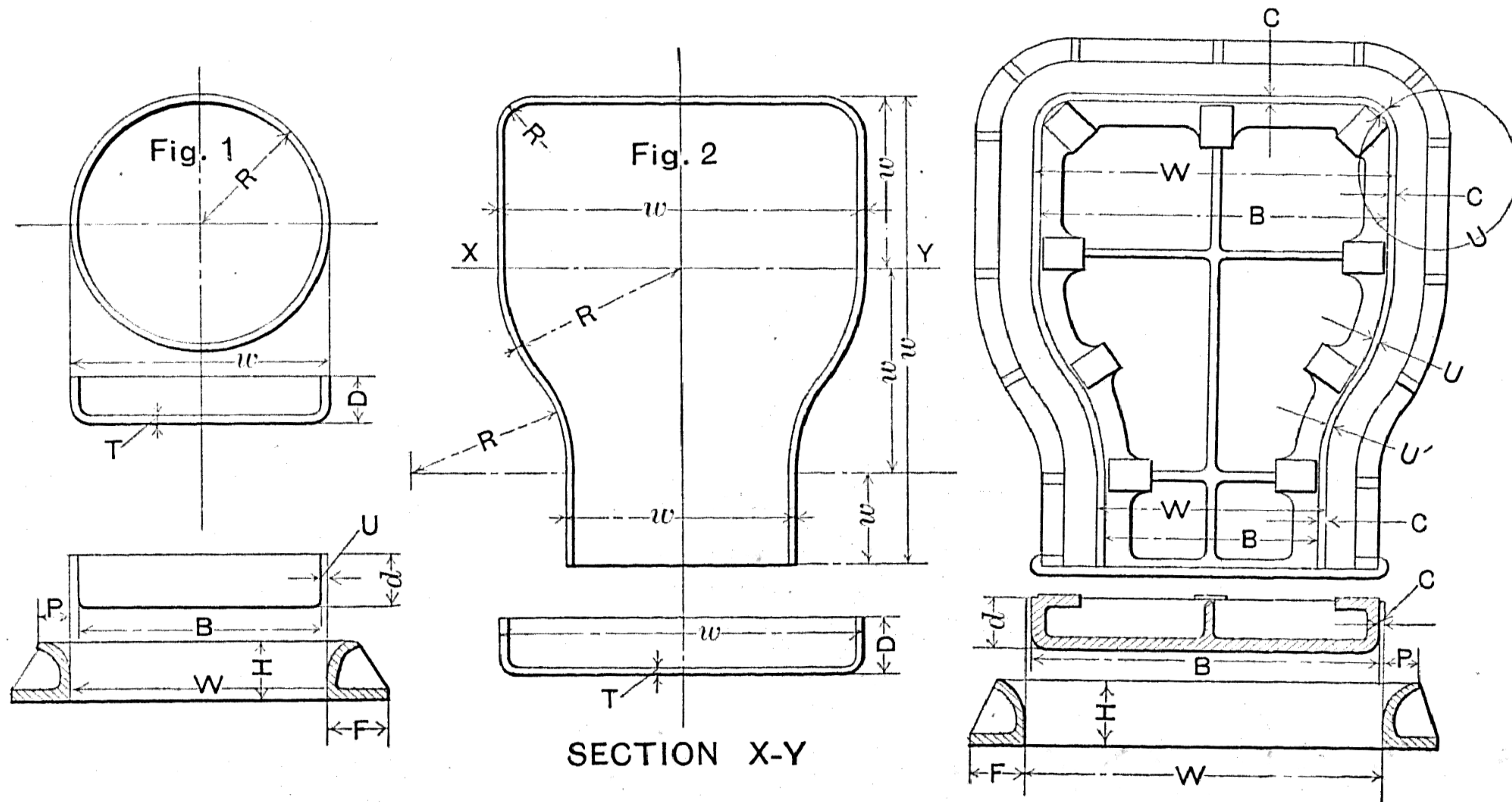


formed in this way and that drawn through a ring, which is commonly known as "drawn" work. This formula has been repeatedly tested in the practical designing of dies for a wide range of work and found perfectly satisfactory.

In cases of doubt connected with the forming or flanging of difficult sheets, a small set of dies, made to a scale size, of hard wood, and used to flange a piece of sheet lead, of also a proportionate scale thickness to the full size sheet, has been found very satisfactory, and owing to the fact that annealed sheet lead, in its action, is analogous to a sheet of boiler steel of full size heated to 1,700 to 1,900 deg. F., the action of the

and rather slow heat. The method of delivery of the heat to the bed of the furnace, in which the sheet is placed, should be such that no one portion of a sheet can become overheated by reason of flame contact. In color the heat should be not exceeding a bright cherry, and in temperature it may range from 1,700 to 1,900 deg. F., according to the character of the flanging.

Before flanging the first sheet, the dies should be heated up, so that their proper expansion, which is provided for in the formula referred to above, may take place, and the sheets, when cool will be of the proper size. A common method of



Values of letters used in formulæ:
 w = Size of flanged sheet or any portion of it when cold.
 R = Radius to outside of flange when cold.
 D = Depth of flange when cold.
 T = Thickness of sheet when cold.
 W = Size of female die when cold.
 B = Size of male die when cold.
 C = Clearance between male and female dies when straight and when cold.
 U = Clearance when curved and edge upset.
 U' = Same when stretched.
 S = .0078" per inch allowance for contraction of sheet.
 All dimensions in inches or decimals of an inch.
 For general proportions of male and female dies:
 H = 2.1 D; F = 2.1 D; P = 1.2 D and d = 1.5 D.

Note.—For ordinary practice and for radii not less than 3" or more than 15" and when "D" does not exceed 4"—"U" can = 1.27T. The female die decides size of sheet and all allowance for clearance must be made on male die.

Then for Fig. 1:

$$W = wS + w \text{ and } B = W - \left(\frac{D}{J} \times .1298 \right) + 2.4T = W - 2U.$$

$$U = \left(\frac{D}{T} \times .0649 \right) + 1.2 T.$$

$$U' = 1.2 T - \left(\frac{D}{T} \times .0649 \right)$$

For Fig. 2: W = wS + w and B = W - (1.2T × 2). C = 1.2T.

Formulæ for Dies for Flanging Sheet Steel.

lead in these dies can be taken as a guide indicating the action of the full size sheet in regularly designed dies for a similar shape. The stretching or upsetting action of the piece of lead used as an illustration in these small dies can be very readily noted if the sheets when flat, and before being formed are laid off in small squares of some convenient size. The distortion of these squares after the flanging of the model sheet will graphically indicate the distortion of the metal, and will be analogous to what will occur in the full size sheet in regularly designed dies.

The flanging press should be located in front of the furnace, with a sufficient space between it and the furnace to allow of a generous sized iron straightening floor. Convenient lifting facilities should be provided for handling the dies, and also, in the case of heavy sheets, an overhead rail or some satisfactory form of quick moving crane for handling the sheets from the furnace to the press, it being important to place the sheet in the dies as quickly as possible after it leaves the furnace, for the best results.

The furnace should be provided with a level, flat floor, preferably of fire brick, and may be heated by either coal, burned in a separate regenerative chamber, producer gas or oil. The construction should be such as to provide an evenly distributed

doing this is to heat the first sheet and place it on the dies without flanging until the dies become sufficiently hot. Between the operations of flanging the dies should be thoroughly wiped on their friction surfaces with some heavy oil, with a hand mop.

The operating levers and the operator for operating the press should be as close to the press as possible, so that the various stages of the operation of the die in performing the work may be closely observed. A center mark placed on the sheets, and corresponding center marks on the dies, will greatly facilitate the centering of the hot sheet on the dies and save time. The larger sheets, after being flanged, will be found more or less out of true on their flat surfaces and will require straightening. The iron straightening floor referred to is provided for this purpose, and this work can be done with the remaining heat in the sheet after flanging.

All flanged sheets should be thoroughly and carefully annealed after they are finished and before being placed in the boiler. Flanging by power being practically one operation, will undoubtedly introduce into the sheet less local strains than would be the case with hand flanging, and such as it may produce are effectively removed by the careful annealing suggested.