Oct. 5, 1926. 1,602,283

C. W. NOBLE ET AL

FABRICATED GIRDER

Filed Feb. 7, 1924 2 Sheets-Sheet 1

Fig. 1.

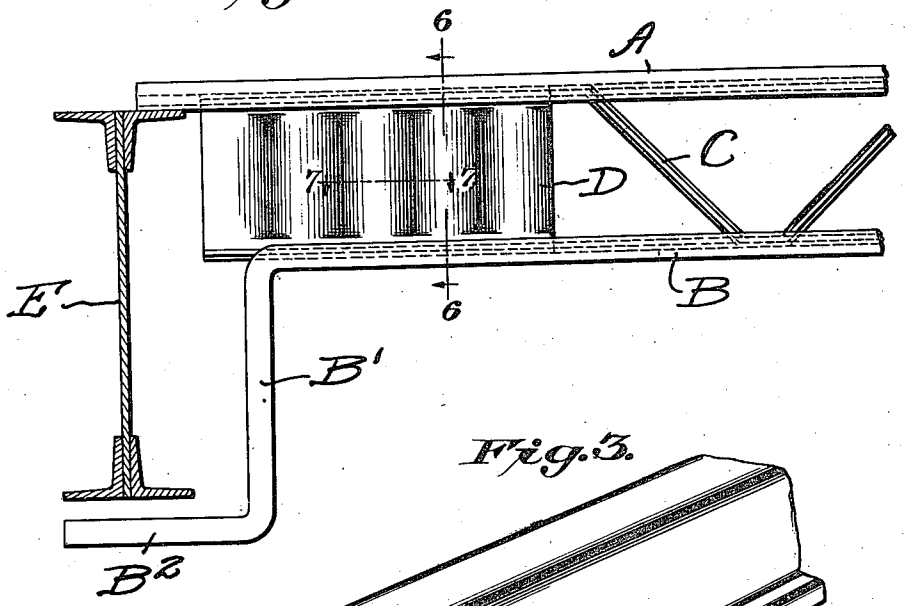


Fig. 3.

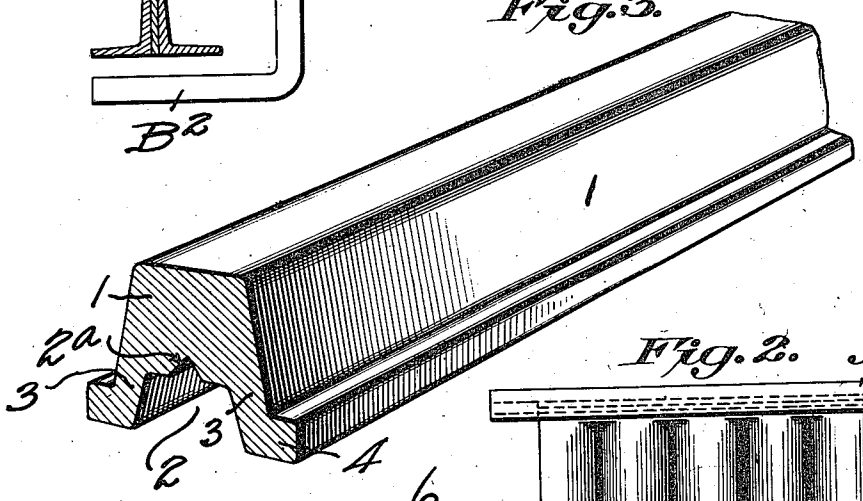


Fig. 2.

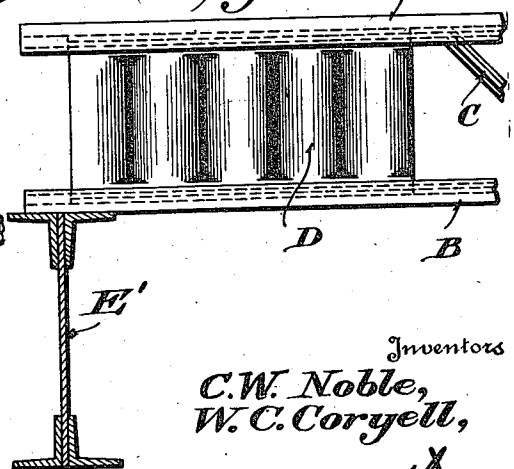
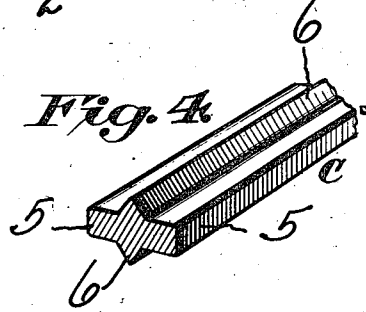


Fig. 4.



Inventors

C. W. Noble,

W. C. Coryell,

By A. P. Wolcan Jr.

Attorney

Witnesses:-

Chas. L. Griesbauer

Emory L. Groff

Oct. 5, 1926.

1,602,283

C. W. NOBLE ET AL

FABRICATED GIRDER

Filed Feb. 7, 1924

2 Sheets-Sheet 2

Fig. 6.

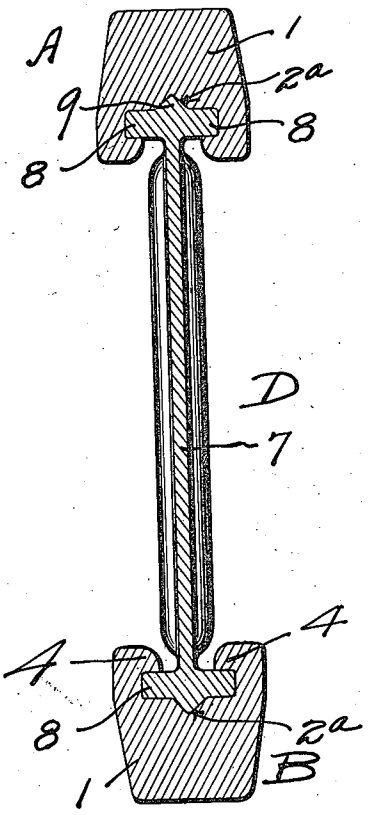


Fig. 5.

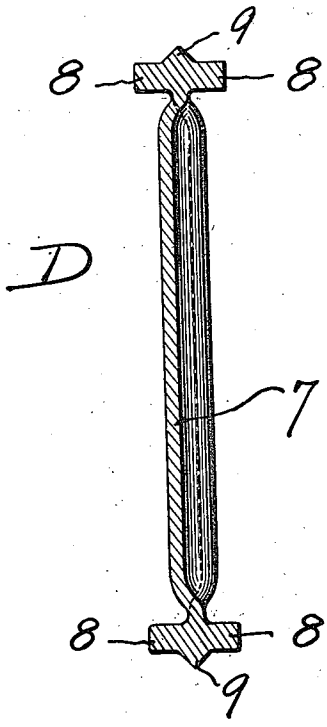
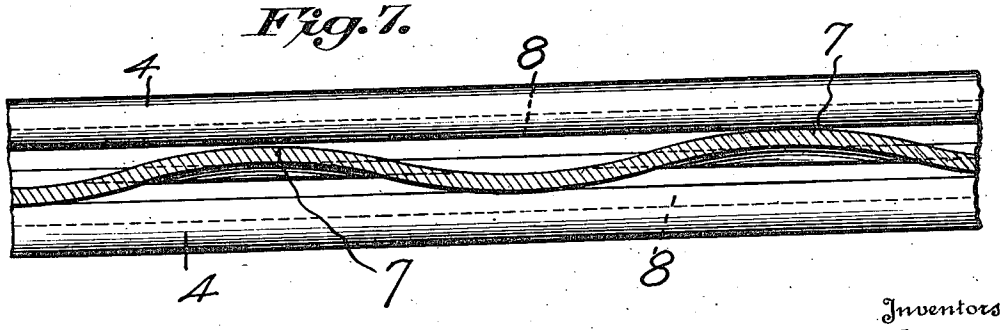


Fig. 7.



Inventors

C. W. Noble,
W. C. Coryell,

By D. P. Wolhaupter
Attorney

Witnesses:-

Chas. L. Griegbauer

Emory L. Groff

Patented Oct. 5, 1926. 1,602,283

UNITED STATES PATENT OFFICE.

CLARENCE W. NOBLE AND WILLIAM C. CORYELL, OF YOUNGSTOWN, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO TRUSCON STEEL COMPANY, OF YOUNGSTOWN, OHIO, A CORPORATION OF MICHIGAN.

FABRICATED GIRDER.

Application filed February 7, 1924. Serial No. 691,227.

This invention relates to girders of the built-up or fabricated type, and more particularly to a construction having novel stiffening and reinforcing means near the end of the span.

To that end the invention contemplates a light girder or joist construction including a plurality of rolled sections or parts made to conform with a standard design, and which may be manufactured in large quantities and in convenient lengths and stored until desired for use. That is to say, the invention has generally in view the provision of a fabricated or built-up girder wherein all of the parts are rolled sections which are bound to match one another when properly assembled. Also because of the fact that rolled sections of various sizes may be stocked under the present plan the designer has a considerable leeway in selecting the depth and size of the bars, and the fabricator cannot very well make an error in executing the specifications of the designer because his materials are standardized and if he should make a mistake, the inspector can detect the error almost at sight. Moreover, the operation of assembling the parts and attaching them together is reduced to a minimum so that the fabricating work is greatly reduced thereby keeping the cost low. In the latter connection it may also be pointed out that a fabricated girder of the present type can be made very economically because the sections are reduced to such shapes as can be readily rolled and can therefore be obtained under favorable price conditions.

A further and more specific object of the invention is to provide a fabricated girder wherein the top and bottom chords are rolled channel bars which have their intermediate portions connected by a shear member while the ends of the chords are connected by a gusset member or equivalent plate-like member which carries the increased load at the end of the span, thereby greatly stiffening the girder without materially increasing its weight and contributing greatly to its strength.

With the above and other objects in view which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts, hereinafter more fully described, illustrated and claimed.

A preferred and practical embodiment of the invention is shown in the accompanying drawings, in which:—

Figure 1 is a side elevation of a portion of a girder constructed in accordance with the present invention.

Fig. 2 is a view similar to Fig. 1 showing the adaptation of the invention to a girder which is supported on its bottom chord.

Fig. 3 is a detail perspective view of one of the top and bottom chords.

Fig. 4 is a detail perspective view of one of the diagonal members.

Fig. 5 is a vertical sectional view of the improved gusset or web member.

Fig. 6 is an enlarged sectional view taken on the line 6—6 of Fig. 1.

Fig. 7 is an enlarged detail sectional view taken on the line 7—7 of Figure 1.

Similar reference characters designate corresponding parts throughout the several figures of the drawings.

A girder constructed in accordance with the present invention preferably consists of the top chord A; bottom chord B; diagonal or shear member C, and the gusset plate or stiffening member D, assembled in a manner which will hereinafter more fully appear. Although the girder is susceptible of embodiment on various structures and may be mounted to suit different requirements, several ways of using the same is shown in Figures 1 and 2 of the drawings wherein it may be supported either by its top or bottom chord upon a main structural girder E or E'.

In connection with the lower or bottom chord B of the girder shown in Fig. 1 it will be observed that the same may be formed with the depending portion B' and the relatively horizontally offset portion B^2 which may extend beneath the structural girder E to provide a support for enclosing the main girder. In other words the extension B'—B^2 of the lower chord B is formed to provide a hanger for metallic lathing or the like which carries the plaster to encase or cover the main girder.

Referring more particularly to the individual structural elements of the present girder it will be observed that the top and bottom chords A and B are, in this instance, of the same cross-sectional shape, namely, channel formation as shown in Figure 3, and consist of the body portion 1 having the groove or channel 2 providing the side flanges 3 having the over-thickened edge portions which provide out-turned lips 4 that act as clinchers for the diagonal as clearly shown in Figure 6 of the drawings.

As previously indicated, the diagonal or shear member C is preferably a continuous bar of uniform section and may be of any shape. However as shown in Figure 4 the stock from which the diagonal is made may consist of a body 5 having the ribs 6 at opposite sides thereof, one of said ribs being adapted to fit in the groove 2^a provided in the bottom of the channel 2 of the chord when the girder is assembled as shown in Figures 1 and 6.

It is known by designers that the diagonal or shear member, such for example as C, takes on higher and higher stresses as it approaches the ends of the girder. In the light structural girder used in modern light floor construction it is very important to economize in material and labor because the structural girder is often in competition with wooden joists, and therefore in order to effect the desired economies by using standard stock bars for diagonals it has been found very desirable and convenient to use a light gusset plate or stiffening member D of the type shown in Figs. 1, 2, 5 and 6 and 7 at the ends of the span where the stresses are the greatest.

As previously indicated, the stresses in the diagonals are a minimum at the center and gradually increase towards the end in relation to the load carried by the beam. The members C are sometimes called "shear" members. In practice the diagonals may be made out of round stock and may therefore vary appreciably in size instead of by increments which will agree with the requirements of the particular truss. On that account a selected size of lattice bar will be adopted for the center of the joist which will run for an appreciable distance on equal sides of the center of such joist, after which lattice bars of larger size will be used at each side of the central bar. This larger size will be continued on either side of the center bar for a given distance from the center of the span until all of its available strength is required as a diagonal. Thereupon, the second size of diagonal will be discontinued and a third size still larger will be adopted again to run out to a further distance from the center of the span. After the span reaches such a point where the largest size diagonal is fully loaded it is then contemplated to introduce the gusset plate, and to carry the gusset plate to the end of the beam.

In any case it is intended to use a gusset plate D at the ends of the beam even though the largest size of diagonal has not been made use of, for reasons which will now be pointed out. In manufacture the joist will, of course, have to be made to a specified length. The latticed bars may have inequalities possibly of both length and angularity, and also the joist may vary in depth. All of these factors will bring about a lack of precision on over-all length of the lattice work. Moreover, due to these inequalities, the open space at the ends of the joists may not be equal in length. The gusset plates being of great strength and coming to the fabricating shop in long lengths, provide a means for correcting the above mentioned inequalities. If, for example, the open ends of the joists do not quite agree in length, the assembling shop will simply cut off a gusset plate of such length as is required to fill the open space, the only precaution being that the gusset plate or stiffening member must begin within some specified distance from the center of the beam. In other words, the gusset plate affords a ready means of completing the lattice work of the joist without stopping to take precise dimensions, and without referring to design tables for strength, and without danger of producing a weakened joist.

Therefore, it is one of the distinctive features of the present invention to use the gusset plate D in combination with a standard size diagonal C: and, to that end, it is proposed to form the said member D of I-section with a thin body or web portion 7 and the upper and lower flanges 8, the latter being formed with the ribs 9 for fitting into the grooves 2^a of the chord members A and B. Obviously, the gusset members may be rolled or built-up of a web plate and edge flanges.

The web 7 may be plain or corrugated according to the type of joist being constructed, that is whether the joist is to be supported by the top chord as shown in Fig. 1, or bottom chord as shown in Fig. 2, although for sake of uniformity in manufacture it is preferred to use a gusset plate with a corrugated web. In joist which is supported by its top chord as in Fig. 1, the corrugations are not of much benefit, but they do no harm, but in a joist to be supported on its bottom chord as in Fig. 2 the corrugations are of great benefit.

That is to say, the corrugations in the gusset plate are desirable in girders which rest on their bottom chords, because, in such cases, the gusset plates carry the total load of the beam in compression. When thus in compression the corrugations are a very de-

sirable feature because they tend to strengthen and stiffen the webbed members. However, if the joist is carried by the top chord as shown in Figure 1, the gusset plate carries the total load as a tension member, but as a tension member it is so much stronger than is required that the corrugations are not necessary although a corrugated gusset plate may be used as previously indicated for the sake of utilizing available stock. In Figure 1 therefore, a plain web may be used but if the joist is to be used as in Figure 2, the corrugations are particularly valuable for stiffening the web against compression.

The corrugating of the web 7 is done for several reasons, first for practicability in manufacture, and second, greater stiffness.

On account of the relatively great thinness of the web 7 of the gusset plate it would be difficult to roll it as a complete member in the usual hot mills, and produce a strong plate on account of the cooling stresses in the bar. That is to say it would be difficult to roll a plain thin web and the relatively thin flanges. It is well known that rolled shapes of unequal cross-sectional area cool unequally, the thin portions cooling more rapidly than the thick portions and the thin portions therefore shrinking more rapidly than the thick portions. This shrinkage causes a compressive stress in the thick portion of the plate while it is still plastic and therefore the thick portion shortens under the high stress. Later however, the thick portions cool below the temperatures at which they are plastic, and set up tensile stresses within themselves and compressive stresses in the previously cooled thinned portion, thus resulting in a tendency to warp, especially in long lengths. To prevent this warping the web 7 of the gusset member is corrugated in the hot rolling mill to produce shallow corrugations. This corrugation may be produced in the last pass of the rolling mill and therefore the continued shrinkage of the thick portions of the plate may be carried on without any damaging effect and only result in exaggerating the corrugations to a very small extent. Thus, by corrugating the web 7 the gusset plate as a whole will remain flat because the corrugations will take care of warping.

From the foregoing it will be understood that the elements A, B, C and D may be produced at the rolling mill in standard sizes and in predetermined dimensions in as long lengths as the material or equipment will permit, possibly as long as sixty feet or more. These parts, because of their reduced cross-section and facility for handling and economy of material can be rolled very cheaply and then shipped to a distant warehouse or storage point and stocked until desired for use. Then, when it is desired to have a girder of a certain plan the designer will select a girder of proper length and depth to suit his requirements and will designate to the shop the size and depth of the continuous girder to be used, having only to add the length dimensions, the length of the latticed portion of the beam, the length of the end reinforcement or gusset members, and the over-all span. This information may be given to the shop on simple diagrams on which blank spaces are left for the specific dimensions required for the particular girder. In that way the detailing of the girder is reduced to a minimum and the attention of the shop is not taxed in studying a complete set of drawings because the fabricating work has become standardized.

After the parts have been thus selected they are assembled in girder formation and then subjected to a pressing or crimping operation which will bend the clincher flanges 4 inwardly about the wings of the body 5 of the diagonal C and also about the flanges 8 of the gusset member D as clearly shown in Figure 6. In that way the upper and lower chords D become firmly locked with the diagonal which may be one or more continuous bars bent into the form of a Warren truss as shown in Figure 1. The gusset member or plate D also becomes interlocked with the girders at the ends thereby to incorporate the stiffening member C in the ends of the span.

The feature of corrugating the web 7 of the gusset member D stiffens the web without materially increasing the weight. Also since the stiffness of the web is related to the height as well as to the radius of gyration of the web, by corrugating the web, the radius of gyration is increased due to the added stiffness, thereby contributing greatly to the strength of this type of design.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

We claim:—

1. A fabricated girder including top and bottom chords formed of rolled channeled sections, a ribbed diagonal member, and a stiffening member located at the end of the girder and having top and bottom flanges embraced and engaged by the side walls of the channeled top and bottom chords at the ends thereof.

2. A fabricated girder consisting of a top chord member adapted to engage a support, a bottom chord member having a depending extension for partially embracing the sup-

port for the girder, a diagonal member secured to the top and bottom chord members and a stiffening member located between the top and bottom chords adjacent the ends thereof.

3. A fabricated girder consisting of channeled top and bottom chord members, a diagonal secured to the medial portions of said chords, a stiffening member secured to said chords adjacent the ends thereof, and the extremity of the top chord being projected beyond the stiffening member to provide a support for the girder, and the bottom chord being extended downwardly and laterally to provide a lath hanger.

4. A fabricated girder including top and bottom chords of channel formation and having grooves in the bottoms of the channels, a diagonal having ribs on opposite sides thereof whereby the ribs fit into the grooves on the channels of the chords when the body of the diagonal fits into the channel of said chords, and a flanged stiffening member also having ribs for fitting into the grooves of the chords, said stiffening member being located adjacent the ends of the chords.

5. A fabricated girder construction including top and bottom chord members spaced parallel throughout their length, a stiffening member having its edge portions secured to the chord members adjacent the ends thereof, and the lower chord member being deflected downwardly and horizontally to provide a lath hanger frame for holding lath in position about the beam which supports the girder.

In testimony whereof we hereunto affix our signatures.

CLARENCE W. NOBLE.
WILLIAM C. CORYELL.