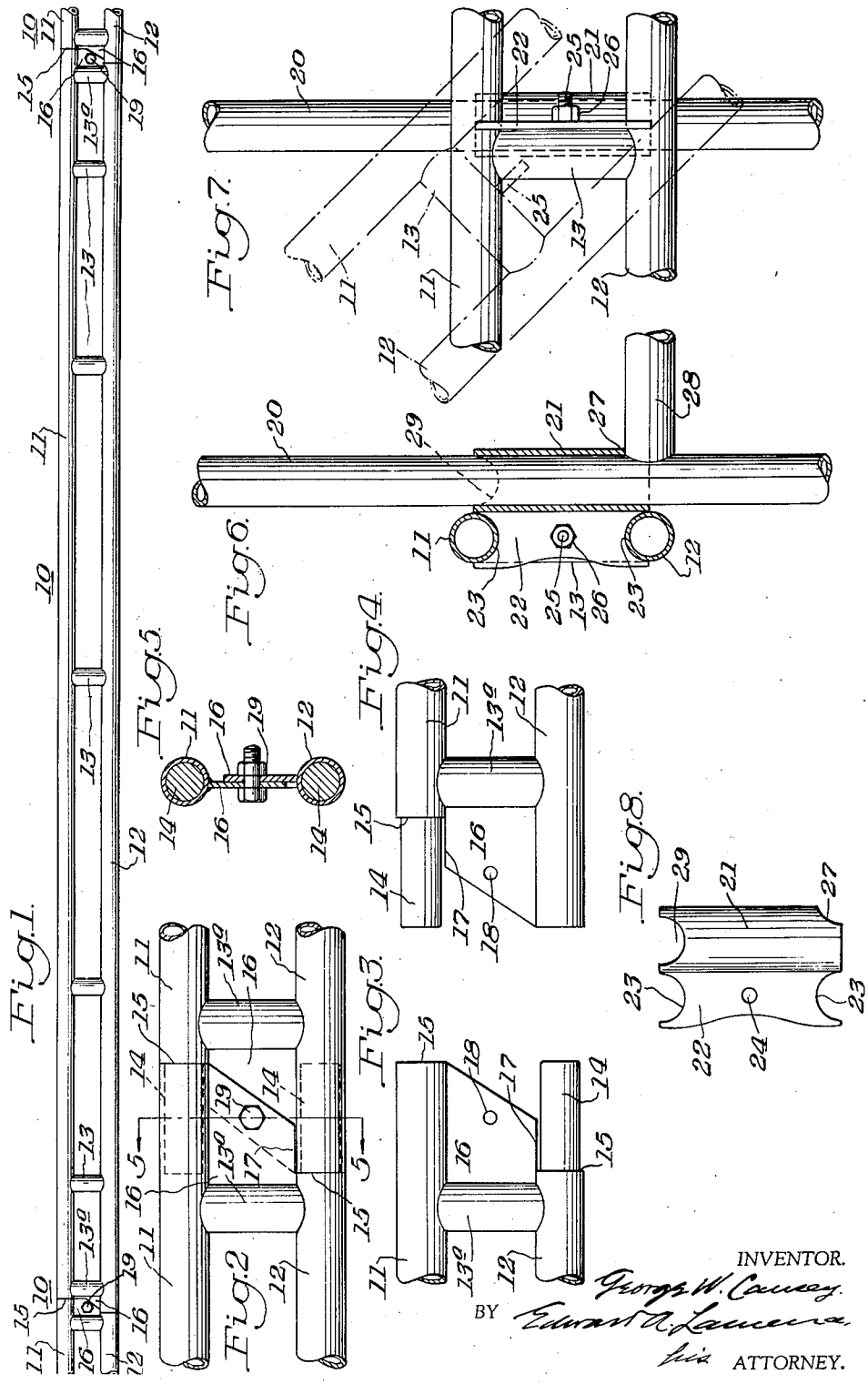
April 13, 1943. G. W. CAUSEY 2,316,560

STRUCTURAL ELEMENT

Filed March 1, 1941 2 Sheets-Sheet 1



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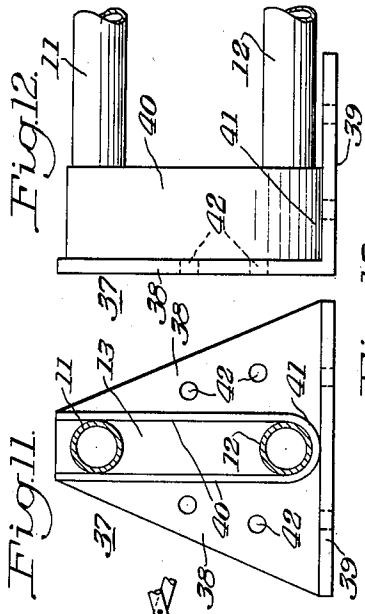

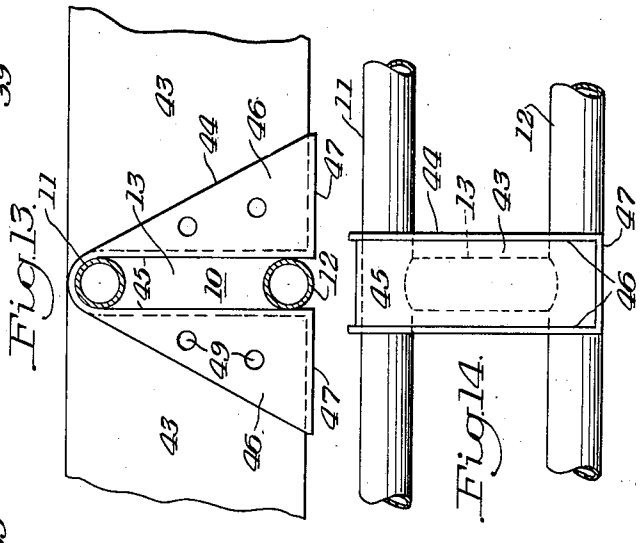

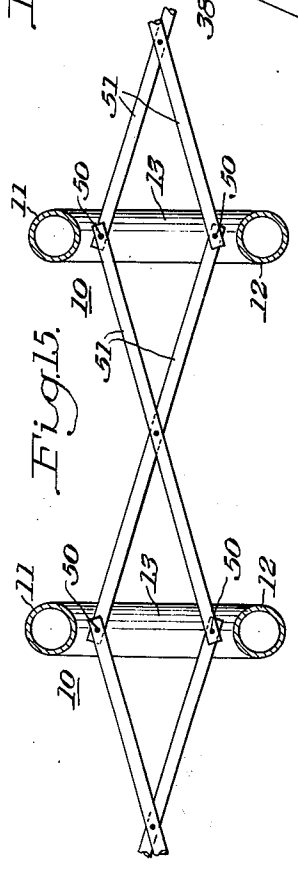

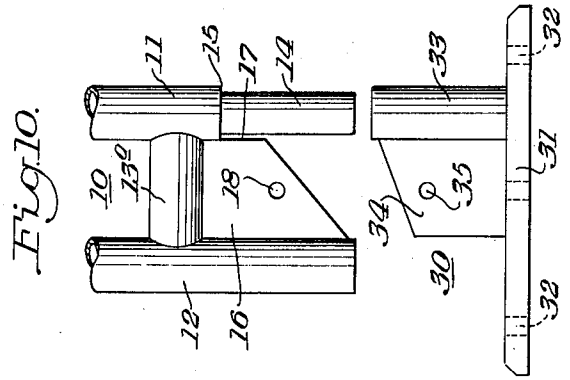

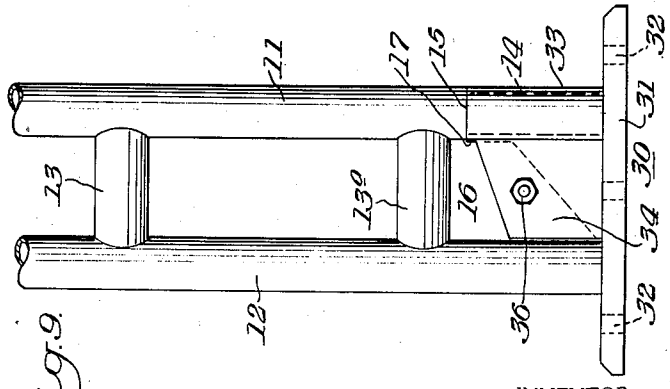

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Patented Apr. 13, 1943 2,316,560

UNITED STATES PATENT OFFICE

2,316,560

STRUCTURAL ELEMENT

George W. Causey, Pittsburgh, Pa.

Application March 1, 1941, Serial No. 381,359

7 Claims. (Cl. 189—36)

My invention relates to structural elements to be employed in the erection of either permanent structures, such as buildings, walls, floors, roofs, towers, bridges and the like, or also temporary structures designed for quick erection and demolition, such as scaffolding, arena seats, platforms, derricks and the like.

One of the objects which I have in view is the provision of structural elements preferably formed of steel which are inexpensive to manufacture and which are relatively light in weight and therefore convenient to handle, and which may be readily assembled to form a safe and substantial structure which may, if desired, be quickly disassembled without impairing the usefulness of the elements for repeated re-use.

For this purpose I have invented the new and improved structural element hereinafter described which may be used as an upright or as a horizontally or diagonally disposed element.

Another object which I have in view is the provision of a new and improved connection for associated structural elements so that the height of a post, the length of a horizontally disposed element may be adjusted to particular requirements without undue sacrifice of strength and rigidity, or two associated elements may be attached together, as for instance a vertical post with a rafter member. This object I accomplish by my new and improved means, hereinafter described, for connecting the elements together.

Another object in view is the provision of a new and improved connector for rigidly attaching the structural element to a post or vertical support. This object I accomplish by my improved sleeve-bracket hereinafter described.

Another object in view is the provision of a new and improved footing or support particularly intended for the under support of one of the elements when the latter is employed as a post or vertical member of a structure. This object I accomplish by the provision of my improved footing member hereinafter described.

Another object in view is the provision of means for supporting and anchoring the ends of the element when it is employed as a horizontal beam or rafter to support a platform, a floor structure or the like, or when it is placed in an inclined position, as in a roof structure.

This object I accomplish by the provision of a new and improved stirrup in which the end of the element is stepped.

Another object which I have in view is the provision of means for supporting joist or rafters from my improved structural element. This object I accomplish by means of the new and improved hanger hereinafter described.

Another object which I have in view is the provision of new and improved means for cross-bracing the elements when they are used in parallelism in roof or floor construction. This I accomplish with the means hereinafter described.

Other objects, and also other novel features of construction, and also of arrangement of parts, will appear from the following description.

In the accompanying drawings, wherein I have illustrated a practical embodiment of the principles of my invention, Fig. 1 is a broken elevation showing three of my improved structural elements connected together end to end.

Fig. 2 is an enlarged elevation showing the connection between elements.

Figs. 3 and 4 combined form an exploded view of the parts illustrated in Fig. 2.

Fig. 5 is a cross-sectional view taken along the line 5—5 in Fig. 2.

Fig. 6 is an elevation showing my improved element horizontally disposed and connected to a vertical post by means of my improved sleeve-bracket connector, the sleeve being shown in section.

Fig. 7 is a view looking from the left in Fig. 6 and illustrating the method of mounting the structural element on the connector.

Fig. 8 is an elevation of the sleeve-bracket connector.

Fig. 9 shows the structural element vertically disposed and undersupported by my improved footing.

Fig. 10 is an exploded view of the parts shown in Fig. 9.

Fig. 11 is a front view of my improved stirrup for supporting the end of the structural element when in a horizontal position, the element being indicated in cross section.

Fig. 12 is a side elevation of the same.

Figs. 13 and 14 are, respectively, front and side elevations of my improved hanger by means of which other elements such as joist and rafters may be supported from my improved structural element.

Fig. 15 illustrates the method of cross-bracing parallel elements when they are used to support platforms, floors, roofs, etc.

Referring to the drawings, 10 indicates the structural element or unit comprising the longitudinally disposed rails 11 and 12 which are permanently held in relatively close parallelism by the transverse struts 13. The rails and struts are preferably steel and tubular, the ends of the struts being welded firmly to the rails. One end of each rail is provided with a longitudinally extending socket which conveniently may be the bore of the tube, while its other end is provided with a pin 14 of reduced diameter providing a circumferential shoulder 15 at the base of the pin. Conveniently the pin ends may be formed by driving a suitably sized solid steel pin to the proper extent into the end of the tubular rail and welding or otherwise securing it permanently in place. The over-all length of the rails is the same, preferably ten feet for convenient handling

of the units. The pin end of one of the rails, as 11, is at the opposite end of the unit from the pin end of the other rail, so that when two units 10 are to be connected end to end the socket end of one of the rails of the first unit receives the pin end of the corresponding rail of the second unit, and the socket end of the other rail of the second unit receives the pin end of the corresponding end of the first unit. When the units are assembled the shoulders 15 abut against the ends of the corresponding rails of the other unit.

Closely adjacent to the ends of the units are the transverse struts 13*a* which not only stiffen and strengthen the ends of the units but also provide additional anchorage for the steel webs 16 which are pieces of steel plate cut to fit between the rails 11 and 12 and which are welded to the rails and the struts 13*a*. The plates are cut away as at 17 to provide clearance to enable the socket on the end of the rail of the aligned unit to slide over the pin.

The webs 16 are offset laterally sufficiently to permit the webs at the ends of adjacent units to overlap as shown in Figs. 2 and 5. The webs at opposite ends of a unit are offset to opposite sides.

The overlapping portions of the webs of two units when joined, as shown in Fig. 2, are provided with holes 18 which are in registry to receive a clamping bolt and nut 19.

Where non-aligned elements are to be connected together, the pin and socket of at least one of the elements would be disposed at the proper angle to provide the desired angular relation between the elements when connected together, and the webs of the two units would be likewise disposed so as to overlap.

It is thus seen that the union between two associated units is firmly braced, the entire load and all the torsion not being carried by the pin and socket connections, but also by the webs and the bolt, thus distributing the forces over the struts 13*a* and the rails 11 and 12 of the two units. Thus whether used as vertical supports or posts, or horizontally as a brace, girder or sleeper, or in an inclined position as a roof beam, the bending stresses are adequately distributed and assumed by the rails and struts of the units and not confined to the pin and socket joints. Therefore the units may be extended to relatively great lengths or heights without rendering the structure, formed thereby, weak or unsafe.

In Figs. 6, 7 and 8, I illustrate the novel connector for attaching my improved unit to other structural elements, such as the post 20, which may itself be one of my improved units.

The connector comprises the steel sleeve 21 of proper interior diameter to slip down over the post 20 or one of the rails of the vertical unit if such a unit be employed as the post, and the bracket plate 22 which is disposed longitudinally and radially of the sleeve and permanently welded thereto. The bracket is provided with substantially semi-circular seats 23 cut out of its ends and is of proper length so that it will span the space between the rails 11 and 12 with the rails snugly engaged in the seats 23 as shown in Fig. 6. The bracket 22 is provided at its center with a bolt hole 24 to receive a threaded stud 25 protruding laterally from the adjacent strut 13 of the horizontal unit, so that after the unit has been mounted on the bracket the nut 26 may be screwed up on the stud against the bracket and the unit is clamped snugly to the post. Thus a firm and rigid connection is effected.

In Fig. 7 I have illustrated how a unit may be mounted in place on the bracket 22 after the connector has first been mounted on the post 20. The unit is first canted out of the horizontal as shown in dotted lines in the view, so that it will provide clearance for the bracket 22. The unit is then swung into a horizontal position as shown in dotted lines, whereupon the rails 11 and 12 of the unit engage the seats 23 and the strut 13 fits against the side of the bracket with the stud 25 protruding through the hole 24 in the bracket, and the nut 26 may then be screwed up on the stud against the bracket.

It is of course necessary to prevent the rotation of the sleeve 21 on the post 20. I effect this by notching the lower end of the sleeve as at 27, which enables the lower end of the sleeve to straddle the cross brace or rung 28 extending from the post 20. It will be noted that the upper end of the sleeve 21 is provided with a similar notch 29 disposed in angular relation at ninety degrees from the position of the notch 28. Thus by reversing the connector, the sleeve may straddle a cross brace extending in another direction from the post. As both ends of the bracket are identical the connector may be employed in engagement with cross braces extending in different horizontal directions.

In these figures of the drawings I have shown the connector used to connect horizontally disposed units to vertical posts, but it will be understood that by disposing the bracket angularly to the axis of the sleeve the unit may be mounted in a position angular to the horizontal.

In Figs. 9 and 10, I illustrate the use of one of my improved units as a vertical post or member, and the provision of a footing or undersupport for the same.

Thus 30 is the footing provided with a suitable base 31 which may be a flat plate preferably provided with holes 32 for bolting it to a suitable foundation.

Erected on the base is the socket 33 of proper diameter to snugly receive the pin 14 on the lower end of one of the rails 11 of the unit 10 and of proper length to engage the shoulder 15 at the base of the pin when the latter is stepped in the socket 33. The end of the other rail 12 seats flatly on the base 31. The base 31 is also provided with the vertical web 34 welded at two of its edges to the socket 33 and the base 31 and disposed to overlap in surface contact the web 16 of the unit 10 as the unit 10 is stepped in position on the footing. The web 34 is provided with a hole 35 which registers with the hole 18 in the web 16, so that a bolt and nut 36 are used to clamp the two webs 16 and 34 together, thus securely attaching the post to the footing.

If desired the footing may be mounted on casters or rollers to render the assembled structure portable.

It is further evident that by suitably mounting the footing 30 in other positions, such as with the socket 33 horizontal or inclined, the unit 10 may be supported at any desired angle to the vertical.

In Figs. 11 and 12, I illustrate means for supporting the units in a horizontal position. Thus 37 is a stirrup support, comprising a back wall 38, a base wall 39, integral with the back wall and a vertically disposed stirrup formed by parallel side walls 40 merging into the rounded bottom or end wall 41. The walls 40 are sufficiently spaced apart to receive the unit with its lower rail 12 seated on the rounded bottom of the stirrup. When used in this manner, as for floors, or roof

beams, the ends of both rails of the unit are preferably tubular, or in other words the rails are unprovided with pin ends but the tubular rails extend to the ends of the units. The back and base walls are provided with bolt holes **42** to enable the stirrup to be attached to a foundation or wall. It is evident that by attaching the stirrup to an inclined surface the units may be mounted in an inclined position as in roof construction.

In Figs. 13 and 14 I show the unit used as a floor or ceiling beam for the support of wooden joist or rafters **43**. For this purpose I provide the hanger **44** which straddles the unit, being provided with a flat surface **45** which is arcuate at the top to ride on the top rail **11** of the unit and extends down vertically at either side to fit the unit laterally and hold the hanger in place. At either side the twin wing walls **46** extend outwardly, increasing in width downwardly and with the bottom walls **47** forming snugly fitting pockets in which the ends of the joist or rafters **43** are stepped and, if desired, anchored by means of bolts extending through the holes **49** and the joist or rafters.

In Fig. 15 I illustrate the method of bracing my units where they are used in parallelism as, for instance, in floor construction. The struts **13** of the units are provided with threaded studs **50**. **51** represents brace crossed rods whose pierced ends are engaged in said studs and held in place by nuts while the rods are bolted or wired together at the points of crossing.

It is evident from the foregoing that my improved structural element or unit is of great usefulness in both permanent and temporary construction work and may be employed for many different purposes.

When used in the erection of scaffolding and other temporary structures, it has the marked advantage of relative light weight, so that it may be conveniently handled in assembling and disassembling. It is strong and rigid, and the means which I provide for connecting the elements together and to other elements render the assembled structure of great value because of its strength and rigidity.

I claim:

1. A structural element comprising a pair of members in parallel spaced apart relation, the end of one of the members being provided with a tubular socket and the adjacent end of the other member being provided with a pin for insertion in a socket of another structure, and a plate rigidly attached to the end of the structural element and spanning the space between the parallel spaced apart members, the plate extending outwardly adjacent the pin member but spaced apart therefrom, whereby the pin may be inserted in a socket and the plate attached to a like plate on another structure.

2. A structural element comprising a pair of members in parallel spaced apart relation, the end of one of said members being provided with a tubular socket and the adjacent end of the other member being provided with a pin for insertion in a socket of another structure, a transverse member rigidly connecting said parallel members adjacent their ends, and a plate spanning the space between the parallel spaced apart members and the transverse member and rigidly attached thereto and extending outwardly adjacent the pin but spaced therefrom, whereby the pin may be inserted in a socket and the plate attached to a like plate of another structure.

3. The combination of a structural element provided with a pair of parallel members in spaced relation, at least one of said members being provided at its end with means for telescopic pin and socket connection with a second structural element and also provided with a plate rigidly attached to the end portions of the parallel members and extending outwardly, with a footing element provided with a platform for the undersupport of the first mentioned structural element and means in telescopic pin and socket connection with the telescopic means of the first mentioned structural element and said footing element also provided with an upwardly extending plate overlapping and attached to the first mentioned plate, the plate carried by the element provided with the pin of such telescopic connection being spaced from said pin.

4. The combination of a structural element provided with a pair of parallel members in spaced relation, at least one of said members being provided at its end with a pin for telescopic pin and socket connection with a second structural element and also provided with a plate rigidly attached to the end portions of said members and spanning the space therebetween, said plate extending outwardly adjacent to but spaced from said pin, with a footing element provided with a platform for the undersupport of said first mentioned structural element and a socket in telescopic connection with the pin of one of the longitudinal members of the latter, and said footing element also provided with a plate extending upwardly therefrom and attached to the first mentioned plate.

5. A footing element, for the undersupport of a structural element provided with means for telescopic pin and socket engagement and also with a plate rigidly attached to the end portion of the structural element, said footing element comprising a base upon which said structural element is supported, upwardly extending telescopic means complementary to the telescopic means of the structural element and arranged to interengage the same, and a plate rigidly attached to the base and extending upwardly to overlap and be attached to the corresponding plate of the structural element.

6. A footing element for the undersupport of a structural element provided with a pin for telescopic engagement with a socket and also provided with a plate rigidly attached to the end portion of the structural element, said footing element comprising a base upon which said structural element is supported, and an upwardly extending socket to receive the pin of the structural element and a rigidly attached upwardly extending plate to overlap and be attached to the corresponding plate of the structural element.

7. A footing element for the undersupport of a structural element provided with a pin for telescopic engagement with a socket and also provided with a plate rigidly attached to the end portion of the structural element, said footing element comprising a base upon which said structural element is supported, and an upwardly extending socket to receive the pin of the structural element and a rigidly attached upwardly extending plate to overlap and be attached to the corresponding plate of the structural element, the plate of the structural element being spaced apart from the pin to permit the insertion of the pin in the socket.

GEORGE W. CAUSEY.