

Dec. 11, 1951

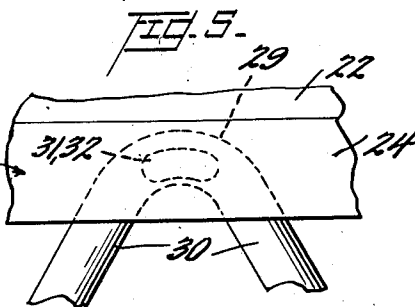
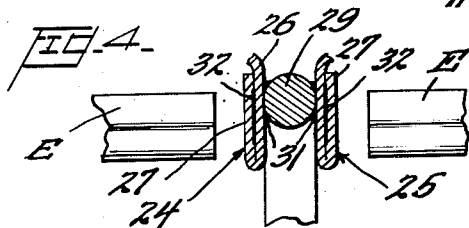
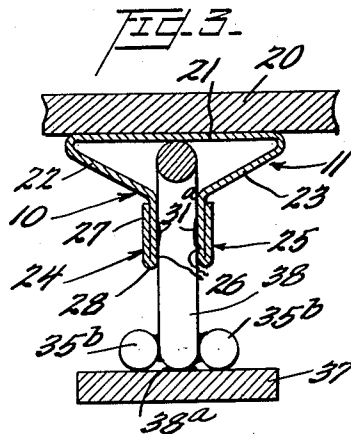
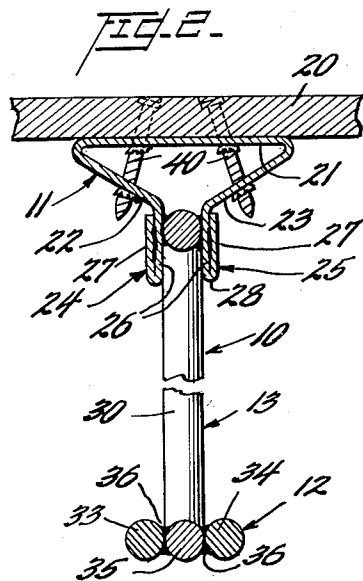
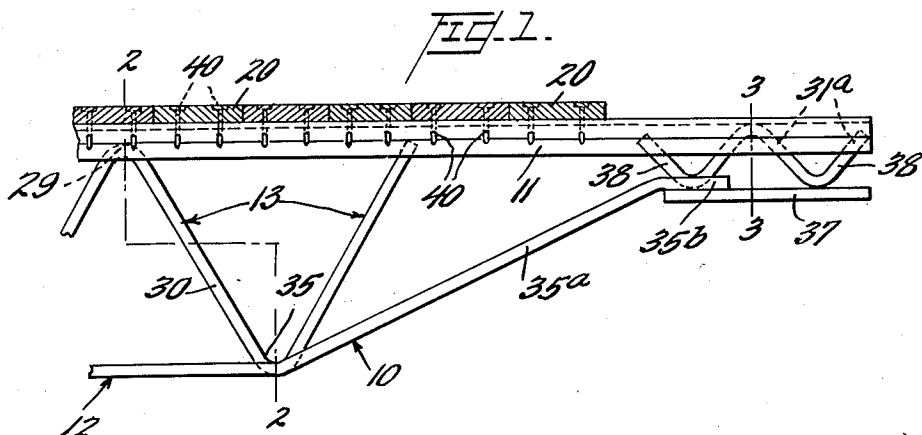
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2,578,465

METAL JOIST

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3 Sheets-Sheet 1



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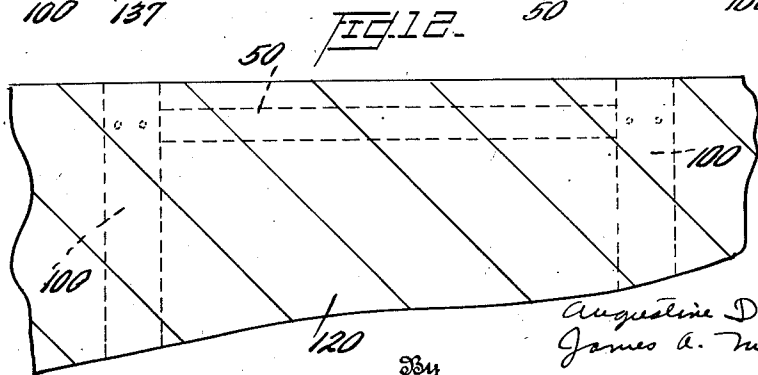
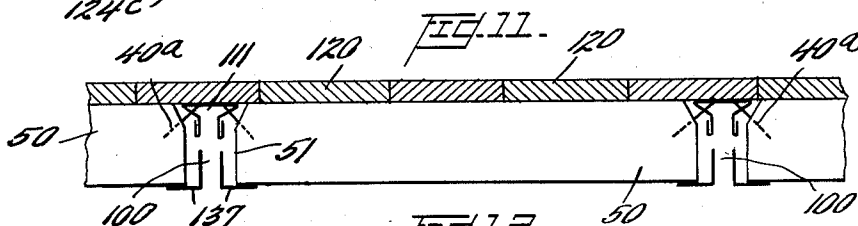
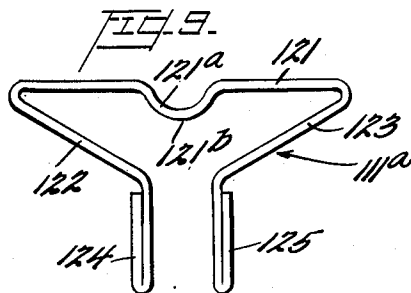
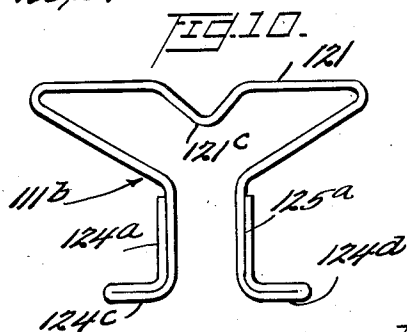
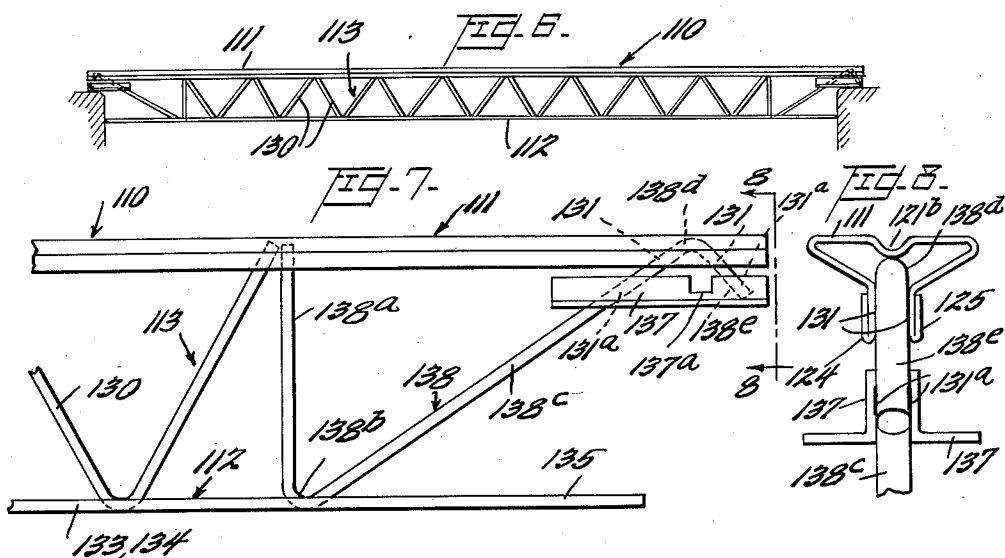
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METAL JOIST

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3 Sheets-Sheet 2



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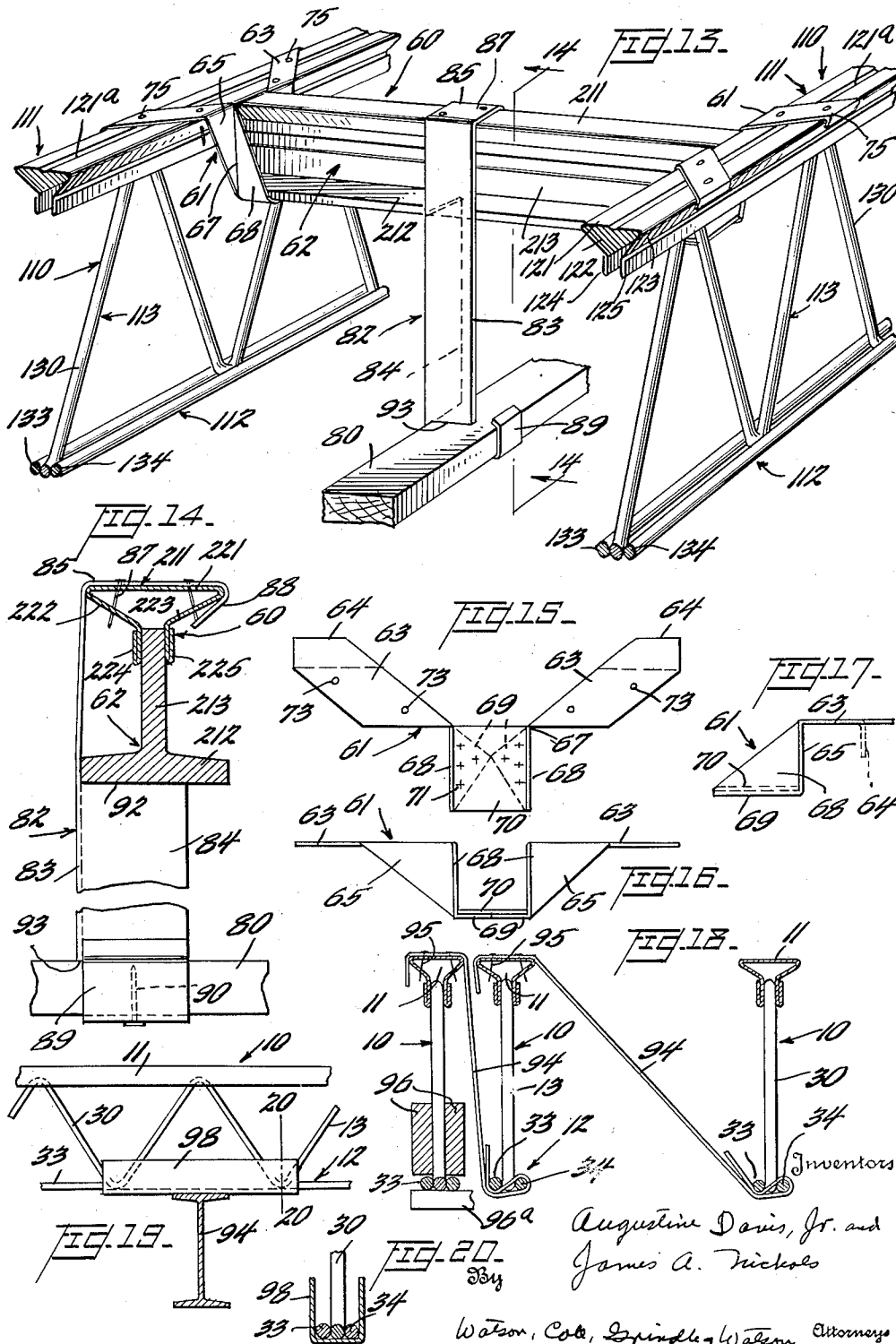
A. DAVIS, JR., ET AL

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METAL JOIST

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,578,465

METAL JOIST

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7 Claims. (Cl. 189—37)

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This invention relates to building constructions, and more particularly to metallic joists, trusses, beams, or girders and their associated connecting and supporting structures.

This application is a continuation-in-part of our copending applications Serial No. 583,948, filed March 21, 1945, and Serial No. 617,638, filed September 20, 1945, both now abandoned.

The principal object of the invention is the provision of a novel and improved metal joist for use in the erection of a wide variety of buildings, whether residential or commercial; one which is of relatively simple construction, easy to manufacture at a relatively low cost comparable to that of wooden joists, and at the same time being of light weight and capable of supporting heavy loads without deformation either by crushing, twisting, or bending.

It has long been known that wooden joists shrink across the grain thus causing the flooring to separate from the shoe strip and the door trim. The shrinking and warping of wooden joists causes plaster cracks and gives rise to sagging uneven floors, and this form of joist, though widely used in expensive as well as low cost houses, is of course generally inferior to steel joists.

Many prior proposals have been made looking toward the substitution of metal joists for the conventional wooden ones, but such metal joists as have been devised to meet the structural requirements of the various building codes, have been too expensive to manufacture in competition with wooden joists.

Furthermore, the attachment of the sub-flooring and of various accessories such as hangers, bridging elements, furring, and the like, has presented serious problems. A steel bar joist must conform to certain requirements of the Steel Joist Institute Code and of building codes of all jurisdictions, both with respect to cross sectional area, weight per lineal foot, and compression, torsional, and bending strength; and it has hitherto been thought impossible to devise a metal joist having a top-chord member made of nailable material (whether of nailable sheet steel or of equivalent nailable gauge of other sheet metals), whereby the attachment of flooring and accessories is facilitated, and at the same time being a true structural member having the necessary strength to pass all of the tests set up by the building codes. It has been proposed to provide a composite joist containing wooden nailing strips or some nail clinching filler materials, or to provide a tortuous slot in the top chord for the reception of the flooring nails; but these expedients

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very obviously increase the cost of the joist enormously, and preclude the use of these joists in the construction of low cost housing.

Another apparent obstacle in the way of using nailable sheet steel in making up a joist chord, has been the presumed difficulty or impossibility of effecting a satisfactory weld between the webbing and chord structures of the joist.

The present invention, therefore, in its preferred embodiment, contemplates the provision of an all-steel joist comprising a bottom chord and web of any suitable or appropriate construction or configuration, but embodying a top-chord member of novel and improved construction and properties. The novel top chord is of hollow construction requiring no internal filling or reinforcing provisions whatsoever, the walls of the chord being of sheet steel of a gauge adapted to be penetrated by a nail or drive screw with no more expenditure of energy than that required in driving an eight-penny common nail into a wooden joist.

Although formed of nailable sheet stock, the configuration of the novel chord is such that it answers to all of the requirements relating to structural strength, and it is also adapted to receive the edge of the web of the joists and to be firmly and permanently resistance-welded thereto.

Further objects of the invention include the provision of improved arrangements of bridging, hangers, short span headers, furring supports, end blocking, and other accessories, all made possible by the novel hollow sheet metal top-chord member of the joist.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawings in which certain embodiments of the invention are illustrated by way of example.

In the drawings,

Figure 1 is a view in side elevation of an end portion of a joist embodying the principles of the invention, some of the sub-flooring applied thereon being shown in section;

Figure 2 is an enlarged view in transverse vertical section taken on line 2—2 of Figure 1, and showing to better advantage the novel top-chord member of the joist;

Figure 3 is a similar view taken on line 3—3 of Figure 1;

Figure 4 is a further enlarged fragmentary sectional view showing the means for welding the flanges of the upper chord member to the webbing of the joist;

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Figure 5 is an enlarged fragmentary view in side elevation of the welded joist effected by the means shown in Figure 4;

Figure 6 is a view in side elevation of a joist representing another embodiment of the invention;

Figure 7 is an enlarged view in side elevation of an end portion of the joist shown in Figure 6;

Figure 8 is an enlarged end view of the end bearing portion of the same joist;

Figure 9 is an end view of a modified form of top-chord member affording added structural strength for a given amount of material;

Figure 10 is a similar view of another modification of the top chord;

Figures 11 and 12 are vertical sectional and top plan views respectively, showing the application of blocking at the ends of the joists, particularly in the case of diagonal sub-flooring.

Figure 13 is a fragmentary perspective view of two contiguous joists, illustrating the application of a header member and the support therefrom of ceiling furring;

Figure 14 is a view in transverse vertical section through the header of Figure 13, and taken on the plane 14—14 of that figure;

Figures 15, 16, and 17 are top plan, front elevation, and side elevation views respectively of one of the header hangers used in the structure shown in Figure 13;

Figure 18 is a view in vertical section of several adjacent joists such as occur at a stair well or the like, and showing the novel tension bridging employed in the preferred form of the invention;

Figure 19 is a fragmentary view in side elevation of a bearing for a joist at a point remote from the end thereof, a supporting beam being shown in section; and

Figure 20 is a fragmentary sectional view taken on line 20—20 of Figure 10.

In Figures 1 to 5 of the drawings there is illustrated one embodiment of the invention in which a hollow top-chord member is employed which is of such configuration as to furnish the necessary structural strength even though the sheet metal of which the chord is formed, is only of a gauge equivalent to 18 gauge sheet steel. This type of joist meets all requirements for relatively short spans, for example joists of say twelve feet by eight inches and fourteen feet by ten inches, disposed on two-foot centers.

The novel joist is indicated in its entirety by the reference numeral 10 and comprises the upper chord member 11, the lower chord member 12, and the webbing 13 which supports and connects the two chord members in substantially parallel spaced relationship. The upper chord member 11 supports a load carrying portion of the building structure exemplified by the wooden sub-flooring 20.

In this embodiment of the invention, the upper chord member is rolled to form an elongated strip of imperforate sheet material having a thickness which when the joist is formed permits the penetration of the upper chord by nails or drive screws such as those indicated at 40.

As most clearly shown in Figures 2 and 3 of the drawings, the upper chord member is formed with an intermediate flat top wall 21 having integrally formed side walls 22 and 23 extending downwardly from the edges thereof and converging toward the center line of the joist, the side walls 22 and 23 preferably being disposed at an acute angle to the top wall 21. The lower transversely spaced longitudinal edges of the converging walls 22 and

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23 are extended downwardly to form parallel flanges 24 and 25.

These bottom flanges of the hollow top chord are vertically disposed and lie in spaced parallel vertical longitudinal planes positioned at right angles to the top wall 21. Each of the flanges 24 and 25 are of double thickness, this feature being attained by turning up or lapping the sheet material as clearly shown in Figures 2, 3, and 4. Each of the flanges thus comprises the downwardly extending inner walls 26 and upwardly extending outer walls 27. The lower edges of the flanges 24 and 25 thus comprise the rounded return bent portion 28.

The flanges 24 and 25 of the top chord 11 provide slots for the reception of the upper edges of the web portions 13 of the joist, these upper edges consisting of the curved portions 29 of the sinusoidally formed webbing rods 30, these rods extending substantially continuously between points adjacent the ends of the joist and are preferably of circular cross-section.

In Figures 4 and 5 there is illustrated the means for rigidly connecting the flanges of the top chord with the webbing rods, this junction being effected by pressure or projection welding effected by electric resistance processes. A pair of welding electrodes are indicated at E in Figure 4 of the drawings and it will be readily understood how an application of electric current to the welding machine will produce a firm and secure weld between the rods 30 at their upper bends 29 and the inner walls 26 of the flanges 24 and 25. These welds are indicated at 31 in the drawings, and are preferably of some longitudinal extent being substantially oval or reniform in area. At the same time similar welds 32 are formed between the respective walls 26 and 27 of the flanges 24 and 25.

The lower chord member 12 consists of two spaced parallel rods 33 and 34, which may be of circular cross-section. These rods receive between them the lower nodes 35 of the webbing rods 30 and are rigidly fixed to the webbing rods at these points by pressure welds 36. The lower chord rods 33 and 34 are inclined upwardly at the ends of the joist as indicated at 35a and the extreme ends of the extensions 35' are again bent to horizontal position as indicated at 35b. These end portions 35b are welded to an end base plate 37, said end plate being held in rigid spaced relation with respect to the end of the upper chord member 11 by a relatively short sinusoidal rod 38 having its lower nodes or curved portions welded to the top surface of the plate 37 as indicated at 38a in Figure 3. The upper nodes of the sinusoidal rod 38 are in abutment with the inner side of the upper wall 21 of the top chord member and the intermediate portions of the convolutions of the rod 38 are welded to the inner walls of the flanges 24 and 25 as indicated at 31a in a similar fashion to the formation of the welds 31 which unite the webbing 13 with the top chord. If desired, welds may also be provided between the end portions 35b of the bottom chord and the bend in the rod 38 which they embrace. This arrangement provides a sturdy bearing portion whereby the joist is supported from a wall or column of a building structure.

The sub-flooring 20 is secured to the upper chord member 11 by means of the drive screws or nails 40. These fastening elements 40 are preferably of the so-called helix type and they need not be any heavier than the size No. 6. The nails 40 are driven through the sub-flooring 20, pref-

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erably diagonally, so as to pass through each side portion of the top chord 11, both the top wall 21 and the side walls 22 and 23 of the chord being imperforate prior to the affixing of the flooring, the nails or drive screws thus penetrating the top and side walls by their own force and locking in the top chord by means of the friction afforded by the inherent slight springiness of the hollow sheet metal top chord. In this way, no further clinching of the nails or screws is necessary and the frequently used embedded wooden nailing strips are also dispensed with.

However, the choice of thickness of the sheet metal of which the top chord is made is rather narrowly limited. If 16 gauge or thicker steel is used the expense naturally rises, and the energy required to drive the fastening elements through the spaced walls of the top chord would be too great for efficient construction. On the other hand if sheet steel of a lighter gauge than approximately 18 gauge is employed, while the nailing would be accomplished more easily, the top-chord element would not have sufficient structural strength and rigidity to satisfy the requirements of the building codes. Thus, for practically all sizes of joist coming within the purview of the present invention, the material of which the top chords are made is approximately 18 gauge sheet steel, or an equivalent gauge in other suitable metals. For example, aluminum alloys and other metals may afford a slightly different gauge of material with the same nailing properties on the one hand and the same self-sustaining structurally rigid properties on the other hand.

The use of sheet metal of the appropriate nailable gauge presents a welding problem in connection with the joining of the web and the top chord. Therefore, the invention provides for thickening the bottom flanges of the top chord and by thus doubling the flanges only of the top chord member, we have provided a structural element which is shaped to fulfill the requirements of resistance to crushing, twisting, and bending, one which provides for the locking of drive nails for securing the sub-flooring and other elements to the joist, and an arrangement whereby a rigid weld may be effected without burning or weakening the connecting flanges of the top chord.

Although the dimensions of the top chord member may be varied widely in accordance with the size of the joist, the span to be bridged, and the load to be supported, a joist for the purposes of the one just described in connection with Figures 1 to 5 of the drawings may have a top-chord member fabricated from a strip of sheet steel about five and one-fourth inches wide. This will provide a top-chord member of a width of approximately one and three-fourths inches and will support a load at say two hundred and forty pounds per lineal foot of the joist, taking into account live load, dead load, and the required factor of safety.

However, for certain other sizes of joists, for example in the case of a joist of about twelve inches in depth, and eighteen feet long, the upper chord member may be fashioned from a strip of 18 gauge steel about seven inches wide. Still larger joists may be made with top sections formed of eight inch strip steel, but in these larger sizes, we have discovered that certain further provisions should be made in the construction of the chords and these will be described in

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connection with the embodiments of the invention illustrated in Figures 6 to 10 of the drawings.

In Figure 6 there is illustrated a joist designated generally by the reference numeral 110 and which comprises the top-chord member 111, the bottom-chord member 112, and the sinusoidal rod 130 comprising the web portion 113 of the joist. As in the other embodiments the bottom-chord member 112 may comprise the two parallel bars 133 and 134 and these rods are extended as at 135 without being brought up to the end bearing portion of the joist. Instead, the end portion of the webbing 113 consists of the rod 138 which has a substantially vertical portion 138a, a bend 138b, a diagonal part 138c, an upper bend 138d and a short downwardly inclined end portion 138e. The lower bend 138b is welded to the lower chord bars 133 and 134 in the manner previously described and the welds 131 may be effected between the flanges of the top chord 111 and the portions of the end rod 138 upon either side of the upper bend 138d. The actual bearing element or shoe for the joist is composed of the two angle pieces 137 which embrace the downwardly disposed end 138e and an intermediate portion of the part 138c of the rod 138 and welding is effected at these points as indicated at 131a. It will be readily seen that by the provision of this novel end bearing structure the same method of lateral pressure resistance welding may be employed in uniting the web rod 138 with the top chord 111 and the bearing shoes 137, and this arrangement lends itself to mass production methods.

In order to provide an opening to receive certain tying or anchoring devices required under some codes, the vertical flanges of the angle pieces 137 may be notched as at 137a.

As mentioned heretofore, additional strengthening provisions are made in the top-chord members which are used in the larger and heavier joists, and which have widths approximating two inches, two and three-eighths inches, or greater. Tests have shown that flat unsupported sections of light gauge steel structural members should not exhibit a ratio of width to thickness which exceeds 25 to 1. Therefore, in providing a top chord member of say seven inch or eight inch blank strip width, and an actual width of approximately two inches, a construction such as is shown in Figure 9 of the drawings is provided. Here the top wall 121 of the chord which is designated generally by the numeral 111a is provided with a longitudinally extending bend or depression 121a which forms an internal bead 121b. The side walls 122 and 123 are similar to those described in the case of the first embodiment and the depth of the bottom flanges 124 and 125 is maintained at a relatively low dimension in order to conserve material and also to prevent too great an unsupported straight width of material at this point.

As indicated in Figure 8 of the drawings the upwardly extending portions of certain parts of the webbing structure may abut the inner bead 121b which has the effect of increasing the internal bracing of the joist to some extent.

In certain cases where wide strips are used in forming the top chords the configuration adopted is that shown in Figure 10 of the drawings where the cord member 111b has an internal bead 121c formed in the upper wall 121 thereof and the rather elongated bottom flanges 124a and 125a are doubled in the usual way but then flanged or flared outwardly preferably at a substantially 90° angle as indicated at 124c and 124d. This

provision has the effect of further strengthening the base flanges of the chord, and sufficient length of vertical extent of the flanges 124a and 125b is preserved to effect the welding operation.

Since the 18 gauge dimensions (sheet steel basis) of the box chords of Figures 8, 9, and 10, is maintained, the same nailing feature is provided as in the case of the previously described embodiments, and it will be understood that in all of the illustrations and descriptions which follow, in connection with the attachment of various accessories to the joists, any of the top chord arrangements illustrated and described herein may be employed, even though the simplest form may be the one selected for illustration.

In Figures 11 and 12 there is shown an arrangement which is particularly valuable in connection with the securing of diagonally arranged sub-flooring. These figures are rather diagrammatic and the end structure of joists fabricated in accordance with the present invention are indicated at 100. The top-chord arrangement 111 and the bearing shoe elements 137 will be recognized. The sub-flooring is indicated at 120 and it is nailed to the top-chord members 111 in the usual way. However, in order to provide adequate end support for some of the diagonal pieces of sub-flooring, blocking members 50 are employed, these members 50 being lengths of wood spanning the space between the joist ends 100 and having edges 51 conforming roughly to the configuration of the sides of the joist ends. Fastening elements 40a are driven through the spaced walls of the chord member 111 and thence into the upper corner portions of the blocking pieces 50. The lower edges of the ends of the blocks 50 are adapted to rest upon the horizontal flanges of the shoes 137 and the vertical dimension of the blocks is approximately the same as the height of the end bearing portions of the joists, which in most standardized constructions is about two and one-half inches.

In Figure 13 of the drawings there is shown a novel arrangement for suspending a header member which takes the place of a joist or other beam structures for short spans. These headers are adapted to support the necessary loads of the structure up to a span of approximately four feet. In the illustrated example, the header 60 is slung or suspended between two joists 110 and by means of the header hangers 61.

In order to equip the header so as to facilitate the attachment of accessories thereto, the head section or upper chord element of the header is of exactly the same construction as the top chord members of the joists. An inspection of Figure 14 of the drawings will reveal that the head section or top chord of the header 60, which is designated by the reference numeral 211, comprises the top wall 221 the downwardly converging side walls 222 and 223 terminating in the parallel vertical flanges 224 and 225.

These flanges provide a slot within which is received the upper edge of the web 213 of the T-member 62. This member is provided with a base flange 212 and constitutes the lower portion of the header 60.

The header hangers 61 are especially constructed to support a header or other similar element from the top-chord portions of the novel joists, and to do this effectively without subjecting the top chords to distortion or twisting. The hanger 61 is illustrated in detail in Figures 15, 16, and 17. These elements are made of strip steel and are provided with the out-

wardly flaring securing wing portions 63 which are provided with end tabs or flaps 64 adapted to be bent or hooked around the far edge of the top chord 111 of one of the joists 110, while the angular parts 63 overlie the top wall 121 of the chord. The straps are continued down in a vertical plane in front of the top chord as at 65, these portions being of a triangular shape. The downwardly extending parts of the straps are creased or bent at right angles on the line 67 and another triangular portion 68 is disposed in a vertical plane which is perpendicular to the central plane of the adjacent joists and parallel to the axis of the header 60 which is to be supported. The remaining tab portions of the straps comprising each half portion of a hanger are bent inwardly into a horizontal position from the areas 68 to form the triangular portions 69 which are disposed beneath the end of the header. A rectangular plate 70 is laid upon the tabs or extensions 69 and securely welded thereto as suggested at the points 71 in Figure 15. There is thus formed a supporting stirrup or sling which snugly receives the header member 60 and is disposed closely to the planes of both the header and the joists, allowing plenty of room in the corners between these elements for any other structural elements which it may be necessary to install.

The header hangers 61 are preferably of a slightly heavier gauge sheet material than the material used in making the top chords of the joists. Therefore, the openings 73 in the diverging webs 63 of the hangers must be preformed in order to receive the securing elements 75 which take the form of nails or drive screws which are driven through the spaced clinching wall portions of the top chords of the joists.

Another important feature of the hanger involves the wide divergence of the wing portions 63 whereby they may be secured around the portions of the top chord 111 of the joists directly above one of the upper bends or nodes of the sinusoidal webbing rod 130 and thus apply the torque to the top section at these points where it is most rigid.

In Figures 13 and 14 there is shown a very effective ceiling suspension means applied to the header 60, the timber 80 representing a furring element of the ceiling to which metal lathing or other supporting means may be applied. This element 80 is suspended from the header by means of the hanger member designated generally by the reference numeral 82. The member 82 is made of nailable sheet metal and it consists of an angle shape having its two flanges 83 and 84 extended in opposite directions. The extension 85 of flange 83 is bent around the upper chord 211 of the header 60 and nailed thereto by means of the nails or drive screws 87, the terminal extension of the portion 85 being bent around the far edge of the top chord 211 as indicated at 88 in Figure 14. The downward extension 89 of the flange 84 is bent around the furring element 80 and may be secured thereto by means of the nail or drive screw 90. The upper edge 92 of the flange 84 abuts the lower surface of the base flange 212 of the header, and the lower edge 93 of the flange 83 abuts the upper surface of the furring member 80, thus squaring up the suspension effectively.

The novel nailable top-chord section provided by the present invention makes possible a very simple and effective bridging means for the

joists. In Figure 18 of the drawings three adjacent joists 10 are shown, two of them being in close juxtaposition to provide double joists as used for example in framing stair wells and the like. Tension bridging members 94 are provided which may consist of approximately 20 gauge strip steel. If these elements are approximately three-fourths of an inch wide, they will be equivalent in strength to the three-sixteenths inch round rod bridging which is required by the Steel Joist Institute Code. One end of these strips is bent around the far side of one of the bottom-chord rods 34, inserted between the rods 33 and 34 comprising the bottom chord 12, and then bent upwardly from beneath the rod 33. The main portion of the strap 94 is then brought beneath the rod 33 and, bearing upwardly against the end portion of the strap, securely snubs the strap around the bottom chord of that joist.

The tension strap 94 then continues diagonally upwardly and its upper end is brought over the top of the top-chord member 11 of the adjacent joist where it is securely nailed in position by means of the fastening elements 95 which pierce spaced walls of the header and are thus securely held in position as described in connection with the earlier embodiments. Of course, these tension bridging elements are provided to extend from top to bottom chord members of adjacent joists in the opposite directions also. This type of bridging is very quickly and easily applied, the workmen having merely to snub one end of the strip around the bottom chord member of a joist as shown and then quickly nail the other end to the top chord of the adjacent joist, thus very effectively lining up the joists and holding them securely in their proper positions.

In Figure 18, there are also shown furring elements 96 and 96a for attaching lath and plaster around the stair well and at the ceiling portions of the lower story. The ceiling furring piece 96a is readily secured to the bottom chord 12 of the joist by wiring it in place in the usual way.

Frequently, it is necessary to span a wide building structure by means of two or more joists arranged endwise, the adjacent ends of the joists being supported by a beam extending at right angles across the structure. To position this beam or any added superstructure high enough to immediately underlie the normal shortened end structures of the joists would dispose the beam or other supports too close to the ceiling near a partition in some cases, and would prevent the disposal of air conditioning ducts and the like at these points. Therefore, it is proposed to terminate the joists at their inner adjacent ends in sections of full height rather than tapering them off to provide the shorter end sections which normally rest upon the walls or foundations. The joist ends thus may overlap slightly and both rest upon the supporting beam side by side. In Figures 19 and 20 of the drawings such a support is illustrated, the beam being designated 94 and supporting the bottom chord 12 of the joists 10 through the intermediary of a bearing channel 98. This channel is of a width slightly greater than the width of the bottom chord 12 of the joist and is adapted to snugly receive the joist and distribute the supporting forces along the joist from one lower node of the sinusoidal web rod 39 to the adjacent one, and thus prevent any possible bend-

ing or distortion of the rods 33 and 34 comprising the bottom chord 12.

It will be understood from the above that there has been provided by the present invention a novel system of supports and suspensions adapted for installation even in low-cost housing projects, and which has for its fundamental basis the provision of the novel hollow nailable sheet metal head or top-chord element of the joist, beam, or header, which is also so constructed and arranged as to constitute an effective rigid structural element and to embody means whereby it may be strongly welded to the other portions of such joist or similar member.

Various changes and modifications may be made in the embodiments of the invention illustrated and described herein without departing from the scope of the invention as defined in the following claims. Thus as previously indicated, the joists may be made of other sheet metals but of a gauge which is the equivalent of the approximately 18 gauge steel used as a basis of comparison. Also, when drive screws are mentioned in the application, it is intended to include all equivalent driven fastening elements having the same frictional holding characteristics.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination, a metal structural element including a web and a chord extending along one edge thereof, said chord comprising an elongated, hollow, unfilled, box-like, supporting element having opposite, spaced apart, angularly related, boundary walls of nail-penetrable sheet metal, the cross-sectional configuration of said hollow chord being substantially triangular, whereby although being of nail-penetrable metal it is structurally rigid and self-sustaining; a collateral structural member disposed adjacent to and supported by said chord; driven frictional fastening elements passing through said collateral member and also successively through said spaced apart boundary walls, thus passing entirely through said hollow chord; said driven fastening elements being retained securely in place by their frictional contact with the distorted margins of the openings formed in the spaced apart boundary walls by the driving of said fastening elements, combined with the locking effect of the slight deflection of at least one of said angularly related walls due to the inherent slight unhindered resilience thereof under the driving force of the fastening element.

2. The building construction combination as set forth in claim 1 in which the structural element is a joist and the hollow chord is the top chord thereof, and in which the collateral structural member is a strap-metal joist bridging member which is of no thicker gauge than that of the joist chord and is therefore readily nailable to the chord, one end of said bridging member adapted to be secured to the diagonally opposite chord of an adjacent joist.

3. The building construction combination set forth in claim 1 in which the structural element is a joist and the hollow chord is the top chord thereof, and in which the collateral structural member is a wooden blocking element having a portion disposed beneath one of the lateral portions of the top chord of the joist and in close juxtaposition to the boundary wall of the chord through which one of the driven fastening ele-

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ments protrudes, so as to be pierced by the end of said fastening element.

4. The building construction combination set forth in claim 1 in which the structural element is a joist and the hollow chord is the top chord thereof.

5. The building construction combination set forth in claim 4 in which the collateral structural member comprises a part of the flooring supported by the joist.

6. In combination, a metal structural element including a web and a chord extending along one edge thereof, said chord comprising an elongated, hollow, unfilled, box-like, supporting element having opposite, spaced apart, angularly related, boundary walls of sheet metal of equivalent strength and penetrability to sheet steel of less thickness than 16 gauge, the cross-sectional configuration of said hollow chord being substantially triangular, whereby although being of such readily nail-penetrable gauge it is structurally rigid and self-sustaining; a collateral structural member disposed adjacent to and supported by said chord; driven frictional fastening elements passing through said collateral member and also successively through said spaced apart boundary walls, thus passing entirely through said hollow chord; said driven fastening elements being retained securely in place by their frictional contact with the distorted margins of the openings formed in the spaced apart boundary walls by the driving of said fastening elements, combined with the locking effect of the slight deflection of at least one of said angularly related walls due to the inherent slight unhindered resilience thereof under the driving force of the fastening element; said chord having an outer wall and two side walls converging from the edges of said outer wall and having their adjacent edges located at one angle of the substantially triangular cross-section of the chord and spaced slightly apart, a pair of parallel flanges, one extending from each of the edges of said side walls, said flanges receiving between them and welded to the edge of said web, said flanges being doubled upon themselves to form a double-ply reinforcing and readily weldable thickness, and said side walls and outer wall being single-ply.

7. The building construction combination as

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set forth in claim 6 in which said double-ply parallel flanges are bent outwardly intermediate their width in opposite directions from the axis of the chord to provide double-ply wing-like strengthening flanges.

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