United States Patent [19]

Butts

[11] **3,913,296**

[45] **Oct. 21, 1975**

[54] **END SUPPORT SHOE FOR COMPOSITE JOIST**

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[73] Assignee: **Hambro Structural Systems Ltd.,** Ottawa, Canada

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[21] Appl. No.: **402,207**

[52] **U.S. Cl.** **52/694**

[51] **Int. Cl.²** **E04C 3/04**

[58] **Field of Search** ..... 52/694, 758 B, 693, 639, 52/338, 695, 690, 730

[56] **References Cited**

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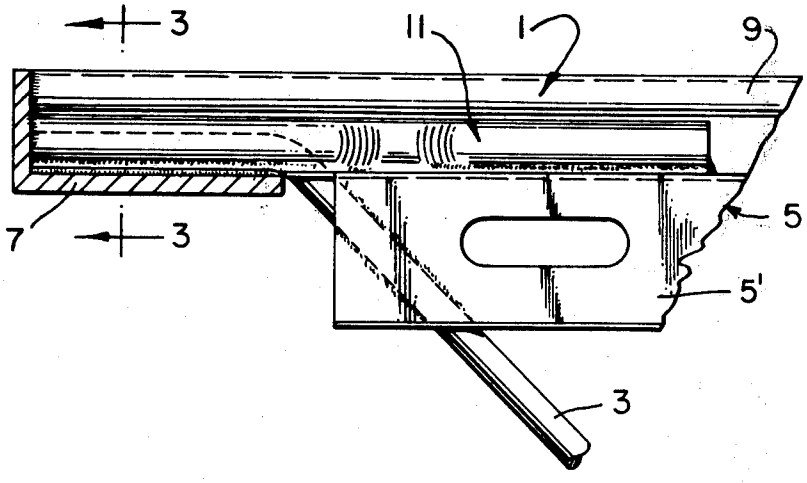
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Primary Examiner—Frank L. Abbott
Assistant Examiner—Carl D. Friedman
Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] **ABSTRACT**

In a steel joist for use in a composite steel and concrete floor structure having a top chord, a bottom chord spaced from the top chord, a zig-zag bar web having its apices welded to the top and bottom chords; an end support shoe consisting of an angle upon which an end of the bar web is welded, and a first bar welded to the bar web and the angle, the first bar being bent so that the end opposite to the angle can be welded to the top chord.

9 Claims, 6 Drawing Figures



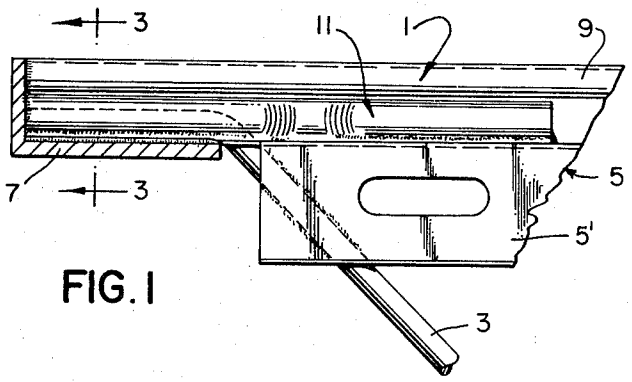


FIG. 1

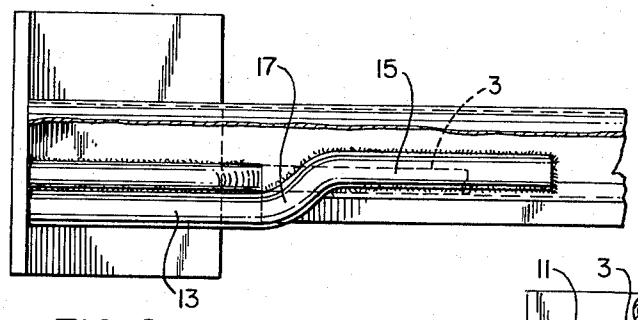


FIG. 2

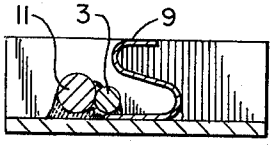


FIG. 3

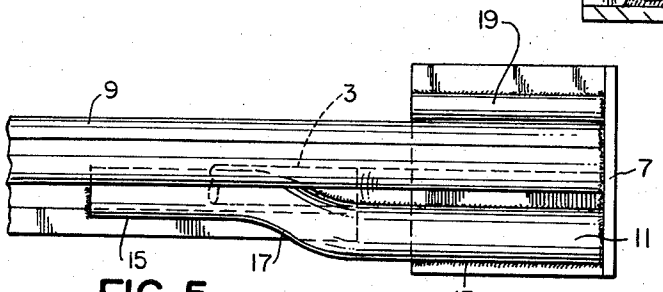


FIG. 5

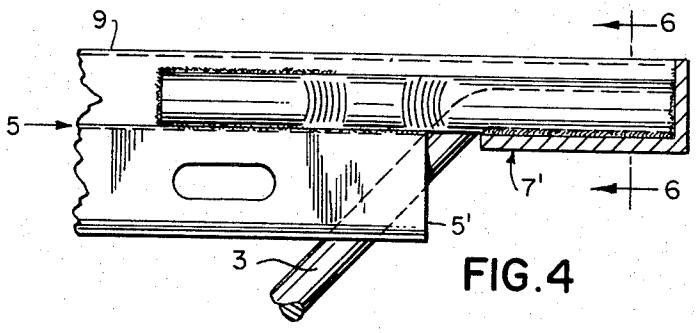


FIG. 4

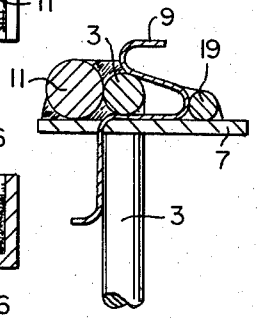


FIG. 6

END SUPPORT SHOE FOR COMPOSITE JOIST

CROSS REFERENCES TO RELATED APPLICATIONS

U.S. Butts et al applications Ser. No. **872,017** filed Oct. **29th, 1969,** now abandoned and entitled COMPOSITE OPEN WEB JOIST and Ser. No. **145,758** filed May **21, 1971,** now U.S. Pat. No. **3,819,143.**

U.S. Application Ser. No. **220,627** filed Jan. **25th, 1972,** now U.S. Pat. No. **3,845,594** and entitled STEEL JOIST FOR COMPOSITE STEEL AND CONCRETE CONSTRUCTION.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is related to the field of composite steel and concrete structures and in particular floor structures. It is specifically related to the steel joists in such structures which are used during the forming of the structure and remain in place as reinforcing after the structure is formed.

2. Description of the Prior Art

The prior art structure consists of a flat plate which is welded to the end of a fabricated joist, the joist being held in the desired position which is normal to the concrete floor structure being formed, by the runs of welding. The joists, however, flex very easily and as well as being able to flex from the normal position, are also liable to twist relative to the flat plate and become out of position in the finished floor structure.

SUMMARY OF THE INVENTION

This invention relates to an end support shoe which is in the form of an angle so that the end of a fabricated joist can be welded to the base and the back of the angle so providing an anchor block to postpone initial slip between the poured concrete and the shoe and giving increased strength. Furthermore, a rod is welded to the angle beside the joist, this rod being bent over the joist from around the rod's middle region, and welded to the joist. In effect, this rod acts like a torsion bar and provides a direct connection between the end support shoe and the web part of the fabricated joist. The joist is therefore stiffened against flexure so that a stronger connection is made between the end support shoe and the web of the joist than is achieved with the prior art structure.

The present shoe also obviates the necessity to cut formwork for clearance during erection.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is an elevational view of an end of a steel joist showing an embodiment of the end support shoe of this invention.

FIG. **2** is a partially broken away plan view of FIG. **1.**

FIG. **3** is a sectional view through **3—3** of FIG. **1.**

FIG. **4** is an elevational view of an end of a steel joist showing a further embodiment of the end support shoe of this invention.

FIG. **5** is a plan view of FIG. **4.**

FIG. **6** is a sectional view through **6—6** of FIG. **1.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1, 2** and **3** a steel joist **1** has an open web formed from rod **3,** and a top chord **5.** The

rod **3** is secured by welding to an angle **7,** the welding being completely along all the meeting surfaces of the rod **3** and the angle **7.** A top reinforcing member **9** is secured to, and integral with, the dependent flange **5;** thereby together forming the top chord **5,** this reinforcing having a cross-section in the shape of an S which extends beyond both ends of flange **5'.**

A torsion bar **11** having two offset straight portions **13** and **15** and an angled joining portion **17** comprised of an elongated S-shaped curve is positioned as shown in FIG. **2** adjacent to the welded part of the web and above flange **5'** of the top chord. As this bar **11** is securely attached to the angle **7,** the end of the open web **3** and the top chord **5,** the top chord and web is relatively rigidly attached to the angle **7.**

Referring to FIGS. **4, 5** and **6,** there is shown a joist having a larger rod diameter fabricated web **3** which is of such a size as to fit only partly in the lower one-half of the S cross-section, which forms the reinforcing member **9,** and a bar **11** also of a relatively larger size to that shown in the previous embodiment. As seen in FIG. **6,** the reinforcing member **9** of the joist is strengthened as well as the degree of rigidity of the joist being increased by the larger size of the members and the increased amount of welding. A further round section bar **19** is also welded to the opposite side of the S section reinforcing member **9** to further strengthen the connection between the reinforcing member and the angle **7.**

It is thus seen that an improved end support shoe for a prefabricated joist has been devised which enables the obtaining of a much stronger rigid joint between the shoe and the joist than was previously possible. Also the lack of form cutting required virtually reduces the field labour required and speeds the erection time.

I claim:

1. In a steel joist for use in a composite steel and concrete floor structure having a horizontal extending top chord, with a vertical extending cross-section a bottom chord vertically spaced from the top chord, a zig-zag bar web having its apices welded to the top and bottom chords; the improvement comprising:

an end support shoe including an angle upon which an end of the bar web and said top chord are welded, and

means acting as a torsion bar between said shoe and top chord including a torsion bar directly welded to the bar web and to the angle from one end and extending therefrom along said top chord in an elongated S-shaped curve disposed in a horizontal plane with the other end opposite to the angle being welded to the top chord for strengthening said joist by said torsion bar limiting the horizontal flexing or twisting of said web and top chord.

2. The joist of claim **1** further including a second bar welded to the top chord and the angle.

3. The joist of claim **1,** wherein the first bar is of a larger diameter than the bar web.

4. The joist of claim **2,** wherein the second bar is of a smaller diameter than the bar web.

5. In a steel joist for use in a composite steel and concrete floor structure, the improvement comprising:

a top chord having at least a portion which is substantially S-shaped in transverse cross section with the bottom part of the S-shaped portion being substantially flat,

an end support right angle shoe including an upright

portion and integral therewith a horizontal portion, the end of said S-shaped portion of said top chord being welded upright inside said shoe to said upright and horizontal portions thereof,

joist web means secured to and depending from said top chord and including a bar having a horizontal portion which at least partially rests on the upper side of said flat part of S-shaped portion and is welded thereto and to the upright portion of said shoe, and

means operating as a torsion bar between said shoe and top chord including a horizontally disposed torsion bar extending along the chord and having one end extending adjacent the said horizontal portion of said web means bar and being directly welded thereto and to the upright and horizontal portions of said shoe,

said torsion bar having its other end inwardly horizontally offset and welded to the reentrant part of said S shaped portion, which reentrant part includes said substantially flat part, for strengthening said joist by said torsion bar limiting the flexing or twisting of said joist.

6. A joist as in claim **5** wherein said one and other ends of said torsion bar extend substantially straight and parallel to each other with the mid portion of the bar extending in an elongated S-shaped curve to effect said offset.

7. A joist as in claim **6** wherein said web bar is substantially smaller in diameter than said torsion bar or the mouth of said reentrant part of said S-shaped portion of said top chord.

8. A joist as in claim **6** wherein said web bar has a diameter substantially the width of the mouth of said reentrant part of said S-shaped portion of said top chord and said torsion bar is substantially larger in diameter than said web bar.

9. A joist as in claim **8** and further including a third bar welded to said horizontal portion of said end shoe and to said S-shaped top chord portion on the opposite side of the latter as said web and torsion bars for further strengthening the connection between the end shoe and top chord.

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