April 9, 1929. W. DALTON 1,708,753

STRUCTURAL BEAM AND METHOD OF MAKING SAME

Filed Aug. 15, 1927

Fig. 1.

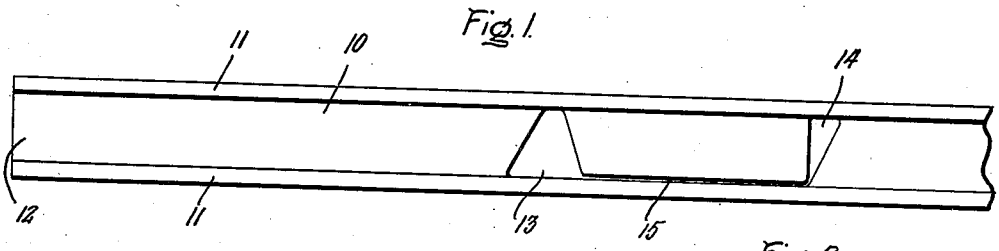


Fig. 2.

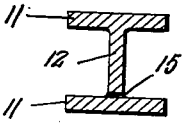


Fig. 3.

Fig. 4.

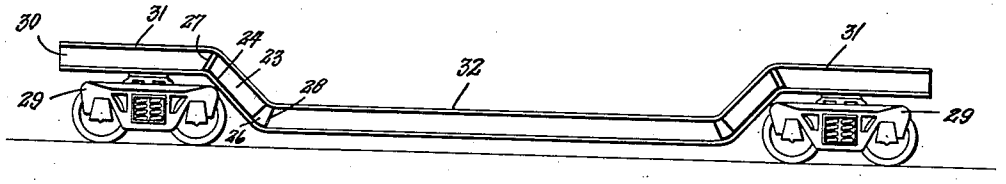


Fig. 5.

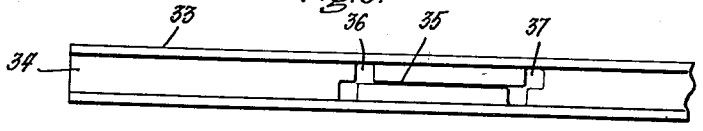
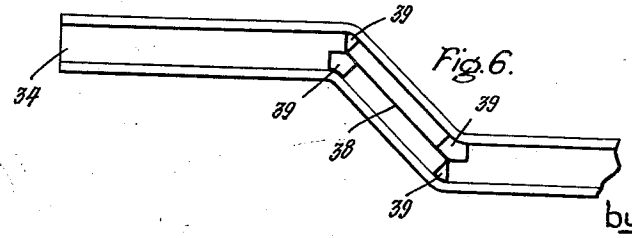


Fig. 6.



Inventor:
William Dalton,
by Alexander S. Lunz
His Attorney.

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UNITED STATES PATENT OFFICE.

WILLIAM DALTON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STRUCTURAL BEAM AND METHOD OF MAKING SAME.

Application filed August 15, 1927. Serial No. 212,904.

My invention relates to structural beams, particularly those of large size or large cross section for carrying heavy loads. In the fabrication of a structure in which beams of this character are employed, it often becomes necessary to provide offset bends in the same to conform to the desired shape of the structure. For example, in the construction of a railroad well car for transporting tall articles of large size, the platform thereof is bent between the trucks to form a lower or well portion on which the main load is carried, being thereby provided with two offset bends. The lower platform is thus offset from the platform portion over each truck.

The frame members or beams for structures of this character are necessarily of relatively large section and are not therefore readily adapted for bending to desired shapes. Hence, according to one common method heretofore employed, such beams have been provided by steel castings.

While castings are satisfactory from the standpoint of strength and may be formed to desired shapes, they are relatively heavy and costly as compared with commonly known rolled section beams, which for structural purposes are coming into more general use and which are known as structural steel. Rolled section beams have been placed upon the market in an increasing variety of shapes and sizes and may be had in various forms, such as angles, plates, channels and H-beams or I-beams. The fabrication of various structures from such rolled shapes is therefore comparatively easy in addition to the advantages of lower cost and greater strength over the casting type of construction.

For a given weight, the H-beam type of rolled section offers the greatest strength for general use in fabricated structures, and recently such beams have been made available on the market in the heavier sizes. One size which may be mentioned, by way of example and not in any way as a limitation, is an H-beam now available on the market, which has flanges sixteen inches wide and two and one-half inches thick and which is sixteen inches deep in the direction of the web.

Beams of this general type are commonly used as straight frame members in various structures, and being of a section especially adapted to resist bending, such beams are not readily bent as desired. In the larger sizes, such as the H-beam above mentioned, ordinary bending as practiced in bending the smallest sizes of rolled beams is practically impossible not only because it would require massive and special bending machinery but also because of the danger of weakening the beam flanges, which carry the compression and tension stresses.

In view of the desirability of rolled section beams as frame members in fabricated structures to replace castings, and in order to make the same available in offset or bent form for offset beam structures, particularly heavy structures requiring such beam or frame members, it is the object of my invention to provide an improved method for providing an offset bend in a flanged and webbed structural beam without injuring the structure of the beam or impairing its strength and without the aid of heavy bending machinery. A further object of my invention is to provide an improved offset flanged and webbed beam having the strength of the original beam or an unbent beam of the same section and which is readily adapted for fusion welding, such as arc welding.

While the method of my invention is particularly adapted for providing a heavy H-beam with an offset bend, it is not limited thereto but may be applied to any beam having flanges united by an integral connecting web. The invention is however, by way of example, illustrated and described in connection with such heavy H-beam and its application to the frame of a well car, and for a further consideration of the same, attention is now directed to the accompanying drawing, the description thereof and the appended claims.

In the drawing, Fig. 1 is a side elevation of a heavy H-beam, the section of which is shown in Fig. 2 and which is prepared for bending to provide an offset therein in accordance with the invention; Fig. 3 is a side elevation of the beam of Fig. 1 after completion of the offset bend; Fig. 4 is a side elevation on a reduced scale of a type of fabricated structure to which offset beams built in accordance with the invention are applicable, being a well car frame provided by offset beams like that of Fig. 3, and Figs.

5 and 6 are views also on a reduced scale illustrating a modification, Fig. 5 being a side elevation of an H-beam prepared for bending, and Fig. 6 being a similar view of the completed bent or offset beam in accordance with the modification.

Referring to Figs. 1, 2 and 3 of the drawing, 10 is a standard H-beam of the heavier type having flanges 11 and a connecting web 12 and may be taken to represent any structural beam having a pair of flanges joined by a web.

In preparing a beam of this character for bending, I remove a portion of the web between the flanges adjacent the desired location for each bend, as indicated by openings 13 and 14 thus formed (Fig. 1) and join the openings by a cut 15 (Figs. 1 and 2). In the present example this runs parallel with and adjacent to one flange, that is, along one flange between the openings.

The openings extend fully between the flanges as indicated and are formed in accordance with the extent and direction of the bends so that the flanges will be free adjacent the bends. The distance between the openings is in accordance with the amount of offset desired.

By this method the heavier flanges remain intact and only the thinner web is cut. The strength of the flanges is thus preserved. The beam is then bent in the plane of the web into the offset form shown in Fig. 3, the flanges then being unrestrained by the web and bending at points 16, 17, 18 and 19 adjacent the web openings. This provides a beam having two straight substantially parallel offset portions 20 and 21 and a diagonal connecting portion 22 therebetween. The flanges of the latter portion and a free portion 23 of the web which is located between the openings, move to compensate for the two tension bends 16 and 19 and the two compression bends 17 and 18. Since a compression bend and a tension bend is made in each flange, the flanges of that portion approach each other in the original parallel relation to close cut 15, the cut being made of such width that the edges thereof are brought adjacent each other as the offset bends are made.

The width of the flame of a cutting torch, as ordinarily employed for making openings 13 and 14, is generally sufficient to make cut 15 of the proper width. Sufficient space should remain however to permit properly re-uniting the web with the flange from which it was cut by brazing, fusion welding, or other method whereby it is made integral with the flange and the original strength of the web is restored. In the present example and as a preferred method, arc welding is employed to weld the adjacent edges of the cut directly together as indicated at 24, a similar weld being made on the opposite side of the web simultaneously therewith in order that warping of the web may be obviated.

Openings 13 and 14, now changed in shape by the bending, are closed by plates 25 and 26 respectively of corresponding shape and of proper thickness also welded in place or united with the web and flanges by welds indicated at 27 and 28, similar welds being made on each side of the web.

Thus in accordance with the method, a certain length of the web of the beam is removed at spaced points fully between the flanges to provide openings which are joined by a single cut leaving the web between the openings integral with one flange. The flanges are then bent in offset form and the web is repaired by brazing, fusion welding or the like, to restore the beam to its original strength, fusion welding being particularly adapted for this work.

I prefer to cut the web so as to permit the edges of the longitudinal cut to come adjacent each other when the beam is offset to the desired form. I then prefer to weld the adjacent edges directly together, all as hereinbefore described. The construction is such that the weld may be readily made by the metallic electrode arc welding process wherein an arc is maintained between a fusible metallic electrode and the metal of the work, the metal of the electrode being fused and deposited to form a head at the joint. It will be apparent to those skilled in the art, however, that the edges may also be united by the so-called gas welding process wherein the fusion is produced by a gas torch and a filler rod used to supply the added metal. Where exceptional strength or ductility is desired the gas electrode method may be used, as for example, where the arc between the fusible electrode and the work is surrounded or shielded by a reducing gas. Alternatively the arc may be maintained between a pair of non-consuming electrodes and a blast of hydrogen directed across the arc as in the atomic hydrogen method of welding, the added metal being in this case also supplied from a filler rod.

While I prefer to cut and bend the beam so as to permit of directly welding the edges of the longitudinal cut together, it is apparent that my invention in its broader aspects contemplates that a wider cut might be made and a plate welded in place in the cut or placed on the web to cover the cut and welded to the web around the edges of the plate. It is likewise obvious that openings 13 and 14 could be closed by similar plates and in a similar manner.

In Fig. 4 is shown a well car having front and rear trucks 29 on which are laid a suitable number of off-set frames 30 thereby providing two platforms 31 and a dropped or

well portion 32 on which a main load of great weight and unusual height may be carried. A fabricated frame of this type not only reduces the cost of construction of such structures but reduces the weight thereof which is an important item. The flooring and other constructional features of the car of the present example are not shown but merely the frame arrangement to illustrate one use to which beams made in accordance with the invention are particularly adapted.

Referring to the modification in Figs. 5 and 6, a beam 33 is prepared and bent in substantially the same manner as the beam of the previously described embodiment, except that the web 34 is cut along its center, as indicated at 35, and the openings 36 and 37 joined by the cut are of different shape to permit a sliding movement of each half of the cut portion of the web when bending. The cut is closed by welding, as indicated at 38, and the openings by plates 39 of shapes substantially like the openings, welded in place, thereby making the web again continuous and integral with the flanges.

The advantage in the latter embodiment lies in the fact that the cut in the web joining the openings at the bends lies along the neutral axis of the web and thus places the weld or joint in a more advantageous position as regards strength.

While the invention has been herein described in its application to an H-beam which is at present the preferred type for reasons herein set forth, it should be understood that it is not limited thereto, but may be applied to beams of any cross-section embodying a pair of spaced flanges joined by a web, that is, united by an integral connecting web, as hereinbefore described.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The method of making an offset bend in a structural beam having a pair of flanges united by a web, which comprises cutting the web to provide a free portion thereof which is integral with one web and to provide openings at the ends of said free portion between the flanges, bending the flanges adjacent the openings into offset form, and repairing the web by fusion welding to restore the original strength of the beam.

2. The method of making an offset bend in a structural beam having a pair of flanges united by a web, which comprises cutting the web to provide spaced openings extending between the flanges, joining the openings by a longitudinal cut through the web, bending the flanges adjacent the openings into offset form until the edges of the longitudinal cut are brought adjacent each other, joining said edges by fusion welding and closing the openings by plates fusion welded in place.

3. The method of making an offset bend in a structural beam having a pair of flanges united by a web, which comprises cutting the web to provide a free portion thereof which is integral with one web and to provide openings at the ends of said free portion between the flanges, bending the flanges adjacent the openings into offset form, and repairing the web to restore the original strength of the beam by uniting the free portion of the web with the other flange by fusion welding and closing the openings by plates welded by fusion to the web and flanges.

4. The method of making an offset bent beam which comprises taking a rolled beam having a pair of spaced flanges united by a continuous integral connecting web, cutting the web free of the flange at spaced points, connecting the resulting spaced cuts by a third cut, bending the flanges adjacent the spaced cuts to provide an offset in the beam, and welding the web to make it again continuous and integral with the flanges.

5. The method of making an offset bent beam which comprises removing from a structural beam of the type having a pair of spaced flanges united by an integral connecting web, a portion of the latter between the flanges at spaced points at which points offset bends are desired, thereby producing spaced openings in the web, connecting the spaced openings by a cut along the web between the openings, bending each of the flanges by two bends, one adjacent each opening to produce two offset substantially parallel beam portions connected by a diagonal portion, and filling the cut by a weld and the openings by plates welded in place, thereby making the web again continuous and integral with the flanges.

6. The method of making a bend in a structural beam having a pair of flanges united by a web, which comprises at least partially severing the web from the flanges at the point of bending, bending the beam to the desired shape, and then reuniting the web and flanges by fusion welding.

7. An H-beam having an angularly extending portion uniting offset portions, the web of the angularly extending portion being united to the flanges and to the webs of the offset portions in part, at least, by fused metal.

In witness whereof, I have hereunto set my hand this 12th day of August, 1927.

WILLIAM DALTON.