July 24, 1934. A. G. LEAKE 1,967,827

METHOD OF REENFORCING COMPRESSION MEMBERS

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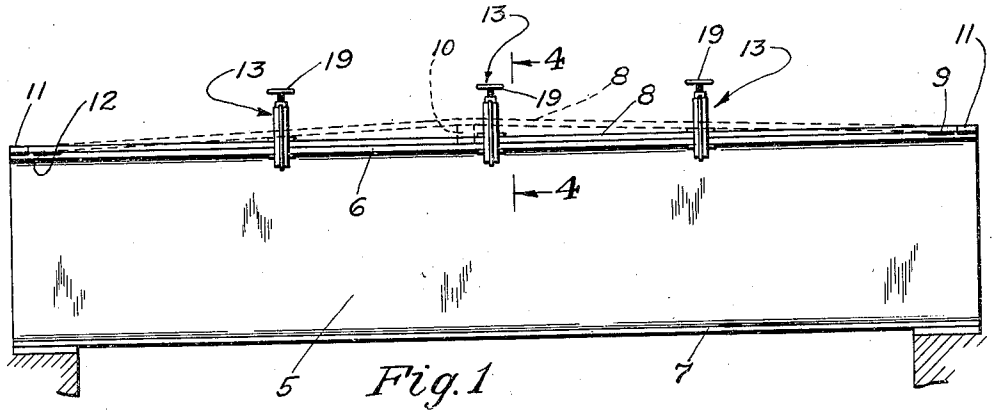


Fig. 1

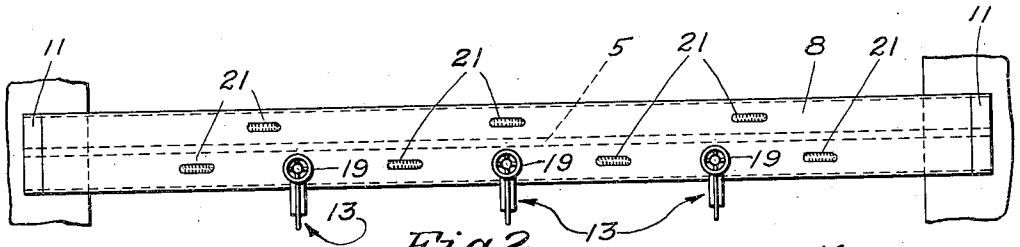


Fig. 2

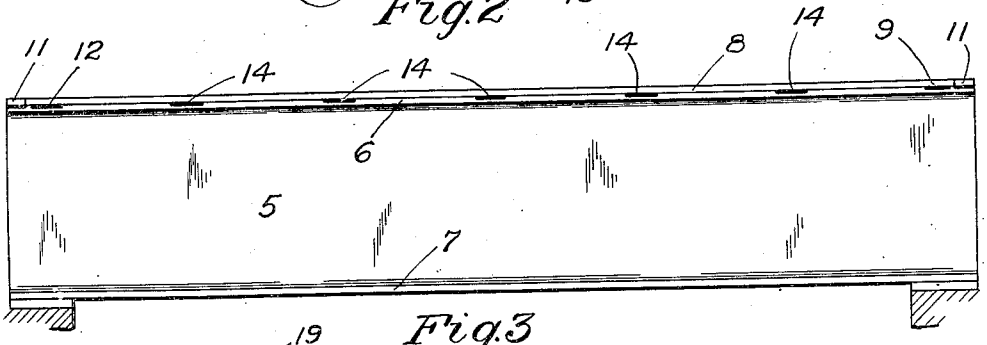


Fig. 3

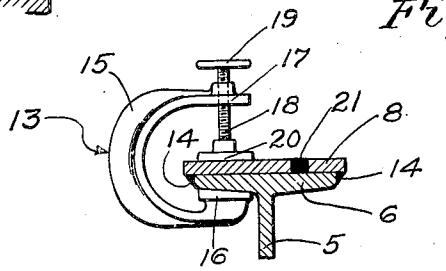


Fig. 4

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METHOD OF REENFORCING COMPRESSION MEMBERS

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3 Claims. (Cl. 29—155)

This invention relates to a method of strengthening or reenforcing structural members such as beams, girders, columns and the like, while they are under load, and has for an object to provide a method of strengthening or reenforcing such members which method will not require tearing down the structures, so that the work may be accomplished in a much shorter time and at less expense and with a minimum of interference with traffic or with the use of the structure being repaired. The present invention relates to certain improvements in the method disclosed in my prior Patent 1,770,933, of July 22, 1930 and relates particularly to improvements in methods of reenforcing or strengthening members under compression.

One use of the present method is illustrated in the accompanying drawing in which:—

Fig. 1 is a side elevational view of a girder or the like and showing in full lines a strengthening or reenforcing bar or member in place at one step in the method and showing by dotted lines the previous position of the member;

Fig. 2 is a plan view looking downwardly on Fig. 1;

Fig. 3 is a side elevational view of a girder or the like strengthened or reenforced according to the method of my present invention; and

Fig. 4 is a sectional detail view taken substantially along the line 4—4 of Fig. 1.

Referring to the drawing, a girder or other structural member to be strengthened or reenforced is shown as in the form of an I-beam including a plate or web portion 5 and upper and lower flanges 6 and 7 which may be rolled with the web 5 or which may be in the form of angle bars riveted or otherwise secured to the upper and the lower edges thereof.

It will, of course, be understood that while the invention is disclosed as used in the reenforcing of a structural member in the form of an I-beam that the invention is equally applicable to other forms of structural members as for example angle bars, channel bars and the like.

In the present instance a strengthening member is shown as a rolled steel plate 8 of the desired length, width and thickness. It will be understood that the flange 6 of the structural member is under compression and the strengthening plate 8 is disposed on this flange and one end of the plate is welded to the flange as at 9. Next, the central portion of the plate is bowed or buckled outwardly by suitable means such as a wedge or the like 10 placed or driven under the plate and the effective length of the plate shortened. By computation it is determined to what extent this plate must be shortened to give it the required initial stress, and it is preferred that gauge blocks or stops be secured on the flange 6, preferably by welding them to the flange, for the purpose of indicating the positions to be occupied by the end portions of the plate.

After the one end of the plate 8 has been welded to the flange 6 as at 9 the block or wedge 10 is positioned under the plate to bow or buckle its center portion whereby its other end portion will abut the inner edge of the adjacent stop 11. This second end portion is then welded to the flange 6 as at 12 whereby the two end portions of the plate are secured to the flange while the central portion of the plate is disposed outwardly in spaced relation thereto.

Next, the block or wedge 10 is removed and suitable clamps such as screw clamps 13 are employed to force the central portion of the reenforcing plate into the engagement with the upper surface of flange 6. Any desired number of clamps 13 may be employed or if convenient any other desired means for applying the required pressure may be utilized. This step in the method merely involves the forcing inwardly of the central portion of the plate 8 whereby the entire plate intermediate its welded ends will be brought into engagement with the flange 6. This will, of course, result in a contraction of the plate 8 with the result that the plate will take on compression stress. While the plate is held in this condition, as by the clamps 13 or otherwise, portions of the plate intermediate the welds 9 and 12 are welded to the flange 6 as shown at 14. These welds 14 may be relatively short welds as shown or the plate may be welded to the flange along the entire edge of the plate.

It will be understood that the difference between the length of the plate 8 and the distance between the stops 11 is so calculated that the compression stress given the plate as above described will be the desired stress for strengthening the beam or girder. From the foregoing it will be seen that after the welds 14 are made the clamps 13 may be removed and the plate 8 will be rigidly secured to the flange 6 and under the same compression as the flange. As the strengthening plate is placed under this initial stress it immediately assumes its part of the load and it will be noted that the initial stress is placed on the reenforcing member without the necessity of tearing down a structure incorporating the member being strengthened. It is also to be noted that according to the present method heat-

ing or cooling of the strengthening plate 8 is not required and therefore the operation of securing the plate to the structural member may go forward without any delay incident to a return to normal temperature by the plate. That is, as soon as the clamps 13 or other means have functioned to force the plate into engagement with the flange 6 the welds 14 may be made since the plate will be under the desired compression and ready for these welds when the clamps have been tightened.

Briefly the preferred method is as follows, First weld on the stops 11. Cut the cover plate 8 longer than the distance between the stops, the excess depending on the stress required and the length of plate. Weld one end of the plate to the beam flange and spring the plate down between the stops preferably using a wedge at the center to help buckle the plate. Weld the other end of the plate to the flange. Remove the wedge at the center and bring plate 8 down tight to the top of the flange 6 using as many clamps as necessary to give complete contact. Then weld the plate in place. If the plate 8 is very wide then it is desirable to use slot welds as indicated at 21 in addition to the welds on the edges.

As above suggested means other than the clamps 13 may be provided or used for exerting the desired force against the plate 8. These clamps as shown include a substantially U-shaped body member 15 having a portion 16 to engage an under surface of the flange 6 and having a portion 17 through which is threaded a screw 18 equipped at its outer side with a manipulating handle or hand piece 19 and at its inner end carrying a head 20 to engage and force inwardly the plate 8.

Having thus set forth the nature of my invention, what I claim is:

1. A method of strengthening a structural member while it is under load which comprises welding one end of a metallic strengthening member to the structural member, forcing the central portion of the strengthening member away from the structural member to reduce its effective length along the structural member without changing its actual length, welding the opposite end of the strengthening member to the structural member, applying mechanical pressure to the strengthening member to force the portion between its ends into contact with the structural member to place it under compressive stress and thereby shorten the member, and welding the two members together at points between the end welds while the strengthening member is so shortened.

2. A method of strengthening a structural member while it is under compression which comprises welding the ends of a metallic strengthening member to said structural member, at least one of said ends being so welded while the central portion of the strengthening member is bowed outwardly away from the structural member to reduce its effective length along the structural member without changing its actual length, applying mechanical pressure to the strengthening member between its ends to force the bowed portion into contact with the structural member to place the strengthening member under compression and thereby shorten the member, and welding the two members together between the first two connections while the strengthening member is so shortened.

3. A method of strengthening a compression member under load comprising welding spaced stops to the member, buckling a metallic reenforcing plate with its ends against the stops, the plate being normally of a length greater than the distance between the stops so that when in position it is bowed outwardly away from the structural member, welding the ends of the plate to the structural member, applying mechanical pressure to the plate to force the bowed portion into contact with the structural member to place the plate under longitudinal compression to thereby shorten it, and welding the plate to the structural member between the end welds while the plate is so shortened.

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