Nov. 21, 1933. H. F. YOUNG 1,936,147

FLOOR OR ROOF JOIST CONSTRUCTION

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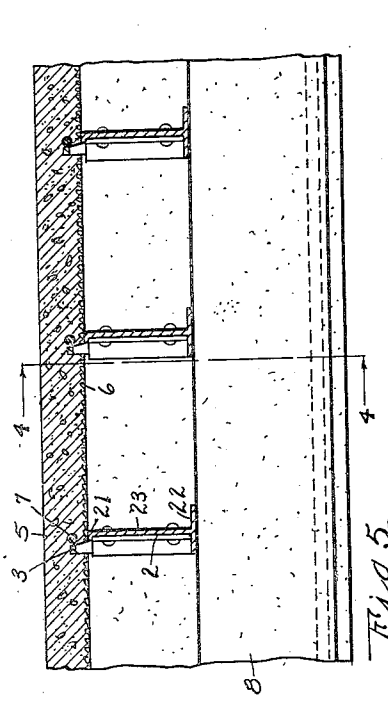


Fig. 5.

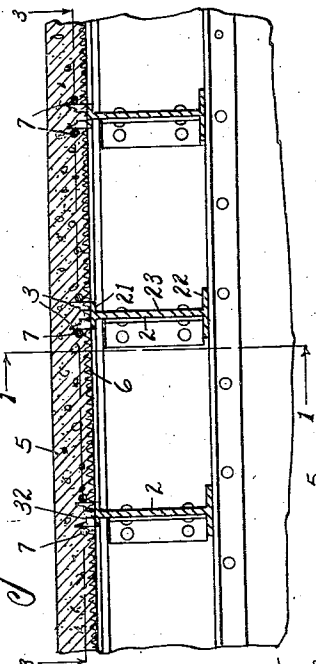


Fig. 2.

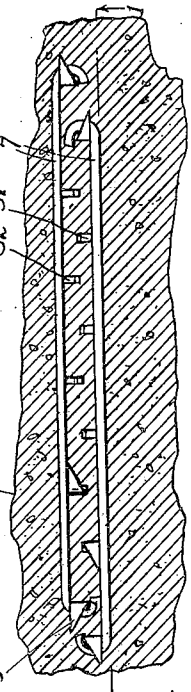


Fig. 3.

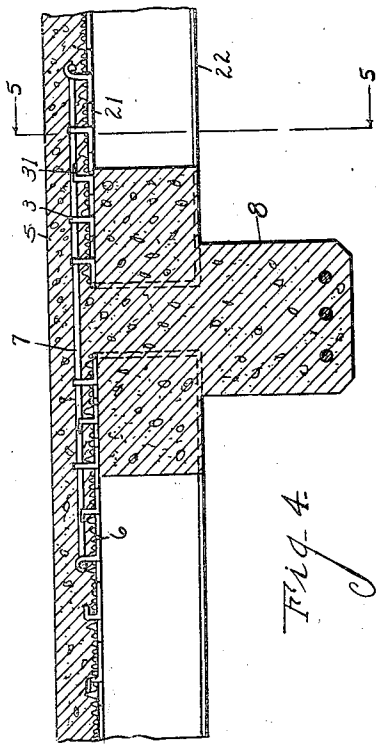


Fig. 4.

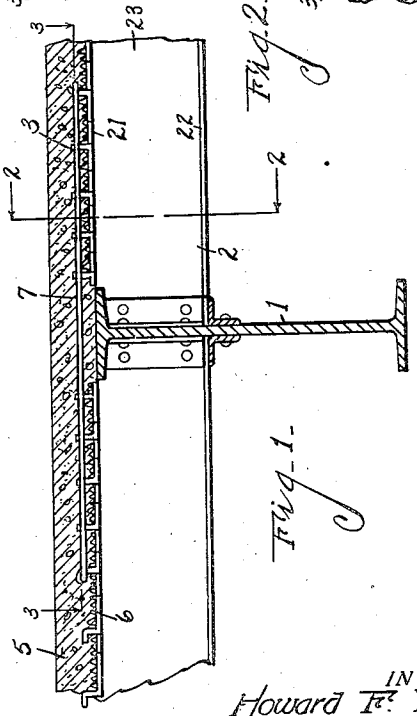


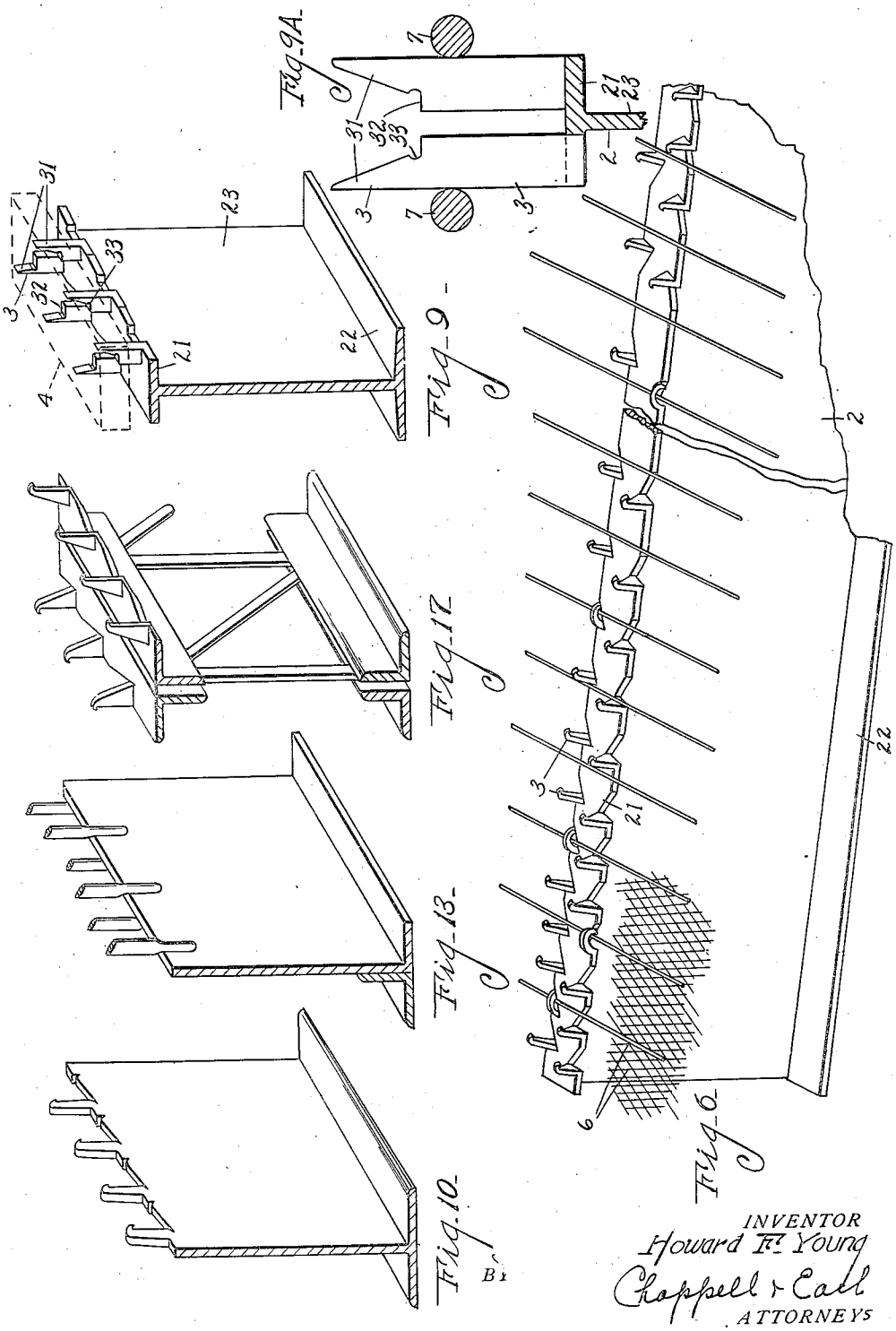
Fig. 1.

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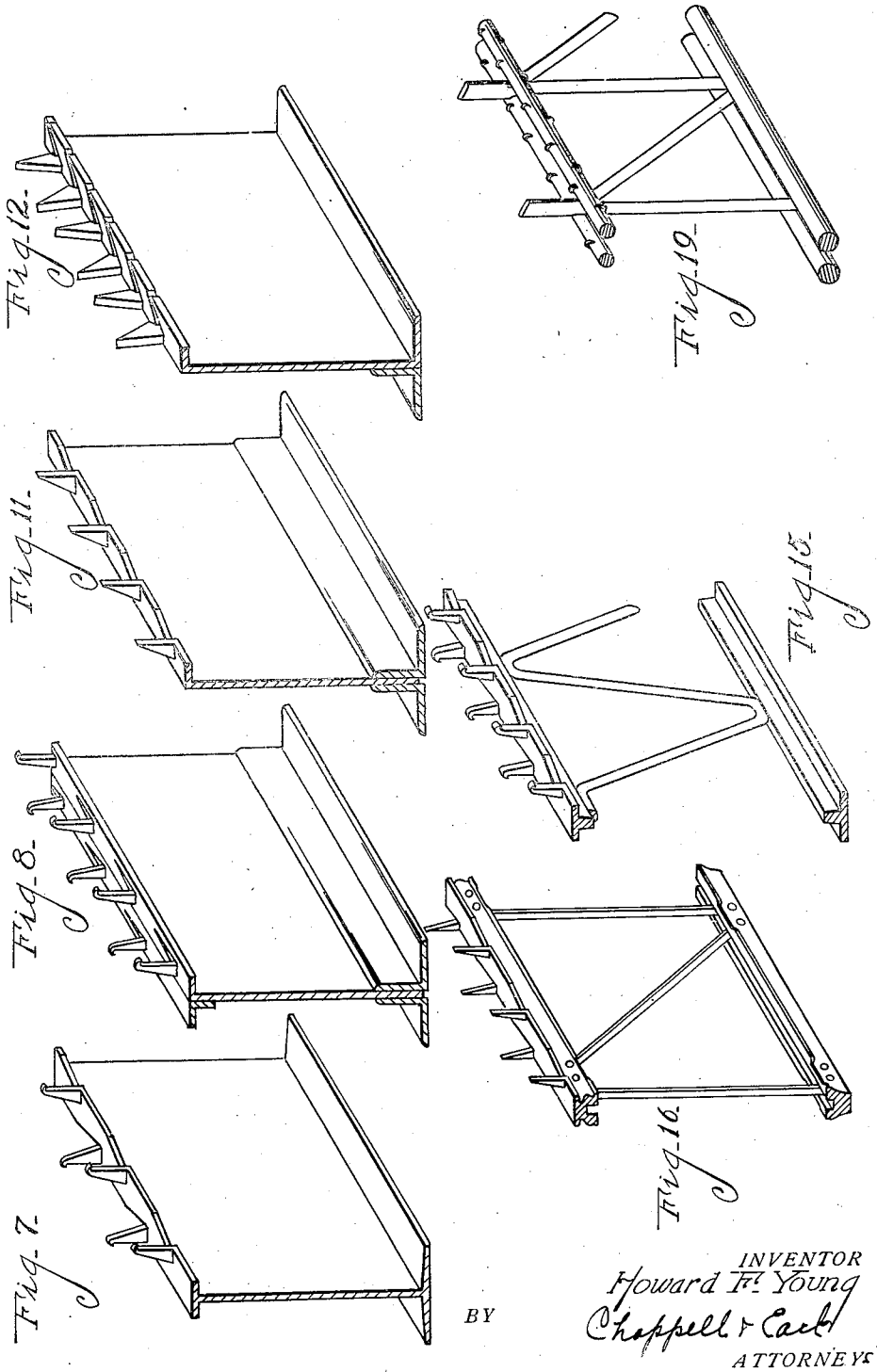
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FLOOR OR ROOF JOIST CONSTRUCTION

Filed Aug. 4, 1930 4 Sheets-Sheet 3



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FLOOR OR ROOF JOIST CONSTRUCTION

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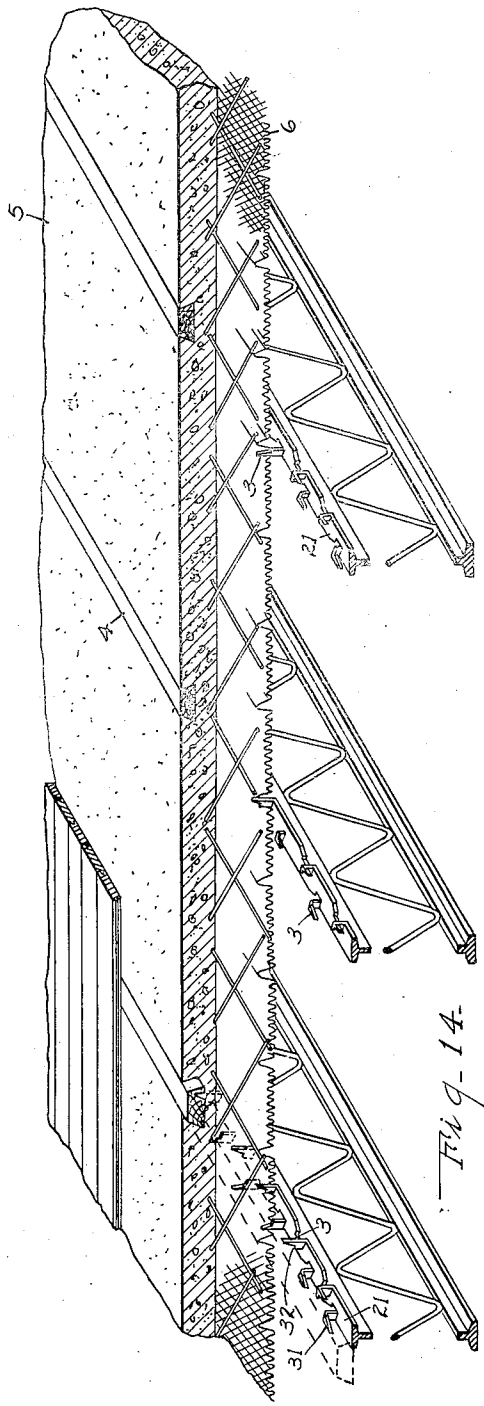


Fig. 14.

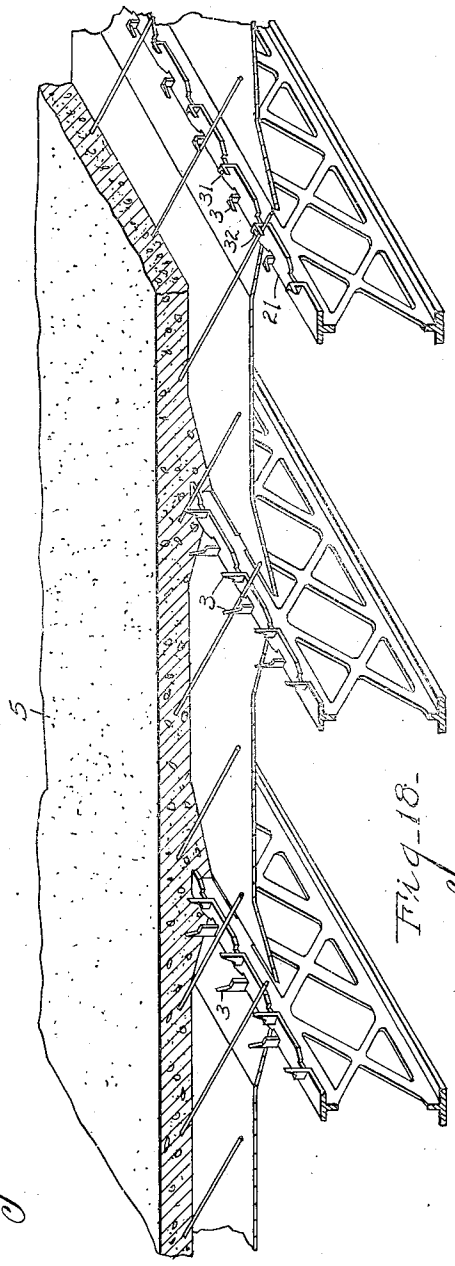


Fig. 18.

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UNITED STATES PATENT OFFICE

1,936,147

FLOOR OR ROOF JOIST CONSTRUCTION

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Application August 4, 1930. Serial No. 472,828

5 Claims. (Cl. 72—70)

The objects of this invention are:

First, to provide an improved construction of the top chord of such steel joists for uniting with the concrete of the floor or roof slab and its reinforcement to insure a positive bond between the joists and slab and provide the necessary horizontal shear resistance so as to utilize the concrete slab for compression stresses and to incorporate the floor or roof slab with the said joinst to form a composite steel and concrete T-beam support of superior strength and rigidity.

Second, to provide an improved construction of T-beam with bonding and shear resisting prongs in the upper chord or flange.

Third, to provide a similar construction in bar joists either of the welded or expanded type.

Fourth, to provide such a construction of top chord for metal joists generally.

Fifth, to provide an improved construction of such joist overgirder or interior supports to enhance the cantilever action of the said joist and get effective continuous beam action by transmitting tension from the prongs in the top flanges of opposing joist through negative reinforcement in the slab over the interior support.

Sixth, to provide with such top chord member an improved construction of shouldered engaging prongs for effective support and anchorage of the nailing strips imbedded in a concrete slab either parallel or transversely to the joists.

Seventh, to provide such a construction which lends itself readily to the use of a removable form structure supported from the said joist or beam without other staging.

Eighth, to provide such a joist construction in which buckling, or twisting of the top chord or member is avoided.

Ninth, to eliminate the necessity for shrinkage or temperature rods running in floor slabs parallel to the joist.

Tenth, to provide in such a joist and floor structure increased resistance to deflection and vibration.

Further objects and objects pertaining to details and economies of construction and operation will appear from the detailed description to follow.

Preferred embodiments of the invention are illustrated in the accompanying drawings, in which:

Fig. 1 is a section through a girder and a side elevation of joists meeting at a girder constructed in accordance with my invention, showing the over-beam tie between the joists, the same being taken on a line corresponding to line 1—1 of Fig. 2, the joist being a modified I-beam construction.

Fig. 2 is a detail cross sectional view through one of my improved joists and floor structures taken on line 2—2 of Fig. 1, the girder being shown in elevation and partially broken away.

Fig. 3 is an enlarged detail sectional plan view, showing the overgirder tie means, taken on section line 3—3 of Figs. 1 and 2.

Fig. 4 is a view comparable with Fig. 1, being a section on line 4—4 of Fig. 5 of my improved floor joists with over-beam tie incorporated into a concrete girder or wall structure.

Fig. 5 is a detail sectional view on line 5—5 of Fig. 4, showing a still further modified I or channel beam.

Fig. 6 is a detailed perspective view of one end of a joist in broken section, one end being entirely broken away, showing the improved construction of top flange member with the prongs struck up of the appropriate size and frequency to give desired results and resistance to shearing strain and longitudinal bearing, and showing the method of securing the expanded metal or rib lath slab reinforcing and form to the said joist, which exemplifies the attachment of such inter-joist or slab support generally.

Fig. 7 is a detailed perspective view of a portion of the modified I-beam showing a narrow flange at the top from which the prongs are struck up.

Fig. 8 is a perspective view of a built-up I-beam with narrow top flange with the prongs struck up.

Fig. 9 is a similar detail perspective view showing a special form of shouldered prongs for supporting a nailing strip in correct position. This is the preferred construction of prongs.

Fig. 9—A is an enlarged section through the top flange of the joist shown in Fig. 9, showing a profile of the preferred type of prongs.

Fig. 10 shows the invention as applied to a T-beam, the prongs being struck up from the edge of the web.

Fig. 11 is another form of built-up T-beam with a single flange at the top from which the prongs are struck up.

Fig. 12 is still another form of a built-up I or T-beam with the prongs struck out of a single top flange.

Fig. 13 is a special form of built-up T-joist with prong members welded to the upper edge of the web.

Fig. 14 is a general assembly detail view of my invention as applied to welded bar joists showing also the method of supporting nailing strips and

with a welded mesh paper back lath or reinforcement.

Fig. 15 is a detail perspective of a section of the bar joist showing its method of construction with a different kind of prong.

Fig. 16 is another form of the said bar joist showing a different type of flange section and method of securing the web bars in place.

Fig. 17 is a still further form showing a built-up structure of angles between the flanges of which the web bars are secured.

Fig. 18 is a general detail perspective view with parts broken away to show details of construction of my invention as applied to an expanded metal bar joist structure with rod reinforcements and removable forms for the floor slabs.

Fig. 19 is a detail perspective view of a section of a bar joist made up of corrugated and reinforcing bars with web bars disposed and secured therebetween by welding.

The parts will be identified by their numerals of reference which are the same in all the views.

1 is a girder to which my improved floor joists 2, 2 are attached by any suitable means, flanging and riveting being showing in the drawings, see Fig. 1. The girder of course can be of any depth required. The floor joists as seen in Fig. 2 in the preferred form are of a special I-beam construction with narrow top member 21 in proportion to the bottom member 22, the web 23 being relatively high.

Prongs 3 are struck up from the flange 21 on the opposite sides of the web 23 in the manner indicated in Figs. 9 and 9—A. The prongs 3 have sharp pointed upper portions 31 and are formed with shoulders 32 for supporting nailing strips 4 running in any direction and for uniting with the floor slab 5. I also notch the prongs at 33 to insure bending in any direction at that point. The prongs also penetrate the expanded metal or lath or other support 6 and a part of them are bent down onto the same to join the said lath reinforcing or other means to the upper flange or member of the I-beam. In the slab 5 over the girder I insert preferably pairs of tie rods 7, the ends of which are hooked around prongs 3 of the opposite joist to tie the joist ends together and make continuous beam floor support, thus eliminating floor cracks over the support and utilizing the cantilever principle and thoroughly incorporating the I-beams with the floor slab. Single rods 7 may be used.

The prongs 3 are numerous toward the ends of the beam, as shown in Fig. 6, to engage with the slab to prevent longitudinal shearing and the tendency of the slab to slip endwise on the beam from mid-span. The middle portion of the beam requires fewer of the prongs and I have illustrated this feature particularly in Fig. 6 where certain of the prongs are bent over ribs of the rib lath 6, or this may be reinforcing rods or means with any metal or fiber form below it.

The same joists may be incorporated with a concrete girder or supporting wall 8 as seen in Fig. 4. The tie rod construction and all other details are the same as in Fig. 1. I have shown in Figs. 4 and 5 a modification of the prongs and the upper chord with but a single flange, making it L-shaped at the top in place of T-shaped.

The preferred prongs are those appearing in Figs. 9 and 9—A. The narrow chisel portion above causes the same to readily penetrate any reinforced structure which is being attached thereby and the comparatively slim sharp portion can be readily battered over with a hammer to form reinforcement engaging hooks and additional seats for nailing strips and to blunt the sharp edges after the reinforcing has been put in place. The notches 33 facilitate this bending. Such shouldered structure is not a necessity as is seen by the shape of prongs illustrated in other views of the drawings.

In Fig. 7, I show a form comparable to that in Fig. 9 with a comparatively narrow T-flange at the top with the prong simply pointed and struck up from the edges of the flange.

In Fig. 8, I show a modified T-flange made up of an angle bar with flat web spot-welded or otherwise secured thereto, the prongs being struck up intermediate the edges of the top flanges.

Figs. 9 and 9—A, as already stated, show a preferred form.

Fig. 10 shows a form in which the prongs are struck up from the edge of a web of an inverted T-beam.

Fig. 11 shows the structure in which there is an intermediate web between angle bars, the upper edge being formed into an L from which the prongs are struck up.

Fig. 12 shows a piece of channel bar extended into a T at the bottom by a suitable L-bar secured thereto, the prongs being struck up from the top flange and forced into substantially vertical relation with the web.

Fig. 13 shows a form similar to that of Fig. 12 in which the prongs are welded to the top edge of the web, there being no flange at the top at all.

Fig. 14 shows a floor construction with open web bar joist in which the webs are formed by welding deflected rod in place. The principle of operation is the same, the upper chord being the same as the upper member of the T-joist already described, such as is illustrated in Fig. 9. (In this structure a woven wire web supporting a paper or fibre sheet may be used in place of expanded metal.)

Fig. 15 shows a bar joist, the top and bottom chord members, and the method of welding the web rod in place.

Fig. 16 is a modification in which there are grooves in the top and bottom members which are pinched onto the web bars and also welded or otherwise secured.

Fig. 17 is still another form of the bar joist with the web bars secured between L-shaped angle bars at top and bottom forming the same into the general contour of I-beams.

Fig. 18 shows a structure which is like that of Fig. 14 except that the bar joists have webs of expanded metal and in Fig. 18 removable forms are shown supported between the joists which are removed after the floor slab has been formed, leaving concrete shoulders around the top chord.

In Fig. 19 the joist is made up of pairs of corrugated bars and rods between which the web bars are secured by welding or otherwise. The ends of the web bars project up to form the prongs. These prongs may be omitted. This form is then particularly adaptable to the construction assembly shown in Fig. 18, the deformed top chord providing the necessary bond and resistance to slipping at the ends of the span.

From this description it is clear that my invention is capable of very considerable modification. I wish to claim especially the particular form of joist as seen in Figs. 9 and 9—A. I also wish to claim the joist and structure broadly as pointed out in the appended claims.

Having thus described my invention what I

claim as new and desire to secure by Letters Patent is:

1. The combination with a suitable girder, of structural metal joists having narrow top flanges, prongs struck up from the top flange on opposite sides of the web having sharp end portions and shoulders, nailing strips adapted to rest on the said shoulders, reinforcement and slab form of expanded metal disposed on the said flanges and penetrated and anchored by the said prongs, and tie bars disposed over the said girders and engaged by prongs of beams on the opposite side thereof, the whole being incorporated together by a concrete floor slab in such a manner as to utilize the concrete as a compression member in the structure.

2. The combination with a suitable girder, of structural metal joists having narrow top flanges, prongs struck up from the top flange on opposite sides of the web having sharp end portions and shoulders, reinforcement and slab form of expanded metal disposed on the said flanges and penetrated and anchored by the said prongs, and tie bars disposed over the said girders and engaged by prongs of beams on the opposite side thereof, the whole being incorporated together by a concrete floor slab in such a manner as to utilize the concrete as a compression member in the structure.

3. The combination with a suitable girder, of structural metal joists, prongs struck up from the top flange on opposite sides of the web having sharp end portions and shoulders, reinforcement and slab form of expanded metal disposed on the said flanges and penetrated and anchored by the said prongs, and tie bars disposed over the said girders and engaged by prongs of beams on the opposite side thereof, the whole being incorporated together by a concrete floor slab in such a manner as to utilize the concrete as a compression member in the structure.

4. The combination with a suitable girder, of structural metal joists, prongs struck up from the top flange, reinforcement and slab form of expanded metal disposed on the said flanges and penetrated and anchored by the said prongs, and tie bars disposed over the said girders and engaged by prongs of beams on the opposite side thereof, the whole being incorporated together by a concrete floor slab in such a manner as to utilize the concrete as a compression member in the structure.

5. In a floor or roof structure, structural metal joists, prongs struck up from the top flanges thereof, said prongs having sharp end portions and shoulders, and reinforcement materials disposed on said joists and penetrated by said prongs some of said prongs being bent over said reinforcement materials to form hooks engaging said reinforcement materials, the whole being incorporated together by a concrete slab in such a manner as to utilize the concrete as a compression member in the structure.

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