July 19, 1966 J. E. KINNEAR 3,261,309

FRAMEWORK STRUCTURES

Original Filed Jan. 5, 1953 2 Sheets-Sheet 1

FIG. 1.

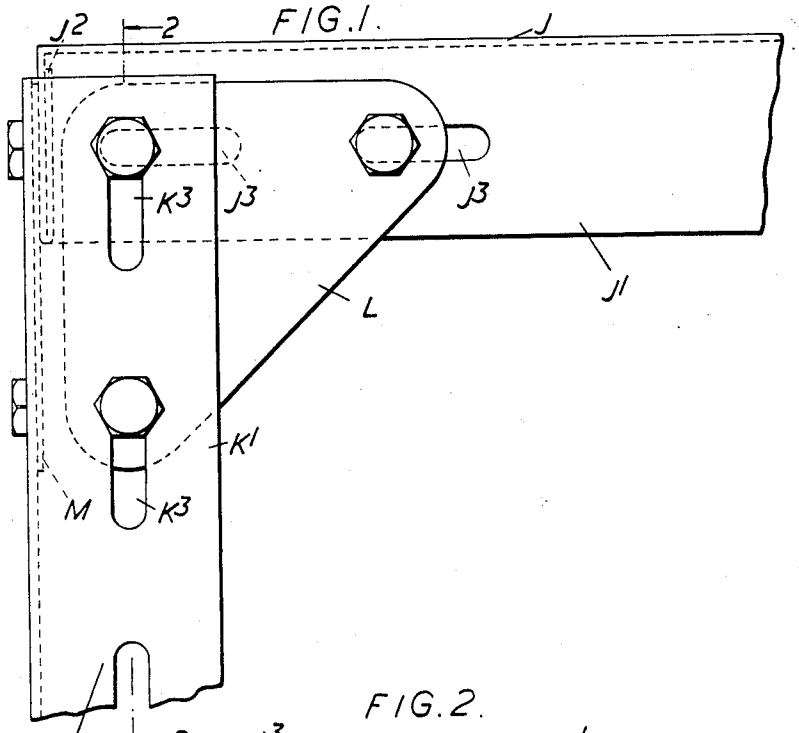
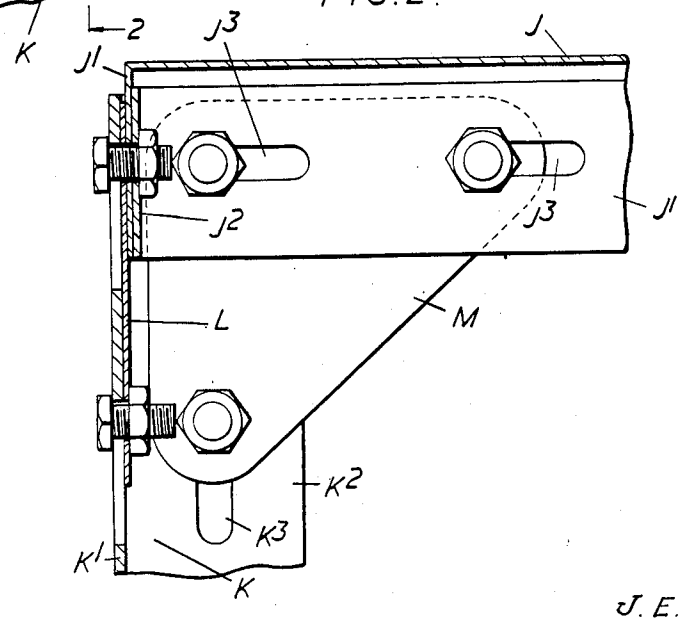


FIG. 2.



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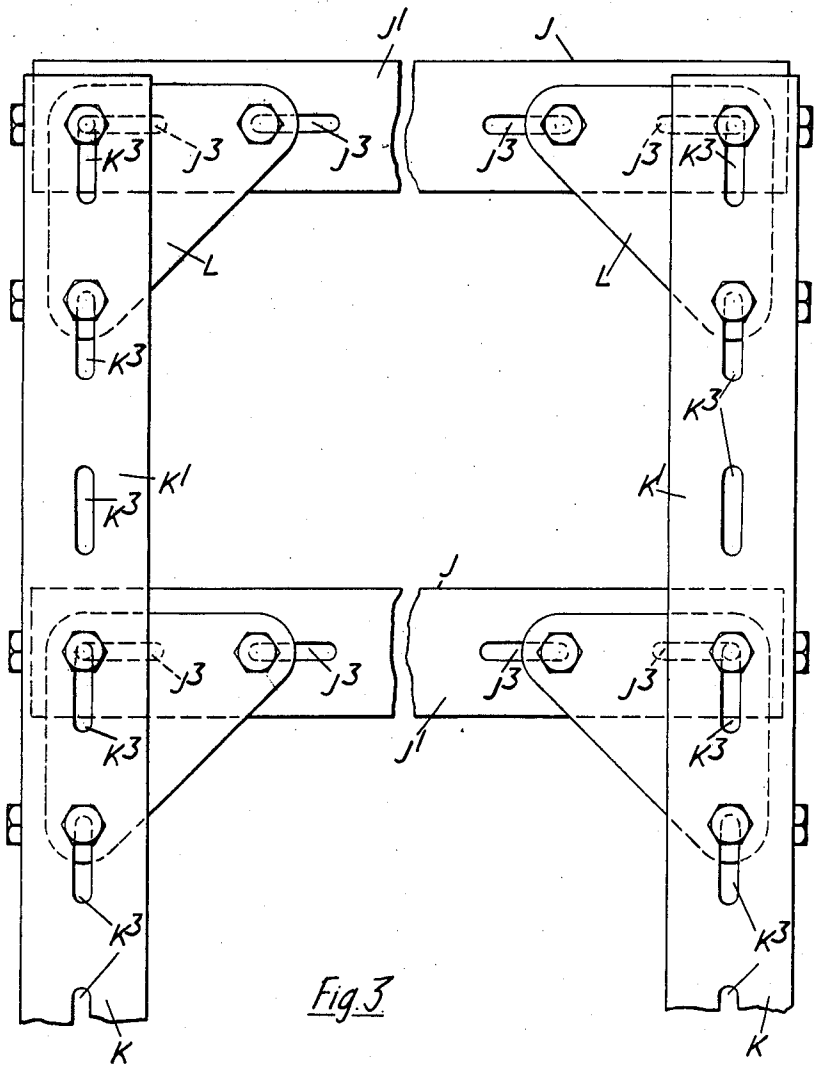


Fig. 3

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FRAMEWORK STRUCTURES

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Original application Jan. 5, 1953, Ser. No. 329,493. Divided and this application May 6, 1963, Ser. No. 278,154

6 Claims. (Cl. 108—156)

This application is divisional from my pending application Serial No. 30,395, filed on April 4, 1960 (now U.S. Patent No. 3,117,656) and bearing date from January 5, 1953, the filing date of my earlier application Serial No. 329,493 (now abandoned). The invention relates to a framework structure built up from perforated elements bolted together and including one or more shelves. Hitherto, in such structures, it has been customary to build up a skeleton framework including both vertical and horizontal strips and to support a shelf element on the horizontal strips.

The present invention has for its object to provide a simple and efficient shelf structure, which will have adequate strength and rigidity to support heavy weights, but which requires less steel or other material and less labour in erection than prior known arrangements.

This is achieved according to the invention by means of an arrangement somewhat analogous to that forming the subject of the above-mentioned copending application Serial No. 30,395. Such copending application relates to a framework structure including two angle strips arranged with their lengths at right angles to one another and each having an L-shaped cross-section with a single row of aligned equally spaced elongated slots in each of the two webs of the strip, one end portion of one of the webs of one of said strips lying in a plane parallel to and overlapping one web of the other strip with the non-overlapping webs of said angle strips projecting in the same direction away from said overlapping webs, a generally triangular flat anchor plate sandwiched between and directly supported against buckling by the overlapping webs of the two strips and having three bolt holes spaced at the corners of a right-angled triangle, the length of each of the shorter sides of which is not less than that required to accommodate two bolts respectively passing through the adjacent ends of two consecutive slots in the strips and is not greater than that required to accommodate two bolts respectively passing through the remote ends of such two consecutive slots, and three bolts passing respectively through the three bolt holes in the anchor plate and also through slots in the angle strips for tightly bolting the strips and the anchor plate together, said structure comprising also a third similar angle strip having its webs bolted to the non-overlapping webs of said two angle strips so as to extend at right angles thereto, and at least one similar anchor plate sandwiched between a web of said third strip and the web to which it is bolted.

The framework structure according to the present invention includes a shelf member consisting of a rectangular sheet having at each edge a turned-down flange provided at each end with two aligned slots, an angle strip at each corner of the shelf member disposed with its length at right angles to the shelf surfaces, said angle strip having an L-shaped cross-section and comprising two webs, each of which extends across one of said flanges and lies in a plane parallel thereto with a portion of each web registering with an end portion of the shelf flange to which it is parallel, each web being provided with a row of slots longitudinally therealong, a generally triangular anchor plate sandwiched between each shelf flange and the angle strip portion registering therewith, each anchor plate having three bolt holes spaced at the corners

of a right-angled triangle and registering with slots in at least one of said angle strip web and shelf member flange, and three bolts passing respectively through the three bolt holes in each anchor plate and also through the slots registering therewith for bolting together the shelf member, the angle strips and the anchor plate.

The lengths of the aligned slots at the ends of each shelf flange are preferably such as to accommodate the securing bolts, whether the angle strips at the corners of the shelf are outside or inside the shelf flanges.

Preferably, each shelf flange is of double thickness formed by bending the material back on itself, the bolts passing through both layers of the flange.

A preferred practical arrangement according to the invention is illustrated by way of example in the accompanying drawings, in which

FIGURE 1 shows in side elevation the mounting of one corner of a shelf,

FIGURE 2 is a sectional view taken on the line 2—2 of FIGURE 1, and

FIGURE 3 is a side elevational view (on a somewhat reduced scale) of a complete shelf, with a further similar shelf beneath it.

In this arrangement, the shelf element J comprises a rectangular steel sheet J with a turned-down flange J^1 at each edge. Each flange J^1 is of double thickness formed by bending back the metal on itself, as shown at J^2, in order to provide added strength. Each double flange J^1 is provided at each end with two slots J^3 of the same shape and spacing as the slots in the angle strip, now to be described.

The shelf element J is supported at each of its four corners by means of an angle strip K of L-shaped cross-section fitting outside the corner and extending with its length at right angles to the shelf surface. This angle strip K is similar to the angle strips used in the framework structure described in the specification of the copending application above mentioned, and comprises a strip of steel, of any desired length and having a width for example of the order of three inches, bent through a right angle along its centre line. Each of the two webs K^1, K^2 has a single row of aligned elongated slots K^3 extending along its whole length, the slots all being of the same length and being equally spaced from one another. The slot width is chosen to suit the bolts used, say of a quarter of an inch diameter, with just sufficient clearance for ready and easy insertion of the bolts. The slots K^3 in the two webs K^1, K^2 are preferably arranged in register with one another, so that, if the strip is transversely cut through the mid-point of a space between two slots in one of the webs, the cut will likewise pass through the mid-point of the space between two slots in the other web. The preferred pitch for the slots is of the order of two inches, and the length of each slot is not less than the space between two consecutive slots. The space between the inside surface of one web and the near edge of a slot in the other web preferably exceeds the space between the other edge of the slot and the free edge of the web and also exceeds half the space between two consecutive slots.

Each web K^1 or K^2 of the angle strip is bolted to one of the shelf flanges J^1, with an anchor plate L or M sandwiched between to provide a strong right-angled joint. This anchor plate again is similar to that used in the framework structure of the copending application above-mentioned and consists of a flat thin steel plate of generally triangular shape having three bolt-holes located at the corners of an isosceles right-angled triangle, the length of each of the shorter sides of the bolt-hole triangle being such that the two bolts through its holes can engage in two consecutive slots K^3 in an angle strip or in the two

slots J^3 at one end of a shelf flange. This anchor plate L or M, as mentioned above, is sandwiched between the angle strip web K^1 or K^2 and the shelf flange J^1, and the three bolts passing through the three bolt holes of the anchor plate and the associated slots in the angle strip web or the shelf flange provide an adequate joint for securing the shelf flange rigidly in position at right angles to the angle strip web. A very large portion of the area of the anchor plate thus lies in close engagement with the angle strip web or the shelf flange, and there is only a relatively small exposed unsupported triangle. Thus the length of the unsupported edge portion of the anchor plate measured along the hypotenuse of the bolt-hole triangle should not be greater than the length of either of the portions of such hypotenuse which are supported by one of the angle strip webs. So long as the hypotenuse of the anchor plate triangle is in tension, it will have great strength, and it will be clear that when all four corners of the shelf are properly bolted up, most of the stresses in the complete framework will be taken up tensionally by one or more of the anchor plates, so that an anchor plate will not often have to withstand a buckling load. The fact that a large proportion of the area of the anchor plate is directly supported by the angle strip web or shelf flange greatly increases the resistance of the plate to buckling, and in practice even a thin plate will withstand quite a big buckling stress before its small exposed triangle begins to buckle. The resistance to buckling can be still further increased, if desired, by providing the middle portion of the hypotenuse of the triangle with a strengthening rib or flange.

The shelf element may be mounted at any convenient height on the vertical angle strips, and there may be two or more shelf elements J (as shown in FIGURE 3) at different heights on the same vertical strips. If, as shown, the shelf element is attached to the top ends of the supporting angle strips, it can be used as a table, and in such case it will be clear that the four angle strips may be attached inside the corners of the shelf element instead of outside, if preferred, the slots J^3 in the shelf flange being long enough to accommodate the bolts in such position.

It will be appreciated that the various modifications in the arrangement of the angle strips and anchor plates described in the specification of the copending application are equally applicable to the present invention. For instance, two or all of the bolt holes in the anchor plate may be made square for cooperation with square-shouldered bolts, if desided.

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

1. A framework structure built up from perforated elements bolted together, and including a shelf member consisting of a rectangular sheet having at each edge a turned-down flange provided at each end with two aligned slots, an angle strip at each corner of the shelf member disposed with its length at right angles to the shelf surface, said angle strip having an L-shaped cross-section and comprising two webs, each of which extends across one of said flanges and lies in a plane parallel thereto with a portion of each web registering with an end portion of the shelf flange to which it is parallel, each web being provided with a row of slots which extends longitudinally therealong, a generally triangular anchor plate sandwiched between each shelf flange and the angle strip portion registering therewith, each anchor plate having three bolt holes spaced at the corners of a right-angled triangle and registering with slots in at least one of said angle strip web and shelf member flange, and three bolts passing respectively through the three bolt holes in each anchor plate and also through the slots registering therewith for bolting together the shelf member, the angle strips and the anchor plate.

2. A framework structure as claimed in claim 1, in which each shelf flange is of double thickness formed by bending the material back on itself, the bolts passing through both layers of the flange.

3. A framework structure as claimed in claim 1, in which the lengths of the aligned slots at the ends of each shelf flange are such as to accommodate the securing bolts, whether the angle strips at the corners of the shelf are outside or inside the shelf flanges.

4. A framework structure as claimed in claim 1, in which the length of the unsupported edge portion of the anchor plate measured along the hypotenuse of the bolt-hole triangle thereof is less than the length of either of the portions thereof (also measured along the said hypotenuse) which are supported by one of the angle strip webs.

5. A framework structure as claimed in claim 4, in which the peripheral edge of the anchor plate lies wholly outside the triangle formed by the three bolt holes in the plate, whereby the material of the plate is continuous and uninterrupted along each of the three sides of the bolt hole triangle.

6. A framework structure as claimed in claim 1, in which the slots in the two rows in each angle strip are positioned in register with one another, and the space between each pair of consecutive slots in the row in each web of each angle strip has a length less than twice the space between the inner side edge of a slot and the inner surface of the other web.

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