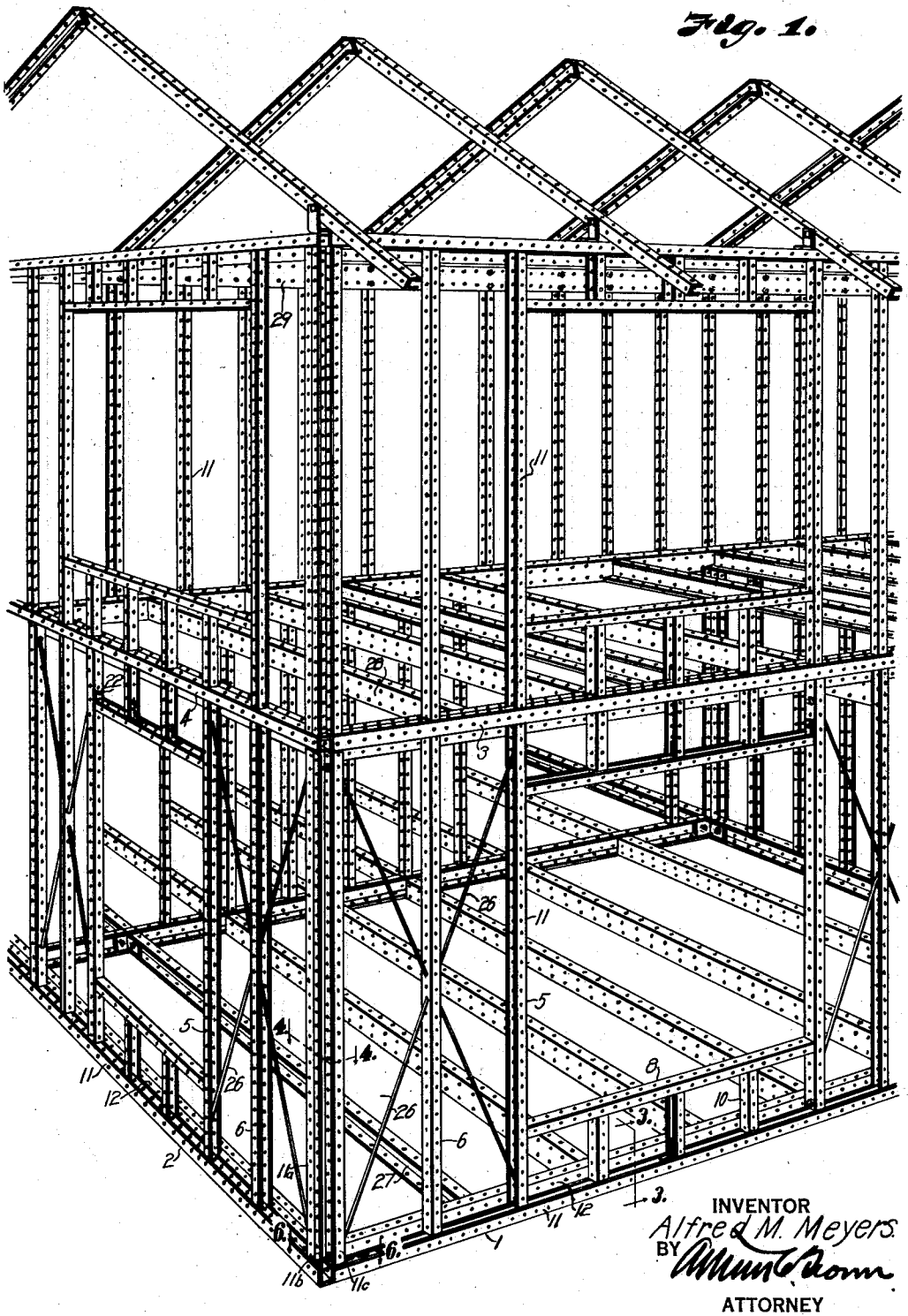
March 22, 1932. A. M. MEYERS 1,850,118

BUILDING CONSTRUCTION

Filed Oct. 15, 1928 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
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Fig. 2.

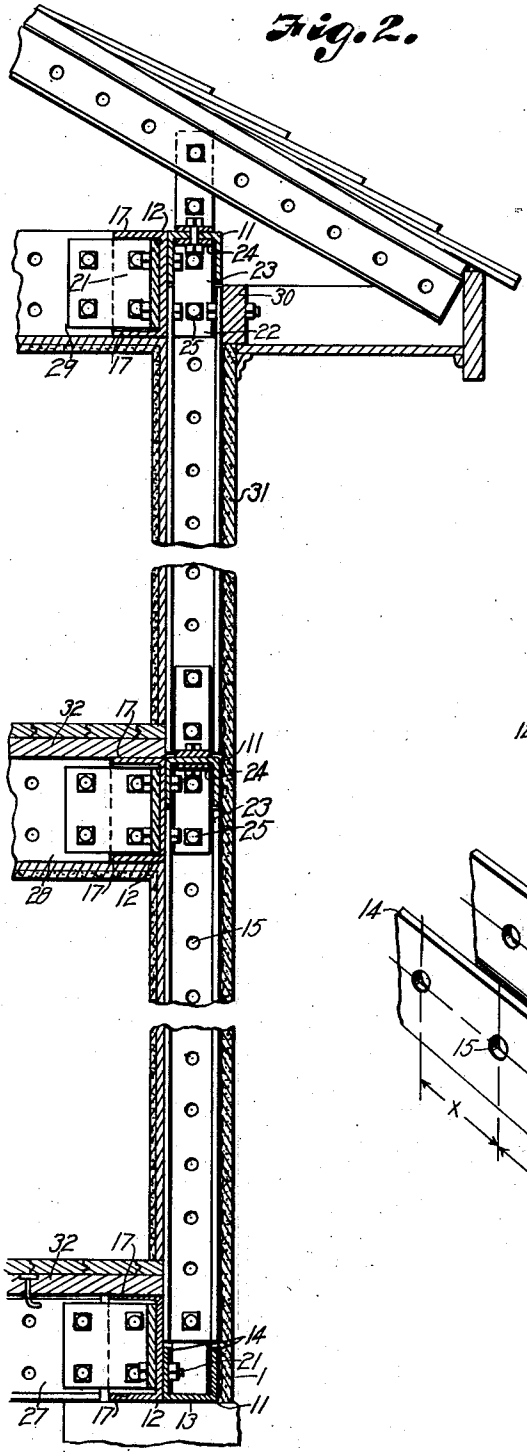


Fig. 3.

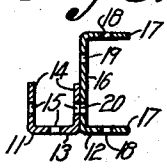


Fig. 4.

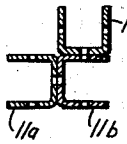


Fig. 5.

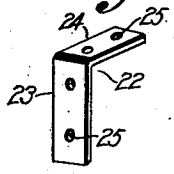


Fig. 6.

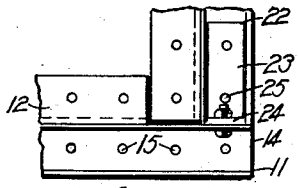
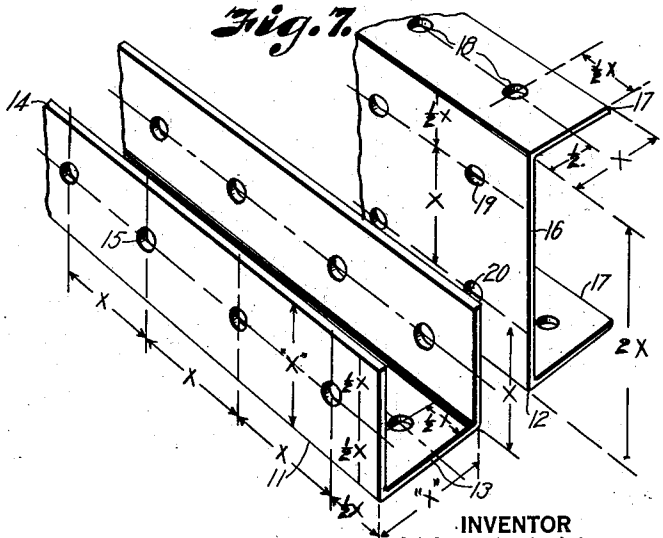


Fig. 7.



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Patented Mar. 22, 1932 1,850,118

UNITED STATES PATENT OFFICE

ALFRED M. MEYERS, OF KANSAS CITY, KANSAS

BUILDING CONSTRUCTION

Application filed October 15, 1928. Serial No. 312,482.

My invention relates to steel structures and more particularly to structural steel sections and methods for fabricating and erecting the same, the principal object of the invention being to adapt steel for use in the construction of relatively small buildings.

Structural steel has heretofore been provided in shapes, weights and condition for the frames of relatively large buldings, and for bridges; and relatively light steel sections such as angles have been provided for miscellaneous framing and reinforcing purposes. The use of standard sections for smaller buildings such as dwellings involves the installation of an excessive amount of steel proportionate to the duty of the frame work, and the use of the lighter standard members such as angles requires make-shift means for building up studs and beam members therefrom and a multiplicity of connectors for tying the structural members together.

Furthermore, standard rolled sections such as I-beams are used in frame-works chiefly consisting of light standard steel members, since the angles and channels now available, are not adapted for building up structural sections to replace the rolled beams.

It is therefore a further object of the invention to shape and fabricate a structural steel section for use in the erection of small buildings and to build up structural steel sections from such novel members, whereby the amount of steel used in a building will be exactly proportionate to the duty of the frame-work, and the connected sections will adequately support the structure.

Further objects of the invention are to minimize the amount of shop drawings necessary for the preparation of the steel material for a building, to minimize the shopwork for conditioning steel sections carried in stock, to simplify the gathering of the steel materials for a building, and to reduce the labor involved in the erection of a steel frame-work while assuring accuracy of assembly and rigidity and strength of the structure.

In accomplishing these and other objects of the invention, I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of adjacent front and side portions of a steel frame-work embodying my invention.

Fig. 2 is a vertical sectional view of a corner portion of a completed building including portions of the steel frame-work viewed from the side in Fig. 1.

Fig. 3 is a cross section of a sill on the line 3—3, Fig. 1.

Fig. 4 is a cross section of a corner stud or column on the line 4—4, Fig. 1.

Fig. 5 is an enlarged perspective view of a clip angle for connecting angularly extending members.

Fig. 6 is a fragmentary elevational view of a connected sill and stud shown on the line 6—6, Fig. 1.

Fig. 7 is an enlarged perspective view of adjacent end portions of characteristic structural steel members constructed in accordance with my invention and adapted to be joined to form beam-like sections.

Referring in detail to the drawings:

1 and 2 designate front and side ground floor sills, 3 and 4 upper floor sills, 5, 6, and 7, studs for supporting the upper from the lower sills, 8 sills of building openings, 9 the lintels for said openings and 10 short studs for connecting the transverse members with the sills, all being constructed in accordance with my invention as presently described and comprising steel frame elements in a two story building to which the invention is shown as applied for illustrative purposes.

The basic elements in the structure are structural steel sections or members such as 11 and 12 which are channel-like and will therefore be identified as channels in the description to distinguish them from beam-like structural members and sections built up of channels either in the yard or on the job.

The channel such as 11, Fig. 7, comprises a web or body 13 and like flanges 14 which may vary in width from the width of the web, the web having a longitudinal series of uniformly spaced openings 15 on its median line and each of the flanges having a series of similarly spaced openings 15′ approximately on

its median line, but spaced from the back edges of the flanges the same distance as the spacing of the web openings from the longitudinal edges of the outer surface or back 13′ of the web, the openings of the flanges being transversely aligned with the openings of the web.

The openings are spaced from the end edges of the web and flanges by a distance equal to half of the spacing between the openings in a series from center to center, and the spacing of the openings from the end edges is equal to the spacing of the openings from the outer common longitudinal edges of the flanges and web.

The channel 12 comprises a web 16 the width of which represents a multiple of the width of the web 13 and is preferably twice the width of said web 13, and equal flanges 17 each provided with a series of openings 18 similarly uniformly speaced and similarly disposed to the openings 15′ in the flanges of the channel 11.

The web 16 of the channel 12 is provided with a plurality of longitudinal series of openings 19 and 20 spaced from the longitudinal edges of the back 16′ of the web by a distance equal to the spacing of the openings 15 and 18 from the edges of the portions in which they are formed. The openings 19 and 20 are also transversely aligned with the openings 18 in the flanges 17 of said member 12, whereby registry of an end or back edge of one channel with an end or back edge of another channel will result in registry of openings for insertion of bolts for connecting the channels.

Attention is now called to characteristics of standard channels which hamper their use for my purposes, namely the inside reinforcing shoulders connecting the flanges and web of a rolled channel and the disparity in width of flanges of a channel formed from a plate or strip. A third characteristic of standard rolled and formed channels which adapt them for use in constructing steel frames for large buildings is their relatively great weight and thickness.

In ordinary practice, angle and channel members are shaped at the mill and are punched by a fabricator according to specifications for a particular job.

I preferably fabricate the channels described, from a steel strip, rolling the strip to provide a flat plate of indefinite length, punching successive lateral series of openings to form parallel longitudinal series of openings in the flat strip, and bending the strip on longitudinal lines positioned centrally between the outer series and the adjacent series of longitudinally disposed openings to form a channel-like section, which may be cut into lengths suitable for a particular job.

Two types of channels may be produced, namely those illustrated in Fig. 7, the member 11 having dimensions in constant relation with the dimensions of the member 12 though the dimensions may vary. One type is represented by the channel 11 which has three openings in each lateral series, the central opening being on the median line of the web when the strip has been formed to produce the channel. The type 12 has preferably four openings in each transverse series whereby two longitudinal series of openings are provided in the web.

A beam member such as the sill 1 (Fig. 3) comprises a channel 11 and a channel 12 positioned with one of its flanges 17 aligned with the web of the channel 11 and the lower portion of its web in back to face contact with the adjacent flange 14 of the channel 11, the series of openings 20 of the channel 12 registering with the openings of the flange of the member 11 to receive bolts 21 for securely connecting the members.

Studs such as the jamb studs 5 and intermediate studs 6 consist of channels 11 positioned vertically on the channel 11 of a ground floor sill 1 or 2 with the sides of their lower ends engaging the upwardly extending portion of the web of the channel 12. Supporting upper floor sills such as 3 and 4 are reversely positioned to the lower sills so that the channels 11 of the upper sills rest on the upper ends of the studs and depending portions of the channels 12 engage the sides of the studs.

The stiffer studs 7 comprising posts or columns for the corners and similar positions in the frame are preferably constructed of three channel members 11*a*, 11*b*, and 11*c* as illustrated in Fig. 4, two of the channel members having their webs in back to back contact while the web of the third is in back to face contact with the flange of one of the first named channels, the engaged channels being connected by bolts.

The end of one channel may extend beyond the end of the mating channel in a beam as illustrated in Fig. 6 and shown in Fig. 1 at the points where the sills meet and are connected with the corner studs, for example the end of the channel 12 of the side ground sill 2 being spaced from the end of the channel 11 of said member to receive the channels 12 and 11 of the sill 1 and permit the mounting of the channels 11*a* and 11*b* of the corner stud on the channel 11 of the sill 2 and the mounting of the channel 11*c* of the corner stud on the channel 11 of the sill 1, a similar interlocking or dove-tailed arrangement being provided for joining the upper end of a stud with upper sills.

The channels of the several beams are further connected and secured together by brackets or clip angles 22 comprising rightangularly extending arms 23 and 24 having a

series of aligned openings 25 uniformly spaced similarly to the longitudinal spacing of the channel openings. The clips may be mounted at the juncture of right-angularly extending members, either within the recesses of the channels or on the outer faces of the channels, and because of the uniform and similar spacing of the openings of the clips and channels, the openings will be in registry to receive bolts for attaching one arm of the clip to one channel and the other arm to an angularly extending channel to secure the stud to a sill as illustrated particularly in Fig. 6, or to secure a lintel to a jamb as illustrated in Fig. 1.

The jambs 5, intermediate studs 6 and short studs 10 may also be connected to sills by clip angles lying in the recesses of the channels or extending along the faces thereof since the uniform spacing of the openings of both clip angles and channels longitudinally and from the end edges of the respective members assures registry of openings to receive connecting bolts.

Portions of the frame comprising the studs and sills are braced and stiffened by tie-rods 26 comprising relatively flexible rods having ends threaded to a distance equal to the longitudinal spacing of the openings in a channel, whereby one end of a rod may be secured to one channel by suitable fastening means such as a nut, extended through a selected opening in an intermediate stud and into an available opening of another channel for latching to the last named channel with a suitable fastener such as a nut.

The uniform longitudinal spacing of the openings in the studs and sills permits any desired extension of the tie-rods over an extremely wide range since an opening is always available within the distance of a unit of spacing of the openings to receive the outer threaded end of the rod, and the rods need not be extended rectilinearly.

Floor beams such as 27 and 28 may be positioned in engagement with the lower and upper sills for support therefrom, and ceiling sills may support angularly extending rafters 29 comprising channels 12, the upper ends of which at the ridge of the roof are connected by single bolts extending through the terminal openings in the channels.

The rafters are latched to the upper ceiling sills by clip angles each having one arm bolted to the sills and an upwardly extending arm bolted to the web of the rafter channel.

Building materials such as wooden beams 30 may be bolted to the flanges or bodies of the channels and the openings provide convenient means for securing wall covering such as 31 and floor materials 32 to the structural sections.

In employing the invention a stock of steel strips is first provided in sets, each set including strips of two widths, one width being adapted to form the channels 11 and the other to form the channels 12. For example, strips approximately 9 inches wide will be provided for the channels 11 and strips approximately 12 inches wide for the channels 12; or strips 12 inches wide for the channels 11 and 16 inches wide for the channels 12. When provided in coil form the strips are first straightened and then the openings are punched. In punching the strip to form a channel 11, the longitudinal spacing of the openings from center to center is substantially equal to one-third the width of the strip, the outer longitudinal series being spaced equally from the positions of the common longitudinal edges of the web and flanges and a distance equal to half the longitudinal spacing of the openings.

The central longitudinal series of openings in the strip adapted for channels 11 is on the median line of the strip. The two interior longitudinal series on the strips adapted for channels 12 are spaced from center to center equally with the longitudinal spacing and equally distant from the median line of the strip.

After the openings are punched the strips are bent into channel shape whereby the end edge or one back edge of one channel may be positioned in registry with the end or back edge of another channel and there will be assurance of registry of openings for connecting the channels.

The channels are then selected in accordance with the tabulation, and cut and assembled without the necessity for shop drawings. No other operations are involved than cutting the channels and bolting the members of a section together. The bolting may be performed on the job. In any event relatively light members in condition for erection are transported to the site of the building and a relatively small number of types of sections is necessary since jambs and intermediate studs, lintels and opening sills, short studs for various positions, and sills for front and sides and for upper stories, are respectively interchangeable.

The tie rods and clip angles are all of uniform type and size since they are adapted to be applied to openings which are uniformly spaced in all the members.

Ordinary skill and care, in view of the relatively simple procedure necessary for the carrying out of the architect's plan for the building, will result in the erection of the steel frame-work and the application of the covering to comprise a substantial and rigid structure.

Variations from the architect's plan and from the arrangement initially provided for in the fabrication of the sections may easily be effected since any shortening of a section will be so done as to space the terminal openings of longitudinal series the same distance

from the ends of the shortened members as were the terminal openings in the original sections.

Partitions, floors, and walls may be modified after completion of the building with relatively small expense and labor, and openings may be closed or new ones installed without weakening the structure, since accurate means for joining newly introduced sections with old sections are provided because of the uniform spacing of the openings in the sections, and the constant relation between the webs of the two types of channels.

It is apparent that corner studs may extend between parallel sills forming the floor and ceiling of a portion of the frame, or may extend between roof and ground sills and intermediate sills may be secured to them.

Strips from which channels of a particular type are formed may vary slightly in width, and the spacing of the series of openings in a flange from the longitudinal free edge or toe of the flange may therefore vary without disturbing the utility of the invention for the purposes now being described.

What I claim and desire to secure by Letters Patent is:

1. A structural steel beam comprising a channel-like section having longitudinal series of centrally disposed openings in its body and flanges and a second channel-like section having a body in back to back engagement with the body of the first named channel and provided with a plurality of longitudinal series of openings spaced similarly to the openings of the first named channel.

2. A structural steel beam comprising a channel-like section having longitudinally centrally disposed openings in its body and flanges and a second channel-like section having a body provided with a plurality of longitudinal series of openings spaced similarly to the openings of the first named channel and spaced from the longitudinal edges of the body equally with the spacing of the openings of said first channel from the longitudinal edges thereof, a flange of the first named section being in face to back engagement with the body of the second-named section.

3. A structural steel beam comprising a plurality of members including a channel-like section having longitudinally disposed equally spaced openings on the center lines of its body and flanges and a second channel-like section having a body in back to face engagement with a flange of the first named channel and provided with a plurality of longitudinal series of openings spaced similarly to the openings of the first named channel and spaced from the longitudinal edges of the body equally with the spacing of the openings of said first channel from the longitudinal edges thereof, means in said openings securing the channels together, said second channel having equal flanges provided with uniformly spaced openings registerable with openings of similar channels for connection therewith.

4. A beam comprising a channel-like member comprising a body and equal flanges of equal width with the body, said body and flanges having longitudinal series of openings uniformly spaced from center to center by a distance equal to the width of the body and a second channel-like member comprising a web having twice the width of said body and a plurality of series of longitudinally arranged openings spaced similarly to the spaced openings of the first named member, whereby an abutting flange of the first named member may engage the web of the second named member for registry of openings of said web and flange.

5. A beam comprising a channel-like member comprising a body and equal flanges of equal width with the body, said body and flanges having longitudinal series of openings uniformly spaced from center to center by a distance equal to the width of the body and a second channel-like member comprising a web having twice the width of said body and having a plurality of series of longitudinally arranged openings uniformly spaced similarly to the spaced openings of the first named member, the second channel member having equal flanges provided with longitudinal series of openings spaced similarly to the openings of the first named member.

6. A beam comprising a channel-like member comprising a body and equal flanges of equal width with the body, said body and flanges having longitudinal series of openings on their median lines spaced from center to center by a distance equal to the width of the body and flanges, and a second channel-like member comprising a body having a plurality of series of longitudinally arranged openings spaced similarly to the spaced openings of the said first named member, and flanges provided with longitudinal series of openings spaced similarly to the openings of the first named member, a selected series of openings in the flange of one member registering with a selected series of openings of the other member, and fastening means in registering openings.

7. In a steel structure, vertical members including channel-like sections, a transverse member comprising a channel-like section, said members having similarly and uniformly spaced series of longitudinally arranged web openings, and a bracket comprising angular arms having a series of longitudinally arranged openings spaced similarly to the spacing of aforesaid openings for registry therewith to receive bolts adapted to connect the arms of the bracket with the vertical and transverse members respectively for support

of the transverse member from the vertical members.

8. A steel structure comprising spaced vertical channel-like sections having longitudinal series of regularly spaced openings, horizontal channel-like sections having series of openings spaced similarly to those of the vertical sections, means including members insertable in selected openings for connecting the vertical sections with the horizontal sections, and tie rods adapted to be mounted in selected openings of said sections to receive nuts adapted to anchor the tie rods in functional position to brace the structure.

9. In a steel structure, a series of vertical channel-like sections having longitudinal series of uniformly spaced openings, transverse sections having series of openings similar to those of the vertical sections, means for connecting the sections, and tie rods movable through selected openings, and nuts adapted to anchor said rods to selected sections in tieing position.

10. In a steel structure, vertical members and transverse members having longitudinal series of regularly spaced openings adapted to register to receive connecting means, and bracing means including tie rods extending through selected openings and having ends projecting beyond selected sections, and nuts on said ends for anchoring the tie rods to the sections.

11. In a steel structure, a beam including channels having right angular web and flange portions provided with longitudinal series of openings spaced equally from longitudinal edges of the portions, one portion of one channel being in face to face engagement with one portion of the other channel and the openings in said portions registering to receive fastening means, and the adjacent right angular portion of the first named channel being in alignment with the adjacent right angular portion of the second named channel.

In testimony whereof I affix my signature.

ALFRED M. MEYERS.