Jan. 9, 1968 A. C. WEBER 3,362,121

FLOOR AND ROOF CONSTRUCTIONS

Filed March 3, 1965 4 Sheets-Sheet 1

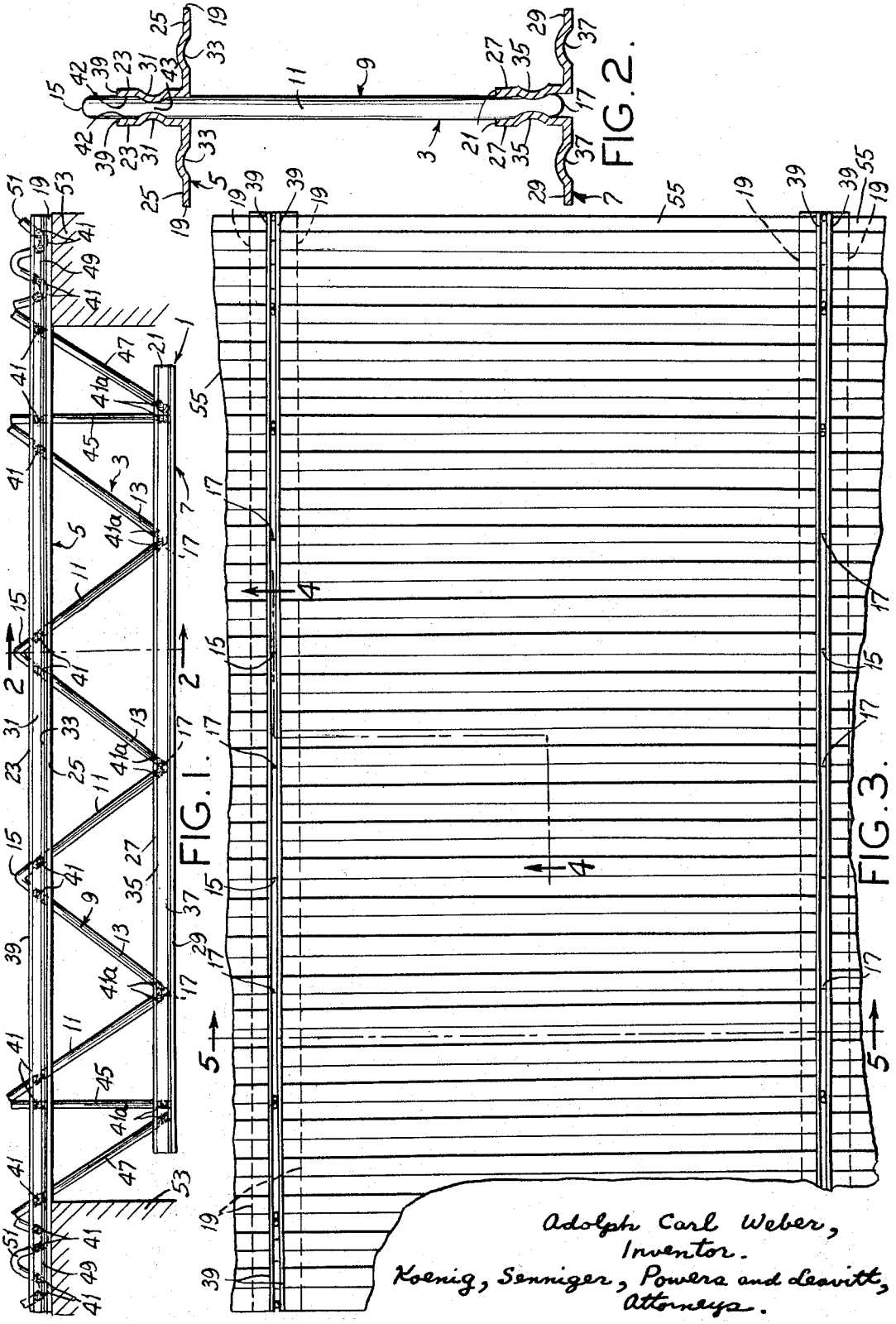


FIG. 1.

FIG. 2.

FIG. 3.

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FLOOR AND ROOF CONSTRUCTIONS

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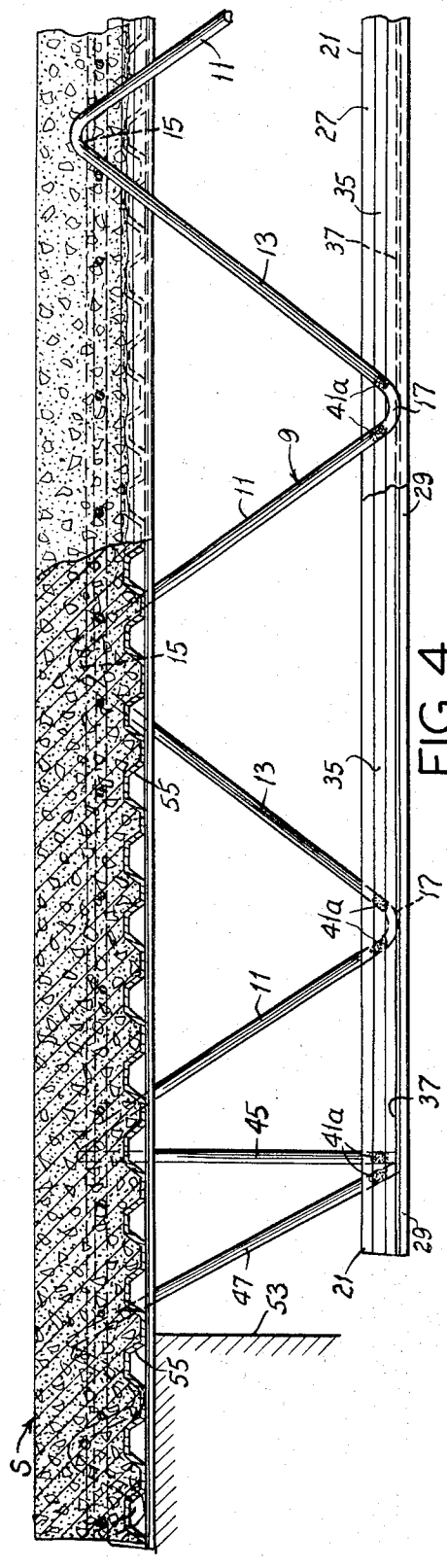


FIG. 4.

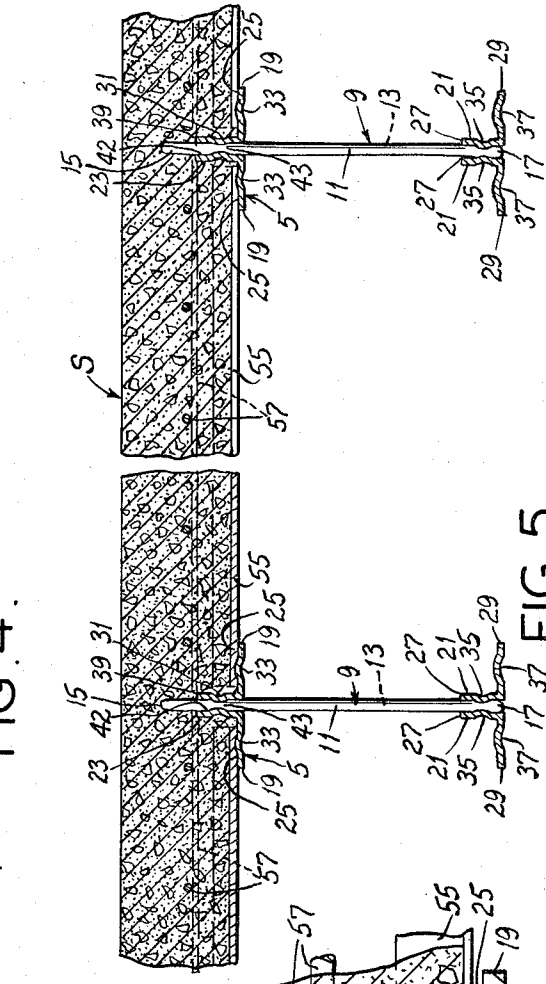


FIG. 5.

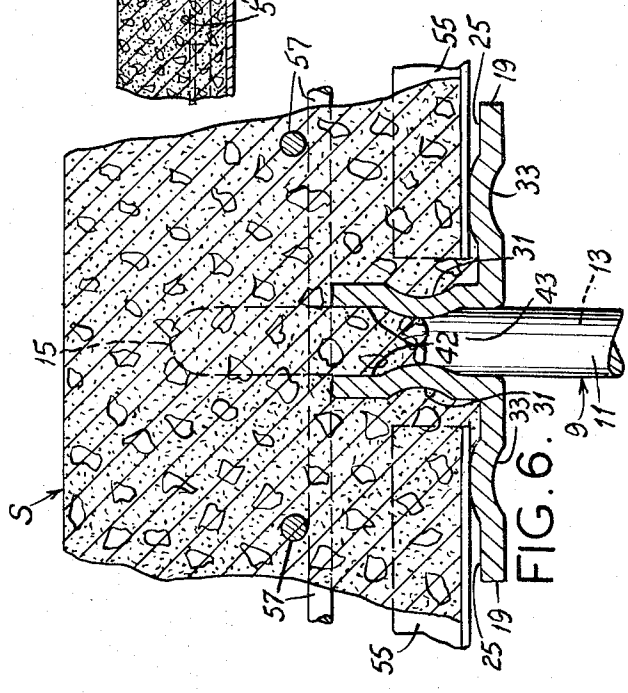


FIG. 6.

FLOOR AND ROOF CONSTRUCTIONS

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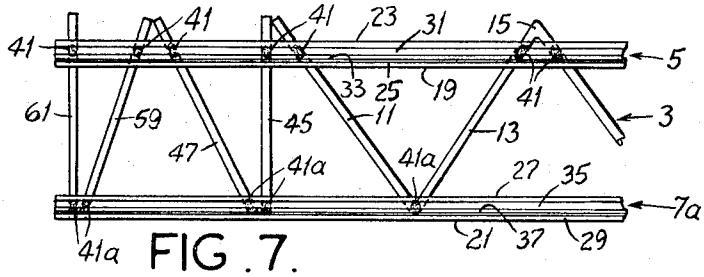


FIG. 7.

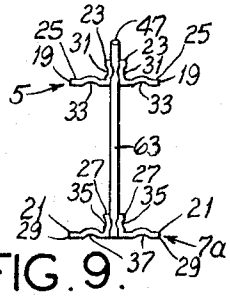


FIG. 9.

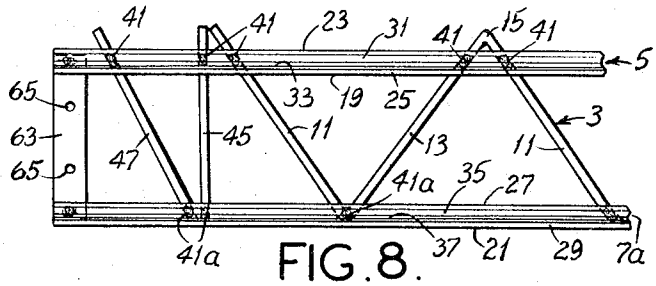


FIG. 8.

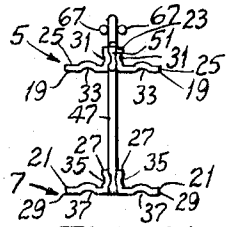


FIG. 11.

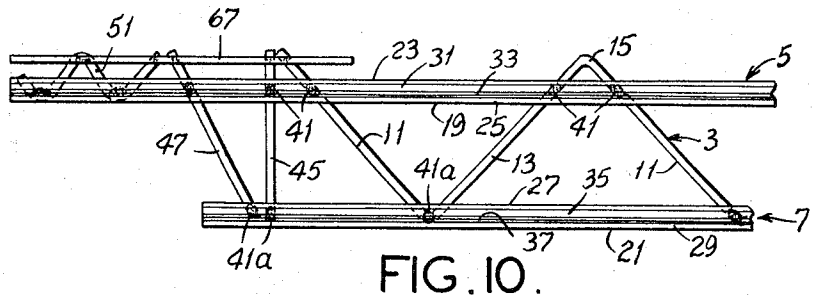


FIG. 10.

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FLOOR AND ROOF CONSTRUCTIONS

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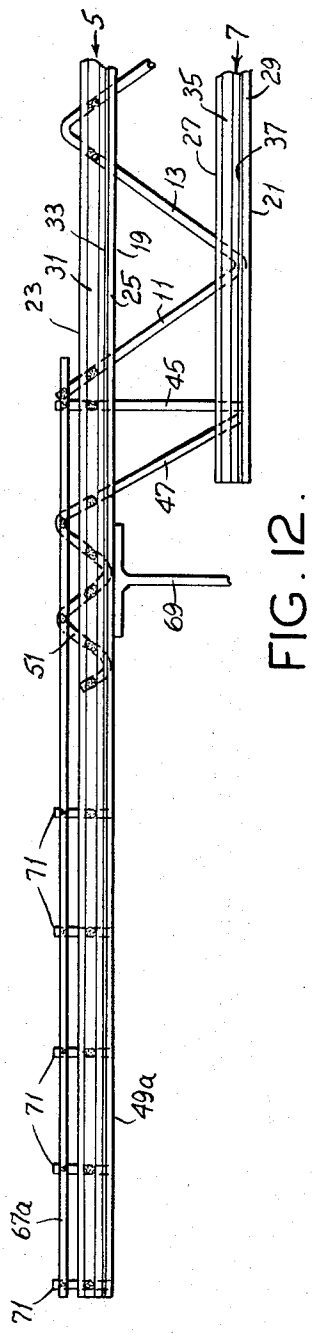


FIG. 12.

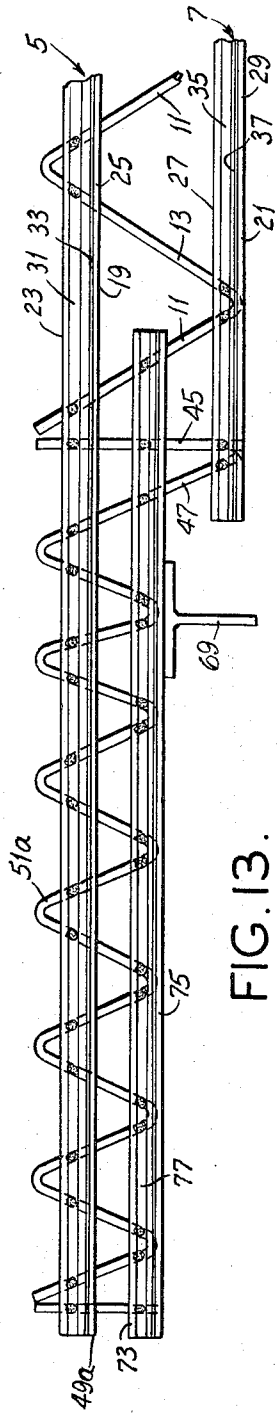


FIG. 13.

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3,362,121

FLOOR AND ROOF CONSTRUCTIONS

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Filed Mar. 3, 1965, Ser. No. 436,807
14 Claims. (Cl. 52—334)

ABSTRACT OF THE DISCLOSURE

An open web steel joist for concrete floor and roof constructions, the joist being in the form of a truss having horizontal top and bottom chords joined by a zigzag web triangulating the space between the chords. The chords are formed of a pair of angle bars having vertical and horizontal legs, the horizontal legs of the angle bars of the top chord as well as the bottom chord extending laterally outward from the lower edges of the vertical legs. The web is welded to the vertical legs and the peak of each triangular web section extends above the top of the top chord.

This invention relates to floor and roof constructions, more particularly to composite open web steel joist and concrete floor and roof constructions, and to open web steel joists used in such constructions.

The invention is particularly concerned with the type of floor and roof construction in which open web steel joists are placed in position spanning structural supports therefor, and a concrete slab is poured on decking supported by the joists. Generally, an open web steel joist is a joist in the form of a truss having horizontal top and bottom chords joined by a web formed of steel bar stock and comprising tension and compression members triangulating the space between the top and bottom chords. Conventionally, such a joist is in the form of a Warren truss, and the web principally comprises a steel bar (usually of circular cross section) bent to zigzag form to provide the stated tension and compression members.

While the chords of open web steel joists may be of varying sections (rounds, channels and folded shapes), the principal type of open web steel joist in actual commercial use has been one in which the top and bottom chords each comprise a pair of steel angle bars, the top chord angle bars being arranged with one leg of each of the bars extending horizontally laterally outward at the top of the truss and the other leg of each bar extending downward on opposite sides of the web, the bottom chord angle bars being arranged with one leg of each bottom chord angle bar extending horizontally laterally outward at the bottom of the truss and the other leg of each bottom chord angle bar extending vertically upward on opposite sides of the web. In the use of these joists for supporting concrete floors or roofs, decking for supporting the slab to be poured is laid on and welded to the horizontal legs of the top chord angle bars at the top of the joists and the slab poured on the decking without any substantial structural integration of the slab and the joists. In such construction, there is no anchoring of the concrete slab to the joists and the slab and joists function, in effect, as separate entities, the slab simply constituting dead load on the joists without contributing materially to the strength of the overall structure.

A modification of the above has been proposed in which the upper ends of the web members project upward above the upper horizontal legs of the top chord angle bars for anchorage in the concrete slab to form a composite slab and joist construction in which the slab may to some extent become a compression member sharing part

of the load, but this type of construction does not attain the full potential of a composite slab and joist construction and has certain disadvantages. For example, the effective anchorage is only between the slab and the upper ends of the web members, so that transfer of stress as between the joists and the slab occurs only at the upper ends of the web members; the slab is necessarily spaced above the level of the supporting structure (which may comprise beams, exterior walls or load-bearing partitions of a building, or trusses) for the joists; concrete being poured may flow down between the vertical legs of the top chord angle bars and leak out; etc.

Accordingly, among the several objects of this invention may be noted the provision of an improved composite open web metal (steel) joist and concrete floor and roof construction and an improved open web metal (steel) joist used therein which attains the full potential of a composite slab and joist construction; the provision of such a composite construction and joist as to which the anchorage of the slab and the joist is complete to the extent that the slab effectively becomes an integral part of the top chord of each joist and functions effectively as a compression member in conjunction with the joist, enabling use of slab and joist construction of overall height (from the bottom of the joist to the top of the slab) considerably less than heretofore required for given spans and loading and thereby enabling considerable reduction in the height of a story of a building (the distance from the top of the slab of one story to the top of the slab of the next story) while maintaining a given ceiling height in each story; the provision of such a composite construction and joist adapted to accept the decking on which the slab is to be poured in such manner that the decking, without being welded to the joists, functions to stay the joists laterally during and after construction (the slab also laterally staying the joists after it has set), thereby eliminating any necessity for the use of separate bridging members for laterally staying the joists; the provision of such a composite construction and joist which minimizes leakage of concrete at the time of pouring, while at the same time providing for anchorage of the top chord members against lateral deflection; the provision of such a composite construction and joist which enables the slab to bear directly on the supporting structure (e.g., beams, walls, trusses) for the ends of the joists; and the provision of joists such as described which are economical to manufacture, easy to use in building construction for forming composite slab and joist constructions, of high strength in relation to the amount of material used, and which enable considerable savings in cost of building construction. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

FIG. 1 is a view in side elevation of a joist of this invention, showing the ends of the joist bearing on typical joist supports;

FIG. 2 is an enlarged cross section through the joist taken on line 2—2 of FIG. 1;

FIG. 3 is a plan, with parts broken away, showing two of the FIG. 1 joists spanning supports therefor and decking applied to the joists for the pouring of a concrete slab;

FIG. 4 is an enlarged section taken on line 4—4 of FIG. 3, and showing the poured slab;

FIG. 5 is an enlarged section taken on line 5—5 of FIG. 3, broken away in part, and showing the poured slab;

FIG. 6 is an enlarged fragment of FIG. 5;

FIG. 7 is a view showing a modification of the end structure of the FIG. 1 joist;

FIG. 8 is a view showing another modification of the end structure of the FIG. 1 joist;

FIG. 9 is an end view of FIG. 8;

FIG. 10 is a view showing another modification of the end structure of the FIG. 1 joist;

FIG. 11 is an end view of FIG. 10; and

FIGS. 12 and 13 are views showing still further modifications of the end structure of the FIG. 1 joist.

Corresponding reference characters indicate corresponding parts throughout the several view of the drawings.

Referring to the drawings, FIG. 1 shows an open web steel joist fabricated in accordance with this invention, designated in its entirety by the reference numeral **1**. As shown, the joist **1** is in the form of a truss, having a web generally designated **3**, a top chord generally designated **5** and a bottom chord generally designated **7**.

The web **3** is an open web, principally comprising a steel bar **9**, preferably of solid circular cross section, which is bent into zigzag form with straight diagonals **11** and **13**. Diagonals **11** are inclined at an angle in one direction and diagonals **13** are oppositely inclined so that the joist is in the form of a Warren truss. As shown, the diagonals **11** and **13** are angled at approximately 37° off vertical, but it will be understood that the specific angle of the diagonals is not critical. As will be understood, certain of the diagonals constitute compression members of the web, and certain of the diagonals constitute tension members of the web. Successive diagonals **11** and **13** are integrally joined at the top of the web at elbow-shaped peaks **15**, and are integrally joined at the bottom of the web at lower elbows **17**.

The top chord **5** (which as will be understood is under compression when the joist is loaded) comprises a pair of steel angle bars each designated **19** (see FIGS. 1 and 2). The bottom chord **7** (which as will be understood is under tension when the joist is loaded) comprises a pair of steel angle bars **21**. The top chord angle bars **19**, as shown in FIG. 1, are longer than the bottom chord angle bars **21**. The legs of each top chord angle bar **19**, which are at right angles to one another, are designated **23** and **25**. The legs of each bottom chord angle bar, which are at right angles to one another, are designated **27** and **29**.

The leg **23** of each top chord angle bar is formed, intermediate its width, with an outwardly bulged rib **31** of arcuate cross section extending lengthwise of the leg (see particularly Fig. 2). The leg **25** of each top chord angle bar is formed intermediate its width, with an inwardly bulged rib **33** of arcuate cross section extending lengthwise of the leg. Legs **27** and **29** of each bottom chord angle bar **21** are shown in FIG. 2 to be formed with similar ribs **35** and **37** (although the provision of ribs **37** on legs **29** of the bottom chord angle bars is not essential, resulting from use of the same angle bar stock for the bottom chord angle bars as for the top chord angle bars).

The bar stock from which the top and bottom chord angle bars are cut to length may be either cold roll-formed angle bar stock (i.e., formed by passing a flat strip of sheet steel of the desired thickness through bending rolls which bend the strip to the desired angle cross section with the ribs in the legs), or may be hot-rolled stock. Generally, the former type of stock will be used for smaller joists and the latter for larger joists. The legs of the angle bars with the ribs may be referred to as being bulbed.

The top chord angle bars **19** are applied to the web **3** on opposite sides of the web adjacent the top of the web, with legs **23** of these bars positioned vertically and engaging opposite sides of the web, with the upper edge **39** of each leg below the peaks **15** of the web, and with legs **25** of bars **19** projecting horizontally laterally outward from the lower edges of legs **23**. With bars **19** so

disposed, ribs **31** on the vertical legs are directed toward on another and ribs **33** on the horizontal legs are directed upward. The peaks **15** of the web project upward beyond the upper edges **39** of the vertical legs, presenting triangular loops of the web at **15** above said edges **39**. The vertical legs of the top chord angle bars are welded to the web **3** by electric resistance welding techniques under high pressure at the points **41** of engagement of ribs **31** with the sides of the web members. When the angle bars **19** are initially brought into assembly with the web at the sides thereof, ribs engage the sides of the web members and the vertical inside faces **42** of legs **23** facing toward the web are spaced from the side of the web a distance corresponding to the offset of the ribs from these faces of the legs. However, the electric current and pressure applied in the welding operation at points **41** are such as to effect forging together of the vertical legs and the web at these points, with squeezing together of the ribs and the web at these points such that the faces **42** of the legs **23** on opposite sides of the rib come into contact with the sides of the web. As a result, the ribs **31** come into relatively close though spaced relation throughout the length of bars **19**, defining a narrow throat or hourglass-shaped constriction **43** between vertical legs **23** of bars **19** below their upper edges **39**. The importance of this constriction will appear.

The bottom chord angle bars **21** are applied to the web **3** on opposite sides of the web at the bottom of the web with legs **27** of these bars positioned vertically and engaging opposite sides of the web, and with legs **29** of these bars projecting horizontally laterally outward from the lower edges of legs **27**. The lower elbows **17** of the web **3** lie wholly between legs **27** of bars **21**, spaced somewhat the bottom faces of legs **29** of these bars. Legs **27** are welded to web **3** at points **41***a* in the same manner as legs **23** of the top chord angle bars **19** are welded to the web at points **41**.

The top chord angle bars **19** (which as above noted are shown in FIG. 1 as being longer than the bottom chord angle bars **21**) extend outward beyond the ends of the bottom chord angle bars **21** at each end of the joist. As shown in FIG. 1, additional web members **45** and **47** are provided at each end of the joist supplementing the zigzag bar **9**, each member **45** and **47** being constituted by a straight steel bar of substantially the same cross section as bar **9**, each member **45** extending vertically between the top and bottom chords adjacent the respective end of the lower chord, and each member **47** extending diagonally between the top and bottom chords. As appears in FIG. 1, the extreme left-hand diagonal **11** provided by the zigzag bar **9** is a tension member, slanting up from the bottom chord toward the left end of the joist, and the extreme right-hand diagonal **13** provided by the zigzag bar **9** is a tension member, slanting up from the bottom chord toward the right end of the joist. The left-hand web member **47** slants toward the left from the bottom chord and extends beyond the left end of the bottom chord, and the right-hand web member **47** slants toward the right from the bottom chord and extends beyond the right end of the bottom chord. The upper end portions of web members **45** and **47** extend up above the top chord (like peaks **15**).

The top chord angle bars **19** extend outward at each end of the joist beyond the upper ends of the end diagonals **47** to provide bearing ends **49** for the joist. At each of these bearing ends and end web member **51** is welded in between the vertical legs **23** of the top chord angle bars. Each end web member **51** is constituted by a length of steel bar stock of circular cross section bent to zigzag form, somewhat higher than the height of legs **23** so that its peaks project above the upper edges **39** of legs **23** like peaks **15**.

Web members **45** and **47** are welded in just below their upper ends between legs **23** of the top chord angle bars at points designated **41** in the same manner as the zigzag

bar 9 is welded in between the legs. The lower ends of members 45 and 47 are welded in between legs 27 of the bottom chord angle bars at points disintegrated 41*a* in the same manner as the lower elbows of zigzag bar 9 are welded in between these legs. The zigzag end web members 51 are welded in between legs 23 of the top chord angle bars at points designated 41 in the same manner as bars 9, 45 and 47 are welded in between these legs.

From the above, it will appear that the joist 1, as completed, is in the form of a truss having a web comprising bars 9, 45 and 47, a top chord 5 and a bottom chord 7. The web is formed of metal (steel) bar stock comprising members 11, 13, 45 and 47 triangulating the space between the top and bottom chords. The top chord comprises the pair of metal (steel) bars 19 each of angle shape in cross section having vertical 23 and horizontal leg 25, these bars 19 having their vertical legs 23 welded to opposite sides of the web adjacent but below the upper ends of the stated tension and compression members of the web at points 41 of engagement of the vertical legs 23 to the web. The vertical legs 23 are positioned with their upper edges 39 below the upper ends of members 11, 13, 45 and 47 (and below the peaks of fillers 51) so that the latter project up above the top chord 5. The horizontal legs 25 of the top chord angle bars 19 project horizontally laterally outward from the lower edges of the vertical legs 23 and are adapted to support decking for the pouring of a concrete slab above the upper ends of members 11, 13, 45 and 47 so that legs 23 and these members become embedded in the slab. The vertical legs have generally vertical inside faces 42 throughout their length along the top thereof which are held spaced from each other by the web a distance corresponding generally to the thickness of the web to allow concrete, as poured, to flow down into the space between said inside faces. However, the vertical legs 23, in the reaches thereof between the points of welding 41, have rib portions 31 projecting inward toward one another from the inside faces of the vertical legs constricting the space between these faces to prevent leakage of concrete from between the vertical legs.

FIG. 1 shows how the bearing ends 49 of the joist 1 are mounted on structural supports 53, such as two walls of a building, spanning the walls, with the horizontal legs 25 of the top chord angle bars 19 bearing directly on these supports. In the construction of a floor (or roof) utilizing the joists 1, a plurality of the joists are placed in position spanning such supports therefor, the joists extending parallel to one another from support to support as illustrated in FIG. 3. Decking such as indicated at 55 in FIGS. 3–6 for supporting the concrete slab to be poured is laid on the horizontal legs 25 of the top chord angle bars 19 (which legs project laterally outward on opposite sides of the joists). This decking may consist, as illustrated, of corrugated steel plate having a width slightly less than the joist spacing. The decking sections are easily fitted down between the tops of adjacent joists 1 and laid on the legs 25. Generally, the corrugations of the decking will extend transversely to the joists to utilize the strength of the corrugations against bending. The decking, as laid, bridges the space between the joists and eliminates any necessity for use of separate bridging members for laterally staying the joists during construction. The decking, however, need not be corrugated steel plate, as long as it is constituted by material of sufficient strength to take load during construction without undue sag or deflection.

After the decking 55 has been applied, reinforcement 57 for the concrete slab to be poured is laid directly on the upper edges 39 of the vertical legs of the top chord angle bars. Generally, this reinforcement will consist of prefabricated wire mesh, easily laid on edges 39, the peaks 15 of the web 3 of the joists and the upper portions of members 45, 47 and 51 projecting up through the interstices of the mesh (which interstices are relatively large). The reinforcement, simply by the act of laying it on the upper edges 39 of the vertical legs 23, is inherently located at an elevation above the decking, and thus inherently positioned to become embedded in the slab of concrete to be poured without any necessity for the use of reinforcement-supporting chairs or the like.

After the placement of the reinforcement 57, and any conduits or other appurtenances which are to become embedded in the slab, concrete is poured on the decking 55 to a height above the peaks 15 so that the vertical legs 23 of the top chord angle bars 19, the peaks 15, the upper ends of bars 45 and 47, and the peaks of fillers 51 become embedded in the slab, which is indicated at S in FIGS. 4–6. In the pouring operation, concrete flows down into the space between the vertical legs 23 of the top chord angle bars 19 of each joist to infill this space substantially throughout the length of the top chord (except where the diagonals 11 and 13 and the bars 45 and 47 and portions of fillers 51 extend between the legs 23) down to the constriction 43. The latter is sufficiently narrow to inhibit leakage of concrete, at the time of pouring, from between the vertical legs of the top chord angle bars.

In the completed structure, the vertical legs 23 of the top chord angle bars 19 of each joist, the elbow-shaped peaks 15 of the zigzag web bar 9 of each joist, and the upper ends of the web members 45 and 47 and the peaks of the zigzag fillers 51 of each joist are embedded in the slab S for substantially complete anchorage of the top chord 5 of each joist in the slab to attain substantially full utilization of the slab as a compression member of the overall structure in conjunction with the joists. This full utilization of the slab as a compression member enables joists of substantially reduced height to be used for a given span and load requirement. This not only results in substantial economies as regards tonnage of steel used for joists of a building, but also enables substantial reduction in overall story height for a given ceiling height, and substantial reduction in quantities of materials other than joists used in constructing the building. Thus, considerable economies may be effected as regards quantities of materials in walls, partitions, columns, etc. of the building.

The positioning of the top chord angle bars 19 below the top of the web with the horizontal legs 25 of these bars projecting laterally outward from the lower edges of the vertical legs 23 is significant not only from the standpoint of providing for anchorage of the top chord as well as the projecting upper end portions of the web 3 in the slab, and attendant reduction in the combined height of the joist and the slab, but also in respect to the fact that it enables the decking 55 simply to be dropped in between the joists and laid on the horizontal legs 25 of the top chord angle bars without any necessity for welding the decking to the joists. The decking is inherently maintained in position between the joists, and acts as bridging between the joist top chords before as well as after the pouring of the slab to prevent lateral deflection of the joist top chords. After the slab is poured and has set, the slab acts further to prevent lateral deflection of the joists. The concrete which infills the space between the vertical legs 23 of the top chord angle bars 19 acts to prevent these legs from buckling in toward one another, and eliminates any necessity for use of metal fillers in the reaches of the vertical legs between the points of welding 41. Decking 55 bears directly on the joist supporting structure (e.g., building walls, beams, trusses or the like), and hence the slab S as poured bears on such supporting structure. The decking overlaps the horizontal legs of the top chord angle bars to a considerable extent, and this minimizes leakage by flow of concrete under the ends of the decking. Use of ribs 33 on the horizontal legs 25 of the top chord angle bars, with the decking bearing on these ribs, may be desirable, though not essential, since this has been found further to minimize leakage of the concrete when poured under the ends of the decking.

FIG. 7 shows a modification of the FIG. 1 joist of the so-called square end type used in construction where the

bottom chord (rather than extended ends of the top chord) are to bear on the joist supporting structure. In this modification, the bottom chord, designated *7a*, is made of the same length as the top chord **5** and an additional diagonal **59** and vertical strut **61** are used at the joist ends.

FIGS. 8 and 9 show a further modificatoin used in construction where the joist ends are to be bolted to joist-supporting beams. In this modification, the bottom chord, designated *7a* as in FIG. 7, is made of the same length as the top chord, and a vertical plate **63** is welded at its upper and lower ends in between the vertical legs of the top and bottom chord angle bars at each end of the joist. Each plate **63** has bolt holes **65** punched therein for accepting bolts extending through joist hangers secured to a supporting beam.

FIGS. 10 and 11 show another modification similar to the FIG. 1 joist with the addition of trussing members **67** constituted by straight steel bars of circular cross section welded in horizontal position extending lengthwise of the joist on opposite sides of the peaks of end web members **51** and the upper ends of members **45** and **47**. The addition of bars **67** makes each bearing end a truss for increased strength permitting adaptability to variation in span by providing for full load bearing ability in the ends of the top chord angle bars to within two inches of their ends.

FIG. 12 illustrates a further modification of the FIG. 1 joist in which the top chord **5** is made considerably longer than the bottom chord **7** so as to have relatively long extended ends as indicated at *49a* in FIG. 12. Each such extended end *49a* is adapted to extend considerably beyond the beam **69** on which it is supported to provide, after the slab is poured, an integral cantilevered slab extension. Outward of the zigzag end web member **51**, short vertical filler rods **71** are welded in between the vertical legs **23** of the top chord angle bars **19**, and trussing bars *67a* (similar to bars **67**) are welded in horizontal position on opposite sides of the upper ends of bars **45** and **47**, the peaks of the end web members **51**, and the upper ends of fillers **71** (which project up above the top chord) to make each extended end a truss. The fillers could be diagonal, or both vertical and diagonal fillers could be used for triangulation.

FIG. 13 shows a further modification of the FIG. 1 joist in which the top chord **5** is made considerably longer than the bottom chord so as to have relatively long extended ends as indicated at *49a* in FIG. 13. A deeper zigzag end web member *51a* is used, and trussing angle bars **73** are welded on opposite sides of the end web member *51a* at its bottom with the horizontal legs **75** of these angle bars projecting horizontally laterally outward from the lower edges of their vertical legs **77**. This provides a trussed bearing end at each end of the joist of which the angle bars **73** are adapted to bear on a beam **69** and to extend considerably beyond the beam to provide, after the slab is poured, a cantilevered slab extension.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A metal joist particularly for use in composite metal joist and concrete floor and roof construction, said joist being in the form of a truss having a web, a top chord and a bottom chord, said web being formed of metal bar stock and comprising tension and compression members triangulating the space between the top and bottom chords, said top chord comprising a pair of metal bars each of angle shape in cross section having a vertical leg and a horizontal leg, said top chord angle bars having their vertical legs welded to opposite sides of the web adjacent but below the upper ends of the tension and compression members of the web at points of engagement of said vertical legs with said web members, said vertical legs being positioned with their upper edges below the upper ends of said web members so that said web members project up above the top chord, the horizontal legs of said top chord angle bars projecting horizontally laterally outward from the lower edges of said vertical legs and being adapted to support decking for the pouring of a concrete slab to a height above the upper ends of said web members so that said vertical legs and said web members become embedded in the slab, said vertical legs having generally vertical inside faces throughout their length along the top thereof which are held spaced from each other by the web a distance corresponding generally to the thickness of the web to allow concrete, as poured, to flow down into the space between said inside faces, and said vertical legs, in the reaches thereof between said points of welding, having portions which project inward toward one another from said inside faces below the upper edges of said vertical legs constricting the space between said faces to prevent leakage of concrete from between said vertical legs.

2. A metal joist as set forth in claim **1** wherein the ends of the top chord angle bars extend beyond the ends of the bottom chord.

3. A metal joist as set forth in claim **2** having end web members welded in between the vertical legs of the ends of the top chord angle bars, said end web members projecting above the upper edges of said vertical legs.

4. A metal joist as set forth in claim **3** further having members welded to the outside of said end web memmers extending lengthwise of the joist for trussing said extending ends of the top chord angle bars.

5. A metal joist as set forth in claim **4** wherein said end-trussing members are located above the top chord angle bars.

6. A metal joist as set forth in claim **4** wherein said end-trussing members are located below the top chord angle bars.

7. A metal joist as set forth in claim **1** wherein the said inwardly projecting portion of each of said vertical legs is constituted by a rib integrally formed on the vertical leg extending lengthwise thereof intermediate the upper and lower edges of the vertical leg.

8. A metal joist as set forth in claim **1** wherein said web comprises a metal bar bent to zigzag form thereby having a series of elbow-shaped peaks at the top of the web, said peaks projecting up above the top chord.

9. A metal joist as set forth in claim **8** wherein the said inwardly projecting portion of each of said vertical legs is constituted by a rib integrally formed on the vertical leg extending lengthwise thereof intermediate the upper and lower edges of the vertical leg, said ribs being continuous throughout said vertical legs except at said points of welding where the ribs are fused into juncture with the web and the said inside faces of the vertical legs engage opposite sides of the web.

10. A composite metal joist and concrete floor or roof construction comprising at least one metal joist in the form of a truss having a web, a top chord and a bottom chord, said web being formed of metal bar stock and comprising tension and compression members triangulating the space between the top and bottom chords, said top chord comprising a pair of metal bars each of angle shape in cross section having a vertical leg and a horizontal leg, said top chord angle bars having their vertical legs welded to opposite sides of the web adjacent but below the upper ends of the tension and compression members of the web at points of engagement of said vertical legs with the web, said vertical legs being positioned with their upper edges below the upper ends of said web members so that said web members project up above the top chord, the horizontal legs of said top chord angle

bars projecting horizontally laterally outward from the lower edges of said vertical legs, said vertical legs having generally vertical inside faces throughout their length along the top thereof which are held spaced from each other a distance corresponding generally to the thickness of the web, said vertical legs, in the reaches thereof between said points of welding, having portions which project inward toward one another from said inside faces below the upper edges of said vertical legs constricting the space between said faces, decking supported on said horizontal legs of the top chord angle bars, and a concrete slab poured on said decking to a height above the upper ends of said web members so that the vertical legs of the top chord angle bars and the upper ends of said members are embedded in the concrete, the concrete infilling the space between said faces of the vertical legs down to the constriction provided by said inwardly projecting portions of said vertical legs and being prevented from leaking out by said constriction.

11. A composite metal joist ad concrete floor or roof construction as set forth in claim **10** wherein the ends of the top chord angle bars extend beyond the ends of the bottom chord and overlie structural supports for the joist.

12. A composite metal joist and concrete floor or roof construction as set forth in claim **10** wherein the said inwardly projecting portion of each of said vertical legs is constituted by a rib integrally formed on the vertical leg extending lengthwise thereof intermediate the upper and lower edges of the vertical leg.

13. A composite metal joist and concrete floor or roof construction as set forth in claim **10** wherein said web comprises a metal bar bent to zigzag form thereby having a series of elbow-shaped peaks at the top of the web, said peaks projecting up above the top chord.

14. A composite metal joist and concrete floor or roof construction as set forth in claim **13** wherein the said inwardly projecting portion of each of said vertical legs is constituted by a rib integrally formed on the vertical leg extending lengthwise thereof intermediate the upper and lower edges of the vertical leg, said ribs being continuous throughout said vertical legs except at said point of welding where the ribs are fused into juncture with the web and the said inside faces of the vertical legs engage opposite sides of the web.

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