(No Model.)

H. H. ROUSSEAU.

PLATE GIRDER.

No. 542,283. Patented July 9, 1895.

Fig. 1.

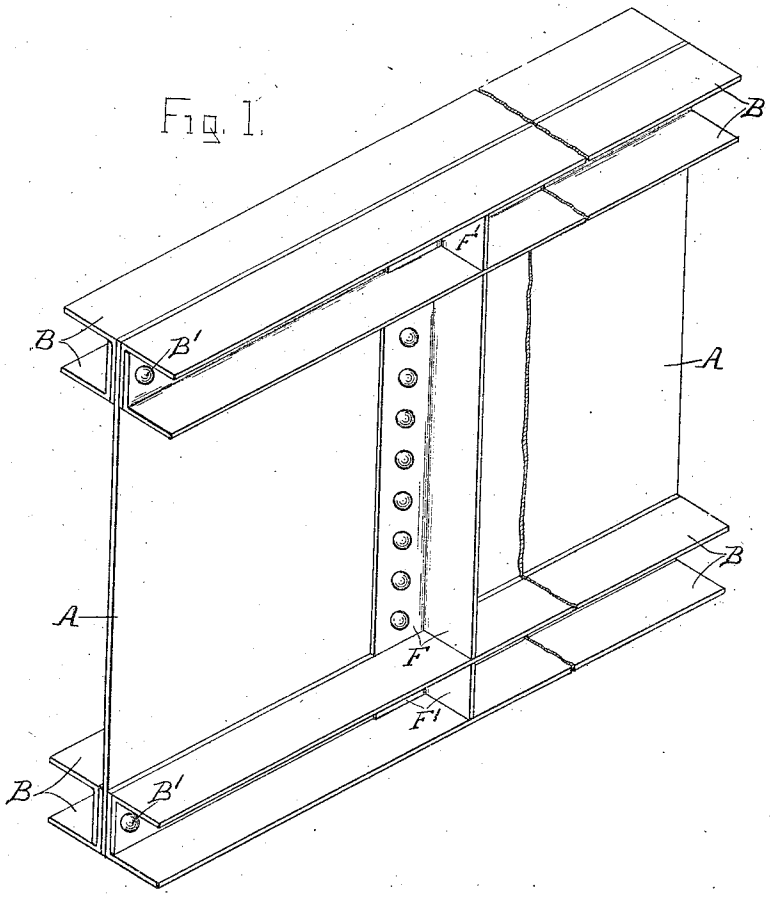


Fig. 2.

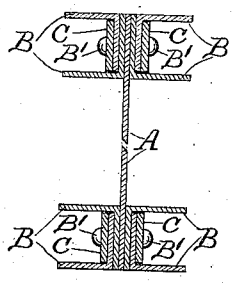


Fig. 3.

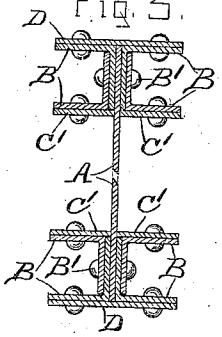
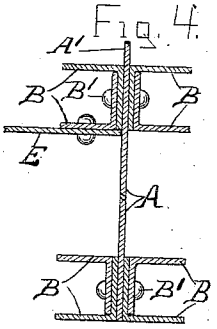


Fig. 4.



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HARRY H. ROUSSEAU, OF PITTSBURG, PENNSYLVANIA.

PLATE-GIRDER.

SPECIFICATION forming part of Letters Patent No. 542,283, dated July 9, 1895.

Application filed November 14, 1894. Serial No. 528,721. (No model.)

To all whom it may concern:

Be it known that I, HARRY H. ROUSSEAU, a citizen of the United States, residing at Pittsburg, county of Allegheny, and State of Pennsylvania, have invented certain new and useful Improvements in Plate-Girders, of which the following is a specification.

The invention relates to such improvements; and it consists of the novel construction and combination of parts hereinafter described, and subsequently claimed.

Reference may be had to the accompanying drawings, and the letters of reference marked thereon, which form a part of this specification.

Similar letters refer to similar parts in the several figures therein.

Though it is now understood among the engineering profession that the true or effective depth of a plate-girder is the depth or vertical distance between rivet-hole centers, by a curious confusion between rolled and built sections, and in accordance with long-established usage, it is still commonly taken as the distance between the centers of gravity of the edge flanges of the girder.

In ordinary plate-girder construction the edge flanges consist of two angle-irons riveted to opposite sides of the web along each longitudinal edge. If flanges of greater cross-sectional area are required than can be obtained by two angle-irons along each edge, cover-plates are added to the angle-irons at both top and bottom of the web until the desired area is obtained. The center of gravity of each edge flange is thus moved farther outward from the line of rivet connection with the web in proportion to the number and thickness of the cover-plates employed; and it will be seen that the discrepancy between the true depth of a built-up girder and the depth commonly assumed as the basis for calculation varies from a difference that is perhaps negligible in a girder having only a single pair of angle-irons along each edge to a more or less material difference where a plurality of cover-plates are employed. All stress exists first in the web and is transmitted to the flanges from the web through the connecting rivets, and when the center of gravity of the flange-section does not coincide with the line of rivet connection the consequent transmission of stress to the flange eccentrically to its center of gravity causes flexure in the flange. This flexure is not calculated, but is considered to be offset or compensated for by making the flanges of sufficient dimensions to alone take up all bending stress caused by the load carried by the girder and disregarding the fact that approximately one-sixth of the web-area itself is available to resist bending and must resist bending-stress before deflection takes place and causes the flanges to begin to assist the web. It is thus apparent that the ordinary methods of computing the necessary dimensions of the flanges of a built-up girder give more or less inexact results and that the flanges will in many cases be made of unnecessarily large dimensions to compensate for possible variations and approximations.

The object of my invention is to produce a plate-girder whose dimensions can be more accurately determined to meet the given requirements in each case, as well as to cheapen and facilitate the construction and use of such a girder. By distributing the mass of flange metal symmetrically about the line of rivet connection with the web, as shown in the drawings, I can produce a girder approximately free from the objectionable features above set forth and which has many structural advantages over the built-up girders heretofore in use.

Figure 1 of the drawings is a view in isometrical perspective of my improved plate-girder. Figs. 2, 3, and 4 are cross-sectional views illustrating various features of my invention.

A represents the web-plate, provided along its top and bottom with longitudinal edge flanges. The flanges, as shown in Fig. 1, are made up wholly of angle-irons B, secured along the edges of the web by rivets B′ inserted through the web and the lapping vertical legs of the angle-irons, the horizontal legs of which project in parallel planes from opposite sides of the web along each edge. There are thus secured along each edge of the web, as shown in Fig. 1, four angle-irons, which together form an edge flange for the web, I-shaped in cross-section, two of the horizontal legs of the angle-irons being above and two below the line of rivet connection.

The arrangement of the lapping-legs of the angle-irons may be varied as desired, and I have shown them lapped in different positions in the drawings; but I prefer the arrangement shown in Fig. 1, in which the vertical legs of the outer angle-irons are contiguous to the web-plate

An increased cross-sectional area of flange can be secured either throughout or in part of my improved girder in various ways, as by increasing the size of a part or all of the angle-irons, or by the use of side plates C, secured upon the lapped legs of the angle-irons, or by the use of horizontal plates C′, riveted to the horizontal legs of the inner angle-irons.

A cover-plate D may be used when desired; but ordinarily a sufficient cross-sectional area of flange can be secured by the use of the auxiliary plates C and C′, in which case I prefer to dispense with the cover-plates, and, if railway-ties are to rest upon the girder, to project the web-plate a short distance beyond the top-flange to form a tongue A′, adapted to enter a cross-groove in the superimposed tie to prevent longitudinal movement of the tie transversely of the girder. The tongue may be dispensed with when so desired.

The connecting-plates for lateral bracing, in constructions where my improved girder is employed, can be attached to the horizontal leg of the inner angle-iron of the top flange, as shown at E, whereby, in the absence of a cover-plate, I am able to wholly dispense with projecting rivet-heads above the girder, permitting the ties or other supported parts to rest directly upon the flange of the girder without countersinking the rivet-heads or notching the ties to receive the rivet-heads, as commonly practiced.

When vertical stiffeners are required, they may be formed of straight sections F of angle-iron, each having one leg riveted directly to the web-plate and its ends bearing, respectively, upon the horizontal legs of the inner angle-irons of the opposite flanges. The ends of the stiffeners fit squarely into the angles formed by the horizontal legs of the inner angle-irons and the web-plate, and neither crimping of the stiffener nor the use of a filler-plate, as now commonly practiced in fitting such parts together, is required.

Shorter stiffeners F′ may be inserted between the parallel horizontal legs of the angle-irons of each flange should the conditions of loading render them desirable.

In calculating the dimensions of a girder of my improved construction to meet given requirements the true depth or distance between rivet-hole centers is approximately the distance between the centers of gravity of the edge flanges, whatever their cross-sectional area, and may, with all practicable accuracy, be made the basis of calculation, and the center of gravity of the flange-section being approximately in the line of rivet connection with the web flexure is avoided in transmitting stress to the flange. The engineer being thus enabled to easily calculate with comparative accuracy the necessary dimensions, there is no reason why the value of the web-plate itself to resist bending should not be allowed for and the edge flanges made correspondingly smaller, resulting in economy in the manufacture of the girder.

My improved construction requires fewer rivets and less skilled labor than constructions heretofore used, resulting in a considerable saving in the cost of the girder.

What I claim as new, and desire to secure by Letters Patent, is—

1. A plate-metal girder comprising a flat web-plate and built-up edge-flanges severally composed of a plurality of connected irons having their combined mass distributed symmetrically about the line of rivet-connection with the web, substantially as described.

2. In a plate-metal girder, the combination with a flat web-plate, of an edge-flange formed of separate angle-irons on opposite sides of the web, and flange-attaching rivets severally inserted perpendicularly through the web, and the irons on both sides of the web, approximately at the center of gravity of the flange-section, substantially as described.

3. In a plate-girder, the combination with a web-plate of an attached edge-flange comprising four angle-irons arranged in pairs on opposite sides of the web with lapping vertical legs and their horizontal legs projecting in parallel planes, and attaching rivets severally inserted through the web and the lapping legs of the four angle-irons, substantially as described.

4. In a plate-girder, the combination with a web-plate and I-shaped flanges secured to its opposite edges, of stiffening plates severally comprising a straight section of angle-iron secured by one of its legs directly to the web-plate and bearing at opposite ends upon the inner edges of the I-shaped flanges, substantially as described.

5. A plate-metal girder comprising a web having I-shaped flanges on its opposite longitudinal edges and its center-line coincident with the center-lines of the web-portions of the respective flanges, substantially as described.

In testimony whereof I have hereunto set my hand this 5th day of November, 1894.

HARRY H. ROUSSEAU.

Witnesses:
GEO. BALBACH,
P. M. CUSHING.