Aug. 14, 1945. E. SCHEYER 2,382,583

STRUCTURAL SECTION FOR FLEXIBLE WELDED CONNECTIONS

Filed Sept. 16, 1943

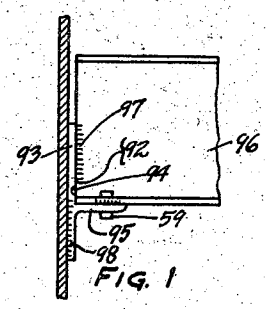


FIG. 1

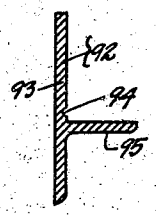


FIG. 2

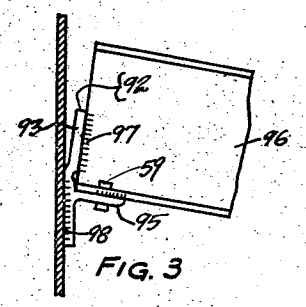


FIG. 3

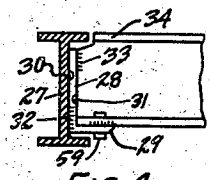


FIG. 4

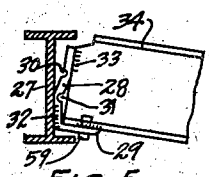


FIG. 5

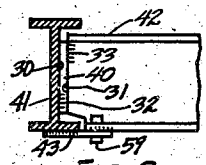


FIG. 6

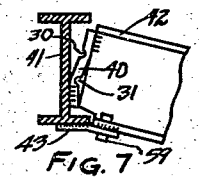


FIG. 7

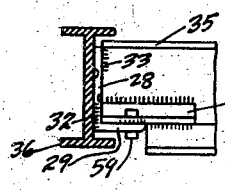


FIG. 8

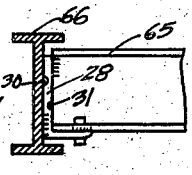


FIG. 9

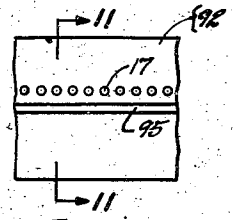


FIG. 10

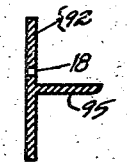


FIG. 11

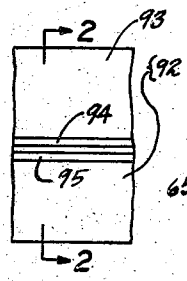


FIG. 12

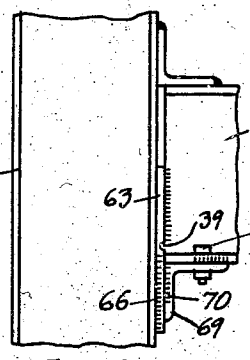


FIG. 13

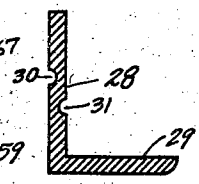


FIG. 14

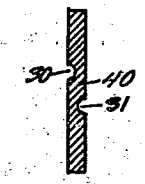


FIG. 15

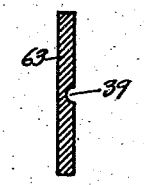


FIG. 16

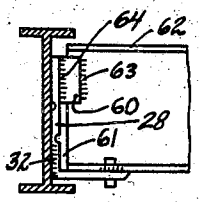


FIG. 17

INVENTOR.
Emanuel Scheyer

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UNITED STATES PATENT OFFICE

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STRUCTURAL SECTION FOR FLEXIBLE WELDED CONNECTIONS

Emanuel Scheyer, New York, N. Y.

Application September 16, 1943, Serial No. 502,571

4 Claims. (Cl. 189—41)

This invention relates to structural sections for use in flexible welded structural connections. They form part of connections which are so designed that the deformations of the connected members are largely prevented from producing secondary stresses in the welding. The structural sections are weak in bending along a certain line or lines so that they flex along these lines and hence do not restrain the members against their deformations under loading, thereby largely preventing said deformations from producing secondary stresses in the welding, allowing the latter to take substantially only principal stress such as shearing.

Instead of fabricating material individually for each connection, especially where an erection seat is used, it is more economical to roll or otherwise produce continuous lengths of predetermined sections and then cut them into pieces to suit desired connections.

Sections of various sizes and forms are made available, which sections can be selected by the detailer and furnished by the mill, just as various beams are.

In one form, the section is substantially T-shaped having the head of the T weakened by a groove or by a line of perforations or by a line of indentations. In another form it is an angle section having a leg weakened along two lines. In still another form, it is a plate weakened along one or two lines for substantially the full length of the plate as rolled.

The sections are preferably formed by rolling.

This application is a continuation in part of my application Serial No. 474,842.

Other objects and advantages will become apparent upon a further study of the description and drawing, in which:

Fig. 1 is an elevation of the end of a beam showing its shear connection to the vertically extending portion of another member, the web of a deep beam or to a column, the connecting piece being the T-shaped structural section.

Fig. 2 is a cross section to a larger scale of the T-shaped section shown by itself. It is taken along the line 2—2 of Fig. 12.

Fig. 3 is an elevation, as in Fig. 1, but with the beam and connection shown deformed.

Fig. 4 is an elevation of the end of a relatively shallow beam showing its shear connection, flush top, to a relatively deeper beam, the connecting piece being the angle-shaped section.

Fig. 5 is an elevation, as in Fig. 4, but with the beam and connection shown deformed.

Fig. 6 is an elevation of the end of a relatively shallow beam showing its shear connection, flush bottom, to a relatively deeper beam, the connecting piece being a double weakened plate section.

Fig. 7 is an elevation, as in Fig. 6, but with the beam and connection shown deformed.

Fig. 8 is an elevation of the end of a beam showing its shear connection to a beam with its bottom flange at a higher elevation, the connecting piece being the angle-shaped section.

Fig. 9 is an elevation of the end of a beam showing its shear connection to a deeper beam intermediate of its flanges, the connecting piece being the angle-shaped section.

Fig. 10 is an elevation of the T-shaped connecting piece showing the weakening effected by spaced holes or indentations.

Fig. 11 is a cross section of the connecting piece taken along the line 11—11 of Fig. 10.

Fig. 12 is an elevation of the T-shaped connecting piece showing the weakening effected by a longitudinal groove.

Fig. 13 is an elevation of the end of a beam showing its shear connection to a column, the web of a deep beam or vertically extending part of a structural member, the connecting piece being a weakened plate with an angle welded on for an erection seat.

Fig. 14 is a cross section of the angle-shaped section to a larger scale.

Fig. 15 is a cross section to a larger scale of the plate section with two weakening lines.

Fig. 16 is a cross section of the plate section with a single weakening line, and

Fig. 17 is an elevation of the end of a beam showing its connection to a supporting beam by the use of the angle-shaped connection, extension plates being used to allow for the erection clearance between the beams.

In its simplest form, the structural section consists of a plate, with a line of weakness preferably rolled therein, as plate 63 with groove 39 in Figs. 13 and 16.

By way of example, a beam 67, Fig. 13, is shown framing to the flange of column 65. Plate 63 has seat angle 69 welded to it by shop welds 70, only the weld on the near side being seen. Plate 63, with angle 69 welded to it, is shop welded to column 65 by means of welds 66, only the one on the nearside being seen. Seat angle 69 is provided with holes for erection bolts 59. Plate 63 has a line of weakness or reduced section at groove 39, said groove being preferably rolled in the plate. Instead of using a continuous groove, a line of indentations can be rolled in the plate, such as the indentations 17 shown in plan in

Fig. 10 for section 92. Instead of only being indentations 17, they can be complete holes as shown at 18 for section 92 in Fig. 11. Indentations 17 in a cross section would have the appearance of groove 94 in Fig. 2.

Structural section 92, Figs. 1, 2 and 3, is a more convenient form than plate 63 for use in the flexible welded connection. Section 92 is formed with a flange 95 which acts as a seat to assist in the erection of beam 96 instead of using a separate seat angle 69 as in Fig. 13. The section is essentially T-shaped in cross section, the portion 93 of the head of the T being grooved or otherwise weakened in the rolling as at 94. See Figures 10, 11 and 12. Where a groove is used it should be on the same side with flange 95. Stem or flange 95 serves as an erection seat when the section is cut into short lengths to serve as connecting pieces. Bolt holes for erection bolts 59 are put in the connecting pieces in the fabricating shop. In order that beam 96 may be set tight up against portion 93 for the purpose of being fastened by weldings 97 thereto, no fillet is formed between said portion and stem 95. To suit connections over a wide range of reactions, a number of standard sizes of the T-section are rolled, that is the head of the T is longer or shorter or heavier, just as various sections of beams are rolled to suit conditions of loading. The head of the T is shop welded to the column below flange 95 at weldings 98 and field welded to beam 96 by weldings 97. When the end of beam 96 deforms under load, as seen in Fig. 3, portion 93 bends readily along the line of weakening 94 preventing undue stress from being produced in weldings 97 and 98 which would otherwise be the case were the full bending strength of the head of T 92 be required to be overcome to permit the deformation of the beam. Enough metal is left in section 92 to transmit the load of beam 96 from weldings 97 to weldings 98.

In cases where the bottom of a supporting member, such as stringer 27, Figs. 4 and 5 is a short distance from the bottom part of beam 34 being supported, it is not possible to use a T-section. In such cases angle-section 28 of Fig. 14 is used. As is the case with T-section 92, broadly speaking angle-section 28 is a plate provided with a flange 29 to serve as an erection seat. In the case of T-section 92, there is stem or seat flange 95 projecting from a plate or head portion.

Just as with the case of T-92, angle-section 28 is preferably produced in the rolling mill, with its lines of weakening 30 and 31 formed therein by the rolls. Where grooving or indenting is used to weaken the section, it is preferable to have groove 31 or equivalent indentations nearer the seat flange or leg 29 extend inward from the same surface as from which said leg extends outward. Groove 30 or equivalent indentations extends inward from the opposite surface from which groove 31 extends. This is to avoid cracking of section 28 when it deforms as seen in Fig. 5. The portion of section 28 below groove 31 is shop welded at 32 to the web of beam 27, while the portion of said section above groove 30 is field welded to beam 34 by welding 33. Flange 29 is provided with holes for erection bolts 59 in the fabricating shop after said section has been cut into a piece of suitable length to serve as connection piece between beams 27 and 34. The use of two lines of weakening is necessary to overcome the reversal of bending moment taking place in section 28 welded as shown.

Section 28 can be used where the bottom flange of the supported beam 35 is below the bottom flange of the supporting beam 36, Fig. 8. In this case beam 35 is blocked out and angles 37 are attached to its web for erection purposes, erection bolts 59 attaching said angles to seat flange 29. The vertical leg of section 28 is provided with weldings between beams 35 and 36 just as shown for beams 34 and 27 in Fig. 4.

Where there is no room for seat flange 29, section 40 as shown in Figs. 6, 7 and 15 can be used. Section 40 is a plate with a double line of weakening, just the same as for the vertical leg of section 28 as seen in Figs. 4, 8 and 9. It is the same as section 28 except it lacks seat flange 29. A welding 32 is used to shop weld section 40 to beam 41, and a welding 33 is used to field weld beam 42 to section 40. There are two such welds as 32 and as 33, a nearside weld and a farside weld. Section 40 is weakened along the two transversely spaced longitudinal lines 30 and 31. Where grooves are used (including indentations) they extend inward from opposite surfaces. Section 40 is provided with two lines of weakening to provide for the contraflexure produced in it by the deformation of beam 42 as seen in Fig. 7. An erection seat for beam 42 is provided by shop welding plate 43 to the bottom flange of beam 41 with suitable holes for erection bolts 59.

To allow clearance for erection where a beam frames in between two others, a clearance 61, Fig. 17, of one-half inch or so is provided to swing beam 62 into position. As it is not feasible to weld across such a gap, extension plates 60 are used, one end of the plates being welded at 63 to the web of the beam and the other end being welded at 64 to connecting angle 28.

In Fig. 9 is shown the more or less central connection of a shallower beam 65 to a deeper beam 66, using the connecting angle 28.

I claim:

1. As an article of manufacture, a structural section substantially T-shaped in cross section, the head of the T having a longitudinal groove extending inward from the same surface from which the stem projects, substantially weakening said head in transverse bending, said groove being located substantially adjacent the stem, the surface of the stem on its side facing the groove extending at right angles to said surface of the head, said surfaces continuing plane, except for the groove, clear to their line of intersection.

2. As an article of manufacture, a structural section substantially T-shaped in cross section, the head of the T having a longitudinal zone of weakness substantially adjacent the stem, materially weakening said head in transverse bending, the surface of the stem on its side facing said zone extending at right angles to the adjacent surface of the head, said surfaces continuing plane, except at the zone clear to their line of intersection.

3. As an article of manufacture a structural section substantially T-shaped in cross section, the head of the T having a reduction in area along a longitudinal line substantially adjacent the stem, materially weakening said head in transverse bending, the surface of the stem on its side facing said line extending at right angles to the adjacent surface of the head, said surfaces continuing plane, except at said line, clear to their line of intersection.

4. As an article of manufacture, a structural section substantially T-shaped in cross section, the head of the T having one of its surfaces depressed along a line substantially adjacent the stem, materially weakening in bending along said line that portion of the head to one side of the stem which contains said line, the surface of said head portion on its side from which the stem projects extending at right angles to the adjacent surface of the stem, said latter two surfaces continuing plane clear to their line of intersection, except at said line of depression, when the surface of said head portion from which the stem extends, is the one depressed along said line.

EMANUEL SCHEYER.