MILD STEEL SECTIONS, BOLTS AND RIVETS[1]

Syllabus.—Brief characteristics of mild steel ; various sections ; bolts and rivets ; applications.

MILD steel is a very important building material used extensively in structural engineering. It is manufactured from iron ore (mined or quarried in certain parts of this country, Sweden, Spain, etc.) which is subjected to a very high temperature in the blast furnace to produce pig iron, this is converted into steel in the smelting furnace, re-heated and finally rolled to the required sections such as plates, angles, tees, channels, beams, etc.

CHARACTERISTICS OF STEEL.—It is elastic, ductile (capable of being drawn into wire), malleable (can be beaten out), weldable and can be tempered to different degrees of hardness. Mild steel contains 0·2 to 2 per cent. of carbon, and its breaking strength in compression and tension is 28 to 33-tons per sq. in.

Some of the various standard sections into which mild steel are rolled are illustrated in Fig. 77.

Flat Bars (A).—Obtainable in sizes varying from $\frac{1}{4}$-in. by 1-in. to 80-in. by 1-in. or more, the wider sections being known as *plates* ; purposes for which flats are used have been indicated in previous chapters (such as bars supporting lintels, floor joists, straps, etc.), and they are still used (but not so extensively as formerly) for tension members in steel roof trusses. Plates are used for connections in steel roofs, base plates and caps of steel pillars, plate girders, etc.

Square Bars (B).—Sizes vary from $\frac{3}{16}$ to 12-in. length of side ; not much used for building purposes.

Round or *Circular Bars* or *Rods* (C).—Diameters vary from $\frac{3}{16}$ to 12-in. ; used in the construction of reinforced concrete floors, pillars, foundations, lintels, etc.

Angles (D and E).—The former, having equal arms, are called *equal angles*, and the latter are known as *unequal angles*. They are specified according to the overall dimensions, thickness and weight per lineal foot : thus D is a 2-in. by 2-in. by $\frac{1}{4}$-in. by 3·19-lb. British Standard Equal Angle (abbreviated to " B.S.E.A.)," and E is a 3-in. by 2-in. by $\frac{1}{4}$-in. by 4·04-lb. British Standard Unequal Angle (abbreviated to " B.S.U.A.") ; the sizes of the equal angles vary from 1$\frac{1}{4}$-in. by 1$\frac{1}{4}$-in. by $\frac{1}{8}$-in. by 1·01-lb. to 8-in. by 8-in. by 1-in. by 51·01-lb., and unequal angles from 2-in. by 1$\frac{1}{2}$-in. by $\frac{1}{8}$-in. by 1·43-lb. to 8-in. by 4-in.

by $\frac{7}{8}$-in. by 33·11-lb. Angles are widely used in structural engineering, including all members of a steel roof truss.

Tee Bars or Tees (F).—These consist of a *flange* and *web*, *both* of which are slightly tapered ; the size varies from 1$\frac{1}{2}$-in. by 1$\frac{1}{2}$-in. by $\frac{3}{16}$-in. by 1·81-lb. to 6-in. by 6-in. by $\frac{5}{8}$-in. by 24·23-lb. B.S.T. (British Standard Tee). They are still used in connection with the construction of steel roof trusses (such as for principal rafters), but angles are now usually preferred.

Channels (G).—The flanges are thicker than the web ; the sizes vary from 3-in. by 1$\frac{1}{2}$-in. by 4·60-lb. to 17-in. by 4-in. by 44·34-lb. B.S.C. (British Standard Channel) ; the web is of uniform thickness and the flanges are tapered from the root to the toe. They may be used as girders, pillars, roof purlins, etc.

Beams (H).—The web is of uniform thickness, that of the flanges tapers uniformly as shown ; the radius of the toe curve is practically half that at the root[1] ; the minimum size is 3-in. by 1$\frac{1}{2}$-in. by 4-lb. and the maximum size is 24-in. by 7$\frac{1}{2}$-in. by 100-lb. B.S.B. (British Standard Beam). They are very extensively employed in the construction of floors, pillars, lintels, etc. Beams are popularly referred to as " R.S.J.'s " (rolled steel joists).

Bolts, Nuts and Washers (J).—Bolts and nuts are used for securing members comprising wood and steel roof trusses and similar framed structures, built-up wood lintels, steel beams, etc., in addition to securing cast iron eaves gutters, straps, etc. When bolts are used to fasten wood members (as in trusses—see K, Fig. 40), washers must be introduced between the timber and the heads and nuts to prevent the latter from being forced into the timber as the nuts are being tightened by a spanner. A bolt consists of a *shank* and *head*, and, as shown, the proportions of the head and nut are related to the diameter of the shank. The end of the shank is in the form of a screw having a *pitch* (distance between *threads*) which varies according to the diameter of the bolt (which is that of the shank) ; thus a $\frac{1}{4}$-in. diameter bolt has 20 threads to the inch, 1-in. bolts have 8, and a $\frac{3}{4}$-in. bolt as shown has 10 threads to the inch. The depth of the thread varies ; in the example it is approximately $\frac{1}{16}$-in. Bolts vary in size

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[1] This is sometimes included in a first-year course in Building Construction to familiarize students with the principal members used in structural details which are included in subsequent years of the course.

[1] Many students at examinations show carelessly drawn sections of beams, common errors being : webs thicker than flanges and the latter either tapering to a point or provided with bulbous toes.