(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 049 096**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 81304358.5

(22) Date of filing: 22.09.81

(51) Int. Cl.³: **E 04 G 11/48**, E 04 G 7/06, E 04 G 1/12

(30) Priority: **29.09.80 CA 361888**
31.03.81 US 249732

(43) Date of publication of application: **07.04.82**
Bulletin 82/14

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

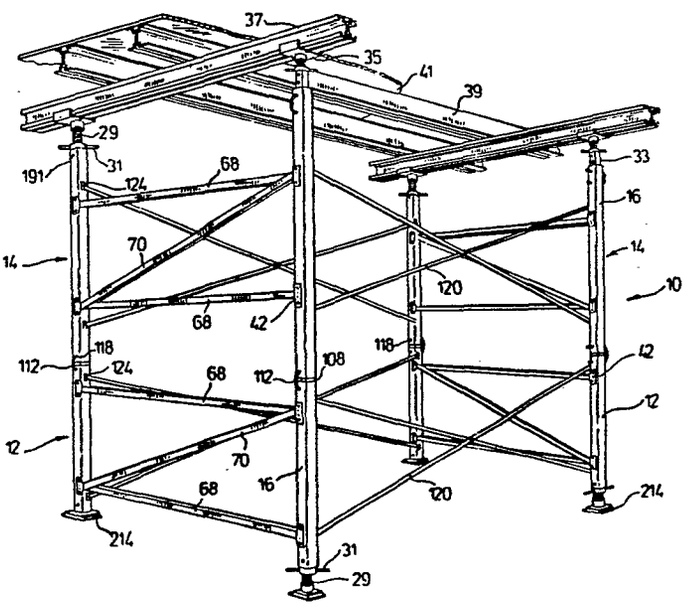
(71) Applicant: **ALUMA SYSTEMS INCORPORATED,**
4800 Dufferin Street, Downsview Ontario M3H 5S8 (CA)

(72) Inventor: **Johnston, Ronald J., 14 Regan Crescent,**
Georgetown Ontario L7G 1B1 (CA)

(74) Representative: **Fisher, Bernard et al, Raworth, Moss & Cook 36 Sydenham Road, Croydon Surrey CR0 2EF (GB)**

(54) Bolted aluminium shoring frame.

(57) A frame (12, 14) for supporting vertical loads and an aluminium tubular leg (16) for such frame (12, 14) is disclosed. The legs (16) are joined by a brace (68, 70, 120) arrangement and connectors are used for mechanically connecting the brace (68, 70, 120) arrangement to the legs (16) for stabilizing the legs (16) when under load. Each of the legs (16) has spaced portions which are substantially symmetrical about a plane containing the longitudinal axes of the frame legs (16) and which provide areas for mechanical connection of the brace (68, 70, 120) arrangement to the leg (16). Such mechanical connection of the frame (12, 14) provides a versatile frame (12, 14) which may be used in concrete forming work and which may be readily repaired.



EP 0 049 096 A1

Bolted Aluminum Shoring Frame

This invention relates to vertical load supporting frames and legs therefor and, more particularly, to frames and legs which may be used in the concrete forming industry.

In the field of concrete forming, several structures are available for supporting panels which define floor areas onto which concrete is poured. In situations where there is sufficient area surrounding the building being constructed and the construction is above ground, a large scale concrete forming structure of the type disclosed in Avery, United States patent 3,787,020 issued January 22, 1974 is advantageously used. Such structures can be rolled out from underneath a poured set floor, raised by crane and placed on the freshly set floor to support panels defining the next floor. Such concrete forming structure is made of aluminum beams and truss components having hinged screw jacks associated with the lower portion of the structure to facilitate levelling of the forming structure prior to pouring and removal of the structure from under the set concrete floor.

Other types of aluminum structures, which are used in the concrete forming industry, are, for example, disclosed in Dashew, United States patent 3,966,164 issued June 29, 1976. The patent discloses an adjustable truss support, wherein a bolted trusss has vertical column members forming components of the trusses. Lower column members may be inserted in the trusses to provide supports having

height adjustment and force determination so as to be able to support the truss loads. The truss construction is not entirely of aluminum and, in particular, the column members are made of steel. The choice of steel is because of its strength characteristics compared to aluminum. This results in a structure having mixed materials with some chance of galvanic corrosion.

Van Meter, United States patent 4,037,466 issued July 19, 1977, discloses concrete shoring structure which may be moved about by use of a crane. The structure comprises corner posts spaced in quadrilateral relationship, supporting pairs of stringers along opposed sides of the quadrilateral so formed. In the structure, a number of pins are used to secure cross-braces in two different directions where the spacing between the corner posts can be easily changed. Arrangements are made using a shackle on each post to lift the structure and telescopically engaged staffs are secured within the corner posts by pins for adjusting the height of the structure. However, the structure has limited effectiveness and, in any event, requires considerable assembly at the site. The pins in most instances are welded to the supporting structure, so that if they are damaged or broken they cannot be easily replaced or repaired in the field.

Cody, United States patent 4,106,156 issued August 15, 1978, discloses an adjustable concrete shoring apparatus. A truss-like structure has a plurality of diagonal struts extending between pairs of back-to-back channels which form upper and lower cords of the truss. The adjustability in the Cody structure comes as a consequence

of a series of holes through which bolts may be passed in the plurality of truss forming locations, by which the spacing between upper and lower cords can be adjusted, but also by which the load capacity of the truss is affected. The Cody structure is one which can be adjusted in the field, but in order for it to be manupilated by hand, it must be totally disassembled.

In situations where sub-basements, parking garage floors below ground level, and smaller scale installations where cranes of suitable capacity are not readily usable, a lightweight shoring frame is desirable for supporting structure onto which concrete floors may be poured. Such shoring frame supports stringers across which beams, such as those disclosed in United States patent 4,144,690 issued March 20, 1979 and 4,146,999 issued June 5, 1979, may be placed. Commonly, such shoring frames have been made from welded steel components which, when damaged in the field, cannot be replaced so that the complete frame must be scrapped or possibly repaired by rewelding.

According to this invention, a frame is provided which may be machanically assembled and disassembled, yet when assembled provides an extremely rigid and high load-bearing capacity frame. The provision of mechanical disassembly provides for repair and/or replacement of components in the frame at the job site without the use of special welding techniques or tools. The legs of the frame are made of aluminum to provide a lightweight structure.

A frame, according to this invention, for supporting

vertical loads comprises a pair of spaced aluminum tubular legs joined by a brace arrangement which is mechanically connected to the legs. The brace arrangement is adapted to stabilize the legs when under load. Each of the legs has provision for mechanical connection of the brace arrangement to the respective leg. The relationship of the connections is such to provide, when the frame is complete, a fixed mechanical connection of brace arrangement to frame legs. Each of the legs has spaced portions which are substantially symmetrical about a plane containing the longitudinal axes of the frame legs. The spaced portions provide areas for mechanical connection of the brace arrangement to the legs.

The leg for the frame may have the spaced portions extending outwardly from the leg wall away from leg axis. Fastener means mechanically connects a component to the brace arrangement which cooperates with the spaced portions to such leg. The spaced portions may be integral with the leg or a support means for such spaced portions may be secured to such leg.

The frame may have means for mechanically connecting the brace arrangement to the legs. Each leg has the spaced portions in the form of spaced wall portions which are substantially symmetrical about the plane containing the longitudinal axes of the frame. The spaced wall portions provide areas for mechanical connection of the connector means to the legs.

Each of the connector means straddles the leg for connection to the respective areas of the spaced wall

portions with at least portions of the interior surface of the connector being adjacent at least corresponding portion of leg exterior surface between the spaced wall portions. This relationship provides for a fixed interconnection of brace arrangement to leg when the assembly is complete.

The leg, adapted for use in the frame according to an aspect of the invention, has spaced stepped wall portions which are substantially equidistant from the longitudinal axis of the leg and are substantially symmetrical about the plane containing the longitudinal axes of the legs when used in the frame. The stepped wall portions provide areas for mechanical connection of the connector means to the leg. At least portions of the leg exterior surface between the spaced stepped wall portions are adapted to be adjacent the interior surface of the connector means when used in mechanically connecting a brace arrangement to the leg.

The leg for the frame, in having the stepped wall portions, may be so formed to displace the areas for mechanical connection outwardly of the leg longitudinal axis to accommodate securement means without substantially obstructing the leg interior.

The aluminum leg may be formed by an extrusion process, whereby the spaced wall portions are provided along the length of a leg to accommodate and facilitate mechanical connection of components of the brace arrangement to any desired position along the leg.

Preferred embodiments of the invention are shown in the drawings, wherein:

Figure 1 is a perspective view of frames according to this invention interconnected by cross-bracing arrangements to provide supports for concrete forming structure;

Figure 2 is an exploded view of the assembly of bracing components to be connected to a frame leg by way of a mechanically fastenable connector;

Figure 3 is a cross-section through a leg of Figure 2 having the connector mechanically fastened thereto, according to an alternative embodiment;

Figure 4 is an isometric view of a mechanical fastener used in securing the connector of Figure 3;

Figure 5 shows a portion of the leg, according to this invention, having a slide lock assembly for cross-brace members secured to the leg;

Figure 6 is a cross-sectional view taken along lines 6-6 of Figure 5;

Figure 7 is an isometric view of a frame connector for use in aligning stacked frames;

Figure 8 is a cross-section view taken along the lines 8-8 of Figure 7;

Figures 9, 10, 11 and 12 are cross-sectional views showing alternative embodiments for the frame leg cross-section and brace arrangement connection thereto;

Figures 13, 14, 15 and 16 are cross-sections showing alternative embodiments for the cross-members of the brace arrangement which provide for mechanical fastening of articles thereto;

Figure 17 is a cross-sectional view showing an alternative embodiment for mechanically connecting the brace arrangement to the leg;

Figure 18 is an isometric view of an endcap assembly for the frame member;
Figure 19 is an isometric view of a base plate assembly for the frame;
Figure 20 is a side elevation of a tiltable stringer support for connection to the top fo a support frame; and
Figure 21 is an end elevation of the tiltable stringer support of Figure 19.

The general arrangement and use for frames, according to this invention, are shown in Figure 1. The assembly 10 comprises two sets of stacked frames 12 and 14. The difference between frames 12 and 14 is with respect to their heights; frame 12 being approximately four feet high and frame 14 being approximately six feet high.

At the upper ends of the uppermost shoring frames 14, there are endcaps in which may be inserted jack screws 29 having handles 31, as shown at the far side of the structure of Figure 1; or there may be extension staffs 33 inserted in the upper ends of the frame legs 16, and they may optionally carry jack screws and handles therefor at their upper ends. All of the jack screws of the upper ends terminate in U-heads 35 (or tiltable stringer supports as discussed hereafter), which support primary members which may be stringers or beams 37, across which are placed secondary members or beams 39 which support panel 41, in the known manner.

At the lower ends of the bottom most frames, there may be placed base plates 214, as discussed hereafter, which may directly terminate at the bottom ends of frame legs 16.

As shown at the far side of the structure of Figure 1, endcaps may be used to accommodate jack screws 39 having handles 31. Alternatively extension staffs may be placed in the bottom ends of the frame legs.

Various shapes may be provided for the frame legs and the devices for mechanically fastening the brace arrangement to the frame legs. Preferred embodiments for the shapes of the legs and connectors are shown in Figures 2, 9 through 12 and 18. With reference to Figures 2 and 3 of the drawings, this is a preferred frame leg shape and connector therefor. In the leg 16, identical faces 18 and 20 are shown (designated front and back faces) and identical faces 22 and 24 are shown (designated side faces and more specifically the outer side face and the inner side face with respect to the leg shown). On the side faces 22 and 24 are found ridges 26. Each of the front, back and side faces has a pair of shoulders 28, (on the front and back faces) and 30 (on the side faces), with ridges 26 being more specifically associated with shoulders 30. The profile of the frame leg is, therefore, substantially rectilinear with corners 32, so that the inside surfaces 34 and 36 of the front and back faces 18 and 20, respectively, are stepped forward and rearward, respectively, of the corners 32.

The stepping forward and rearward of the inner surfaces 34 and 36 of the corners 32 permits an accommodation of bolt heads 40 in Figure 2, or fastener plates 38 in Figure 3 for bolts 40 which pass through holes formed in the front and back faces. That is, the entire fastener 38 (or a bolt head as discussed hereafter) can be installed in such

a manner, within the frame leg, without substantially obstructing insertion of another member for sliding up or down within the frame leg fitted about the corners 32.

Each frame leg 16 has a connecting bracket 42 secured to it, one near the top and bottom of each such frame leg. An exploded view of the assembly of the connecting bracket and other structure to the frame leg is shown in Figure 2.

Two alternative methods, by which each connecting bracket may be secured to the frame leg 16 at its respective position by bolts 40 which pass through opposed pairs of holes 44 formed in each of the front and back faces of each frame leg, are shown in Figures 2 and 3. As shown in Figure 3, each bolt 40 may be inserted with its bolt head at the outside of the front or back face, against a "lock" washer 43, with each bolt 40 threadedly engaged to a fastener 38. Alternatively, the bolts 40 may be passed from the inside of the frame leg 16 to the outside, engaging nuts 45, as shown in Figure 2. Common to either arrangement is that the opposing stepped sidewalls at 34 and 36 provide areas at bolt holes 44 for mechanically fastening the connector to the leg. Such areas of connection are substantially equidistant from leg axis 23 and are substantially symmetrical about the plane 21 which contains the axes 23 of both legs in the frame.

With specific reference to Figure 4, the fastener 38 is shown, which serves the purpose of a bolt retaining means. The fastener 38 has a central portion 48, in which there are formed holes 50 and upstanding portions 52 which are tapped or threaded as at 54 near each end. The

spacing between the neck or upstanding portions 52 is the same spacing as between the holes 44 in the front and back faces of the frame leg 16. The fastener 38 is preferably formed of steel and the neck portions 52 are formed in it by upsetting, extruding or drawing, after which they are tapped at 54. Alternatively, the fastener plate may be pierced or drilled and thereafter tapped to form the threaded portions 54 which engage the bolts 40 as referred to above. When the fastener 38 is in place, on one of the inside surfaces of the frame leg, the bolts 44 are threaded into portions 54 and tightened against lock washers 43.

The fastener 38 provides two threaded apertures which are fixed relative to one another. This facilitates the connection of both bolts 40 to the fastener, because as soon as one bolt is threaded into the fastener 38, the location of the threaded opening 54 relative to the opening 44 in the leg is aligned. In addition, the fixed relationship of the two fastener openings 54 prevent relative rotation during the threading and tightening of bolts in mechanically connecting the connector 42 to the leg 16. It is appreciated that other arrangements may be provided for the fastener 38, such as two nuts having threaded portions where the nuts are interconnected by a bar or the like to provide their fixed stationary relationship. The mating aspect of the fastener 38 with the interior of the stepped portion of the leg sidewalls also prevent rotation of the fastener device while the bolts are being tightened. Therefore, the stepped portions not only accommodate the fasteners so as to not appreciably obstruct the interior of the leg, but also in

providing a mating relationship with the fastener facilitate connection of the connector to the leg.

The holes 50 in the fastener 38 are provided to mate with the hole 51 in the frame legs. The holes are provided to accommodate adaptor pins and the like which are used in interconnecting the legs in a manner to be discussed.

As is particularly noted from Figures 2 and 3, each connecting bracket 42 is generally U-shaped when viewed from above, having a pair of lugs or legs 56, whose spacing between the inside surfaces of the lugs is slightly greater than the distance from front to back faces 18 and 20 of a frame leg. There is a pair of holes 58 in each leg 56 of the connecting bracket 42, the spacing between the holes 58 being the same as the spacing between holes 44 formed in each of the front and back faces 18 and 20 of each frame leg. The connection of each connecting bracket 42 to each frame leg is effected by means of bolts 40 and nuts 45 threaded thereto, or bolts 40 into connector or fastener plates 38. Another pair of holes 59 is also formed in each leg 56 of each connecting bracket 42, one of each of which registers with the hole 51 in the frame leg 16. Thus, it is seen that there is no designated up or down direction, nor a designated left or right end, for each connecting bracket 42.

The U-profile of each connecting bracket 47 is such that a base 62 is centrally located between the lugs 56 and is adapted to span and contact the side face 24 of the frame leg in the manner illustrated. A pair of stubs or plates 64 extends away from the base 62, in the opposite

direction to the lugs 46. The connector, therefore, functions as a support for the outwardly extending spaced plates 64. The spacing between the stubs 64 is less than the spacing between the lugs 56. The stubs 64 each have a hole 66 formed in them.

The connecting brackets 42 are preferably formed of extruded aluminum and are afterwards cut and drilled so as to have the side profile, as illustrated in various Figures of the drawings. The integrity of the connecting bracket as an extruded piece is thereby assured.

As shown in Figure 1, 2 and 3, each frame is assembled by mechanically connecting a pair of tubular horizontal braces 68, secured between and cooperating with a brace arrangement to the legs. The brace arrangement is constructed in a manner to stabilize the legs when the frame is under load. The brace arrangement comprises, according to this embodiment, pairs of connecting brackets 42, between opposite pairs of frame legs 16 and a diagonal brace 70 connected from the upper connecting bracket in one frame leg to the lower connecting bracket of the other frame leg. The horizontal braces 68 may be each identical to one another (except as discussed hereafter in respect of varying frame widths) and each diagonal brace 70 may be connected from left to right or right to left. It is understood, however, that other arrangements may be provided for the bracing between frame legs, as long as the required stability is provided. The ends of the components of any desired form of brace arrangement is, according to this invention, mechanically connected to the frame legs, so that the brace arrangement in its entirety

or its individual components are removable from the frame legs. With the particular brace arrangement shown, the horizontal members are arranged so as to be fixedly connected to the vertical legs at a 90 degree angle thereto.

According to the embodiment of Figure 1, each of the horizontal braces 68 is substantially a square or rectilinear tube, preferably of extruded aluminum. Each tube has front and back faces 72 and 74 and opposed top and bottom faces 76. Likewise, each diagonal brace 70 has similar front and back faces 80 and 82 and opposed top and bottom faces 86 respectively. The width and height of the diagonal braces 70 are greater than those of the horizontal braces 68.

There are two preferred alternative ways in which the horizontal braces 68 may be secured within the bolted shoring frame, particularly as to their connection to the connecting brackets 42. In the one alternative, the horizontal brace 68 is secured to the connecting bracket by a bolt 88 having bolt head 90 and nut 92 passing through holes 94 in the front and rear faces 72 and 74 of the horizontal brace 68 and through the holes 66 formed in the stubs 64 in connecting bracket 42. In the case where the tubular diagonal brace 70 is also secured to the connecting bracket, as in Figure 3, the bolt 88 passes through holes 98 formed in the front and rear face 80 and 82 of the diagonal brace as well and the length of the bolt 88 is chosen appropriately.

Alternatively, the horizontal braces 68 may be welded to

the connecting brackets 42 by a filet weld 100 made to horizontal brace 68 to the base 62 of the connecting bracket 42. These welds are shown in Figure 3 where there is no bolted connection of the free end of horitontal braces 68; i.e. the end which does not carry one end of a tubular diagonal brace 70, to the respective connecting bracket 42.

In yet another alternative assembly, the horizontal braces 68 may be both welded and bolted to the connecting brackets 42, combining all of the details discussed above.

Preferably as stated, each of the frame legs 16, horizontal braces 68, connecting brackets 42 and the diagonal brace 70 of each frame is formed of extruded alumimum. Suitable alloys of aluminum may include Standard Structural Aluminum Alloys 6061, 6351 and 7005 by way of example only.

A distinct advantage in the mechanical connection of a brace arrangement to the legs of the frame permits the use of a brace arrangement which may be made of materials different from the leg material. For example, the brace arrangement may be constructed of steel tubing or lightweight fibreglass. Either construction can be adapted to mate with the connectors 42 so as to be secured to the legs in the manner discussed in Figures 2 and 3.

The means by which the shoring frames are placed in extended height relationship one to another is by way of frame connectors 104 which are shown in Figures 7 and 8. Each frame connector 104 comprises a length of tubing 106,

preferably extruded tubular aluminum, which has a profile adapted to fit within the tubular frame legs 106, such as by means of rivets or bolts 110 or 112 (as alternatives for each other) and as indicated in Figure 8.

The profile of the connector tube 106 is such as to fit intimately within the frame legs 16 and the length of the connector tube 106 is not so great as to extend below or above the topmost or bottommost bolts 40 securing connector brackets 42 near the ends of the frame legs being extended. There may be a plurality of ribs 114 formed on the outside faces of the connector tube 106, so that the connector tube may be more accurately centered when it is inserted into any one of the tubular frame legs 16. Also so as to accommodate the insertion of the connector tube into the tubular frame legs 16, or the placement of a tubular frame leg over the connector, the ends of the connector 104 may be chamfered as indicated at 116.

The profile of the collar 108 is such as to cause interference with the end of a frame leg 16, to thereby preclude intrusion of the collar within the frame leg and assure that the length of connector tube 106, which is above or below the colar 108, extends into the respective frame leg. In the preferred embodiment, the profile of the collar 108 is the same as the profile of the frame leg and is simply a short piece of frame leg extrusion secured to the connector tube extrusion.

A U-shaped locking pin 112 secures the frame connector into the respective upper and lower frame legs. Each lock

pin 112 has two legs, one of which passes through holes 118 in the front and back faces of the appropriate frame legs and through holes 119 in the connector tubes 106, so that one leg of the lock pin 112 is above the collar 108 and the other leg is below the collar 108. In a preferred embodiment of the lock pin 112, one of the legs of the lock pin is longer than the other. Either leg, usually the longer leg, may be adapted for locking by way of a split pin or C-clip in the assembled configuration so as to preclude inadvertent disconnection of the lock pin 112 from the extended frames. Also washers (not shown) may be welded to the legs of the locking pin 112 or broached to preclude jamming of the pin into the holes 118 of frame legs 16.

Especially where the collar 108 has the same configuration as each frame leg, axial loading from an upper frame to a frame upon which it is superimposed is assured through the frame legs of each frame. Thus, more even load distribution is assured and the chances of buckling or failure of any frame leg are diminished.

So as to assemble a shoring structure of the sort shown in Figure 1, pairs of shoring frame legs 12 or 14 are spaced apart, with pairs of cross-braces 120 extending from one of the spaced-apart pairs of frames to the other spaced-apart pair of frames in crossed relationship or formation to each other. Each cross-brace member 120 may be flat, tubular or angular in cross-section. The ends of each of the cross-brace members 120 are fitted to the respective frame leg 16 at lock assemblies 124, each of which is on a respective inner face of a frame leg near

the top or bottom of each such frame leg respectively. It will be noted that the upper lock assemblies 124 on the shorter and taller frames are above the upper horizontal brace 68.

The sliding drop lock or gravity lock assemblies 124 are more fully illustrated in Figures 5 and 6. Each sliding lock assembly 124 includes a bolt 126 (also referred to as a drop-lock pin or post) which extends through a hole formed in the respective inner face 24, for purpose of this discussion, of a frame leg 16. Bolt 126 has bolt head 128 whose inner end is clear of a line extending between the inner faces of shoulders 30 from corners 32. A track member 130, which is a flattened U-shape having a base portion 132 and legs 134, is secured to the frame leg by a jam nut 136 (which may also include a lock washer 138) tightened against the outside surface of the base 132 of the track member 130. The ends 140 of the legs 134 of the track member 130 contact a portion of the face of the frame leg on the shoulder 30, as shown.

Preferably as indicated above, there are ridges 26 formed on each shoulder 30 and corresponding ridges or teeth 142 formed in the ends 140 of the legs 134 of the track member. The cooperation of the ridges 26 and the teeth 142 is such that, when the jam nut 136 is tightened against the base 132, a reaction occurs between the ridges 26 and teeth so as to preclude spreading of the legs 134 of the track 132. Once again, for ease of assembly and manufacture, the extrusion, which is used to form the frame legs 16, is made with ridges 26 on both of the side faces thereof, so that there is no question of a lefthand

or righthand extrusion being required for use as a frame leg.

It should also be noted that the underside of the track member 130 has, near the upper inner ends of each of the legs 134, a landing surface 144 which is adapted to contact a corresponding portion of the inner side face 24 of the frame leg at 146, when the track member 130 is secured to the frame leg by tightening of the jam nut 136. Positive force transmission from the track member 130 to the frame leg is thereby assured, so that any upsetting or twisting moments which may occur in the bolt 126 or against the track member 130, especially during a time when the shoring frame is either being flown or otherwise unevenly loaded, is transferred into the frame leg, whereby the security of the sliding lock assembly and the cross-brace held thereby is assured, so that there is less likelihood of damage or breakage of the sliding lock assembly.

The slide locking member 148, as particularly illustrated in Figure 5, has an inner leg or slide portion 150. The lower end of the slide 150 at 152 is bent slightly outwardly to prevent the slide from being removed upwardly out from behind the base portion 130. At the upper end of slide 150, a transverse portion 154 is provided which is stepped at 156 to provide further transverse portion 158. At the extremity of transverse portion 158 is a depending portion 160 which has an open ended slot 162 provided therein to accommodate post or bolt 126. The relationship of the base 130 to the leg 16 is such to define a sleeve within which the slide 150 may slide up and down, where a

closed end slot 164 is provided in the slide 150 to accommodate the bolt 126 to permit the slide to move up and down. Provided at the extremity of bolt 126 is a wing nut 166 which may be used to secure the slide lock in its down position. The slide lock operates in a manner such that, when in the down position, it captures the ends of the brace members which are placed over the post or bolt 126. When the slide lock is moved to its second position, the depending end 160 clears the bolt 126 sufficiently to allow the brace member free ends to be removed from the bolt, thus facilitating diassembly of the interconnected frames. The stepped portion 156 provides for positive location of two brace ends against the base portion 130, since the transverse portion 154 is sufficiently wide to accommodate two brace ends. However, should four brace ends be positioned on bolt 126, then depending portion 160 is sufficiently spaced from the base portion 130 that the four brace ends are captured between depending portion 160 and the base portion 130. Such an arrangement prevents excessive movement of the cross-brace member ends along the bolt 126.

For some applications in the concrete shoring frame, it may be required that substantially thicker cross-bracing members be used to interconnect one frame to another. In this instance, clamps may be used to clamp in various orientations thicker bracing members to the frame legs. Due to the various orientations of such braces, it is preferable that the leg be substantially square with four similar sidewalls to simplify the clamp device required to clamp a brace member to anyone side of the leg. Considering the leg of Figure 3, it has four similar

sidewalls 18, 20, 22 and 24 which approximate a square. Thus, the sidewalls are symmetrical about the plane 21 and another plane which contains leg axis 23 and is perpendicular to plane 21.

Alternative embodiments for the leg configuration and corresponding connectors are shown in Figures 9 through 12. In Figure 9, a rectangular-shaped leg 170 has opposing stepped sidewalls 171 and 172 and front and rear sidewalls 173 and 174. The opposing stepped sidewalls 171 and 172 are so formed as to provide inward stepped portions 175 which define a recess 176 and have spaced opposing projections 177. This configuration defines what is commonly referred to as a bolt slot to permit the head 178 of a bolt to be inserted in the slot, extend through an appropriate hole in the connectors 179, whereby each of the connectors 179 is secured to the leg 170 by nut 180 threaded onto the bolt and tightened thereon. The bolt has been left out of the stepped sidewall 171 for clarity in illustrating the bolt slot recessed area 176. Each connector 179 has lug portion 181 with an interior face which fits the exterior of the rectangular leg 170, such that with the connectors mechanically fastened to the legs the interior surfaces 182 of the connectors abut the exterior face of frontwall 173. The connectors 179 include outwardly projecting plate portions 183 which function in the same manner as the plate portions 64 on the connector 42 of Figure 3. A bolt 184 is used to connect the horizontal member 185 in the manner shown.

In Figure 10 a somewhat differently shaped leg is shown. The leg includes a frontwall portion 186 and diverging

wall portions 187 and 188. The diverging wall portions 187 and 188 include stepped portions 190 which form the bolt slot recesses 192. Bolts 193 are, therefore, used to mechanically fasten the connector 194 to the leg 195. Extending rearwardly from the diverging wall portions 187, 188 are parallel sidewalls 196 and 197. A rear wall 198 interconnects the parallel walls 196, 197 and includes a bolt slot arrangement at 199.

The connector 194 has wing portions 203 and 205 which straddle the face 186 of the leg and contact the spaced stepped wall portions of walls 187 and 188. The connector 194 includes an inner portion 207 between the wings 203 and 205 which abuts the face 186 of the leg when the connector is mechanically fastened to the leg. The connector 194 includes plate portions 209 which function in the previously discussed manner for facilitating connection of a horizontal cross-member 211 to the connector 194 by use of bolt 213.

Turning to Figure 11, a circular leg 300 is provided with spaced wall portions at 302 and 304 which provide for mechanical connection of the connector 306 to the circular leg 300. The spaced wall portions are provided in appropriate areas with apertures 308 and 310. Such apertures accommodate either bolt 312 or rivet 314 used in connecting the connector to the leg. In using the bolt 312, it is threaded into the curved plate fastener 316. The curved plate fastener 316 has the curvature of the interior 318 of the circular leg 300. The fastener has threaded aperture 320 which receives the threaded bolt 312. In tightening the bolt in the fastener, or

alternatively riveting such connection, the connector 306 with its interior surface contacting the sidewall between apertures 308 and 310, is mechanically fastened to the circular leg. The connector 306 includes the spaced leg or plate portions 322 for securing horizontal member 324 to the connector by use of bolt 326.

Figure 12 shows a somewhat rectangular leg 328 having opposing sidewalls 330 and 332 with stepped wall portions 334 and 336. The stepped wall portions provide areas to which the connector 338 may be secured by welds 340 in the manner shown. The connector 338 provides a support for the plate portions 358 which are used in the mechanical fastening of the horizontal member 354 to the leg 328. The plate portions extend outwardly from the leg wall away from its axis 352 and they are symmetrical about the plane 350. The interior surface 342 of the support 358 abuts exterior surface portions 344 and 346 of the leg, where an inward step 348 is provided in the face of the leg 328. The wall portions 344 and 346 are symmetrical about the plane represented by dashed line 350. This plane contains the longitudinal axis at 352 of the leg and also includes the longitudinal axis of the spaced leg in the same frame, which is interconnected to leg 328 by the horizontal cross-members 354 as secured to the support 338 by bolt 356. The welds at 340 to the stepped wall portions 334 and 336 are symmetrical about the plane 350 and are equidistant from the longitudinal axis 352 of the leg. According to this embodiment, the horizontal member 354 is sufficiently narrow to fit between the plate portions 358 and have the bolt 356 fasten the cooperating portion of the member 354 to the plates 358. The support 338,

therefore, provides a means whereby spaced portions in the form of plates 358 are located on the leg.

To provide for mechanical connection of the brace arrangement to the legs of the various embodiments of Figures 3 and 9 through 12, in each instance the following common elements are provided. The leg has spaced wall portions which are equidistant from the longitudinal axis of the leg and which are symmetrical about the plane which contains the longitudinal axes of both legs in the frame. These planes are shown in Figure 3 at 21, in Figure 9 at 352, in Figure 10 at 354, in Figure 11 at 356 and in Figure 12 at 350. The face of the leg is adapted so as to be adjacent the interior surface of the connector, thus there is mating fit between the interior surface of the connector and the portion of leg wall between the spaced wall portions. Such contact assures a fixed interconnection of the brace arrangement to the leg, since the connector is not permitted to swivel or pivot about the fastener bolts, because of the interference between the interior surface of the connector and the face portion of the leg. In Figure 12, portions of the leg 344 and 346 contact the interior of the connector to satisfy this requirement. In this embodiment, such portions are symmetrical about the plane 350. Alternative arrangements include providing the planar exterior surface by face portions 24 of Figure 3, 173 of Figure 9 and 186 of Figure 10, which present a surface which is symmetrical about the respective planes in the noted Figures. With the circular leg 300 of Figure 11, the surface portion against which the connector 306 contacts is circular, thus the connector is provided with a circular interior surface to mate with

the exterior of the leg in facilitating mechanical fixed connection of brace arrangement to the leg.

Figures 13 through 16 show alternative sections for the cross-members and diagonals used in the brace arrangement for interconnecting the legs. Common to each of these configurations is the provision of a slot which is adapted to receive a bolt head to function as a bolt slot. In Figure 14, the brace member 360 is rectangular in shape and has its bottom wall 362 provided with a slot 364 which has reinforced edges 366. An appropriate bolt head may be inserted through the slot 364, rotated 90 degrees for seating on the reinforced edges 366 to permit fastening of various articles to the brace component which may include angle reinforcing portions.

In Figure 14, the brace component 368 has a curved upper wall 370 and straight parallel sidewalls 372. The bottom 374 has provided thereon downwardly depending lips 376 which define a bolt slot at 378 to receive a bolt head, for the reasons previously discussed.

Figure 15 shows the brace component 380 having its bottom wall 382 provided with the slot 384 to accommodate fasteners. Figure 16 shows a brace component 386 with curved upper wall 388. The bottom wall 390 includes a slot 392 and has an interior wall portion 394 to provide a bolt slot recess at 396.

Referring to Figure 17, an alternative arrangement is shown for mechanically connecting a component of a brace arrangement to a frame leg. The frame leg 400 has five

sidewalls 402, 404, 406, 408 and 410. In keeping with the other previously discussed embodiments of the invention, the leg has spaced portions 412 and 414 to which a cooperating component of the brace arrangement is secured. In this instance, instead of using a connector or the like to provide the spaced plate portions on the leg, the spaced portions 412 and 414 are integral with the leg. The spaced wall portions 412 and 414 are symmetrical about the plane 416 which contains the axis 418 of leg 400 and corresponding axis of the other frame leg. The integral forming of the wall portions 412 and 414 on the leg may be provided by extruding the leg with the hollow portion formed by leg wall 402, spaced walls 412 and 414 and transverse wall 420. As determined by the desired array for the brace arrangement, particular locations on the leg will be used in mechanically fastening the brace component ends to the spaced frame legs. The portions of the walls 412, 414 and 420 of the leg, apart from the connection location, may be removed from the extruded leg by standard milling techniques.

According to this embodiment, the brace member 422 has its end portion adapted so as to cooperate with the walls 412 and 414 and thereby overlap them in a manner similar to that of Figure 3. The overlapping portions are mechanically fastened by bolt 424.

Turning to Figures 18 and 19, endcap assembly and base plate portions are shown. The endcap is used for insertion in an open end of the frame leg to provide support for a jack screw, such as 29 shown in Figure 1, where the nut portion with handles rest on the outer face

of the endcap. The base plate is used for insertion in the bottom of the open end of the frame to support the bottom end of the shoring frame against a sill, a previously formed concrete floor, graded earth or such other foundation on which the shoring frame assembly may stand and support the loads to which it may be subjected. Turning to Figure 18, an endcap assembly 201 has a plate 202 and a tubular staff 204, which is welded to the underside of plate 202. The tube 204 is substantially circular and has four equidistant spaced lugs 207 at its periphery. The plate 202 may be configured at each corner 208 so as to substantially match the profile of a frame leg 16, but of a slightly greater dimension. The dimensions of the tube 204 are such that it will extend into a frame leg 16, and the lugs 207 position and secure the tube in place by their coopration with the corners 32 of the leg. A hole 210 is formed in the plate 202 to accommodate the screw of the screw jack as it extends through the hole 210. Conveniently the plate 202 is extruded so that no additional fabricating steps other than welding, or placing the insert 206 are required. Holes 212 are formed around the periphery of the tube 204, spaced between the lugs 207, so that the endcap assembly 201 may be secured in place to the frame leg by pins or bolts, if necessary.

The base plate assembly 214 of Figure 19 is adapted to fit directly to a frame leg 16. The base plate assembly 214 has a tube 216 similar to tube 204 of the endcap assembly 201 of Figure 18, except that it is shorter in length. The tube 216 has lugs 218, the same as lugs 207 of tube 204, and is otherwise identical to the tube 204. Holes

220 are formed for purposes of securing the base plate assembly 214 to a frame leg 16 by a pin or bolt passed therethrough.

Plate 222 is also formed of extruded aluminum material, but in this case the extrusion is formed lengthwise rather than crosswise as with plate 202 of the endcap assembly 201. The tube 216 is secured to the plate 222 by welds 221, placed around the circular peripheral portions of the tube, but not around the peripheral portions of lugs 218 where they contact the surface 224 of plate 222. The plate 222 has an upper surface 224, a pair of stepped shoulder surfaces 226, and a pair of side sloping shoulder surfaces 228. Holes 230 are formed through the thickness of plate 222 in the shoulders 230. The corners of the plate 222 may be chamfered as at 232.

Turning now to Figures 20 and 21, there is shown a tiltable stringer support which is particularly adapted for use with shoring frames according to this invention, and which may also be used for other welded steel shoring frames.

The tiltable stringer support 234 is particularly adapted for use with extruded aluminum stringers having a configuration as shown in Canadian Registered Industrial Design 456992, issued July 23, 1979, and as shown generally at 235 in Figures 20 and 21.

At the upper end of a shoring leg 16, there may be installed a hollow screw 136 at the top end of which is a U-shaped bracket 238 secured (such as by welds 239) to a

post 240 inserted into the screw. The post 240 and U-shaped bracket 238 may also be otherwise mounted at the upper end of a shoring frame leg by a pin passed through holes 191 in the frame leg and 142 in the post. The U-shaped bracket 238 has a base portion 242 and a pair of upwardly extending legs 244. Preferably, the U-shaped bracket is formed of steel.

Above the U-shaped bracket is a support plate 246 of extruded aluminum, having an upper surface 248 and a pair of upwardly extending lips 250, one at each side of the upper surface 248. The width of the plate 246 is greater than the width between legs 244 of the U-shaped bracket 238. A pair of downwardly extending legs 252 is formed beneath the support plate 246 and depend thereform, extending between the legs 244 of the U-shaped bracket 238.

The assembly of the support plate 246 to the bracket 238 is by way of a pin 254 which extends through the holes 256 and 258 formed in the legs 244 of the U-shaped bracket 238 and the downwardly depending legs 252 of the support plate 246. The pin has a head 260 at one end thereof and is threadably secured in place by a nut 262 and a washer 264 at the end. A split pin 266 may also be installed, as shown.

The support plate 246 and its depending legs 252 are rotatably mounted on the pin 254. The amount of rotation of the support plate 246 around the pin 254 is determined by the interference of the bottom of one or the other of the ends 253 of the depending legs 252 with the base 242 of the U-shaped bracket 238. This is accommodated by the

fact that the distance that the lower edges of the legs 252 are below the pin is less than the distance that the upper side of the base 242 is below the pin, leaving a space 268 between them. As the support plate rotates, there will be an interference of one of the ends 253 of legs 252 with the bracket 238.

The manner by which the stringer may be secured to the tiltable stringer support is as follows. At least one hole, preferably a pair of holes 270, is formed and extend through the support plage 246 on the centre line thereof. Preferably also, a slot 272 is formed along the centre line of the support plate, with the holes 270 extending into the slot, one near each end thereof. A T-head bolt 274 may be secured within the slot 272, having a nut 276 which has a turning handle 278 welded thereto, threadedly engaged to the shank of the bolt 274. When it is desired that the stringer be secured to the stringer support, the bolt 274 is lifted upwardly so that its head 280, having a crosswise dimension which permits it to pass into the bolt slot 282 of the stringer 235 and a lengthwise dimension which interferes with the shoulders 283 of bolt slot 282, is lifted into the bolt slot 282 and turned and thereafter the nut 276 is tightened on the bolt. The locked and unlocked positions of the bolt 274, nut 276 and handle 278 are shown at the left and righthand ends, respectively, of the elevation view of the tiltable stringer support in Figure 20.

In the unlocked position, the head 280 of the bolt 274 lies entirely within the slot 272 and does not extend above the surface 248 of the support plate 246. Other

flat bottom beams may, therefore, be accommodated by the tiltable stringer support.

As an alternative embodiment to the tiltable stringer support discussed above, the positions of the legs 244 of U-shaped bracket 238 and the downwardly depending legs 252 of the support plate 246 may be reversed. That is, the legs 252 may be placed outwardly of the legs 244. In that case, the limiting of rotation of the support plate 246 about the pin 254 comes as a result of the interference of the tops of the legs 244 within the underside of the support plate.

Returning to the leg 16 of Figure 3, it has a particular shape where the sidewalls 18, 20, 22 and 24 each include a stepped portion which displaces the sidewall outwardly from the longitudinal axis 23 of the leg. The stepped portions increase the strength of each leg sidewall. It has been found that such shape for the leg, albeit non-circular, is useful in supporting loads independently of the frame. The leg, in combination with jack screws, may be used as a jack post or a post shore in the concrete forming field. This is particularly desirable after the pouring structure has been removed and post shores are required to support the poured floor of concrete to withstand forces of material placed on the curing concrete. The shape of the leg is such that it is a compromise between the superior circular shape for load bearing capacity and the square shape which provides surfaces for mechanical connection. The corrugations in the sidewalls, that is the stepped portions, lie principally within a circle drawn to contain the stepped

sidewall portions. Thus the shape in section is relatively close to the shape of a circle. It has been found that this shape has load bearing capacities greater than a rectangular section and which may approximate those of a circular section.

In addition, to increase the strength of the leg 16 of Figure 3, the corner portions 32 are thickened so as to strengthen the corners and increase the load bearing capacity of the leg. Such thickened corner portions also resist damage to the leg, should the frame be dropped on sharp areas which could cause denting of the leg corners.

The stepped portions of the leg sidewalls, as previously explained, accommodate fasteners used in securing the brace connectors to the leg. Such accommodation leaves the leg interior substantially unobstructed to permit insertion therein of staffs and extensions on the endcaps and base plates. The staffs are so configured that their wing portions, such as 207 of Figure 18, fit within the corners 32 to provide a snug interfit without overly complicating the design of the staff portions.

The mechanical connection of a brace arrangement to legs of a frame substantially faciliates use of the frame in the field. Because the frame can be disassembled, it can be shipped to various construction sites in a "knockdown" form. When the units arrive at the site, the legs with brace arrangement may be assembled to provide complete frames. This mechanical fastening aspect is also advantageous from the standpoint of repair, in that should one of the brace components or legs become damaged, the

frame may be disassembled and the component replaced to renew the frame to its 100% full capacity. This is a distinct advantage over aluminum frames which are presently being used in the field and which are commonly interconnected by welding. As is appreciated, welding of aluminum in the field is very difficult and almost impossible. Thus should a welded aluminum frame become damaged in the field, it cannot be repaired and has to be sent to the shop for repair or may have to be scrapped.

Depending upon the end use of the frame and supporting structures, its shape for the leg may be larger or smaller. For example, when the frame is used in the concrete shoring trade, the leg is considerably larger in section that if the same leg were used for access scaffolding which has substantially lower load bearing requirements.

As to actual use of the shoring frames, the arrangement may be such that the distance between the longitudinal axes of the legs is normally set at 1.8 meters, although it may be less for example, 1.2 meters. The height of each frame leg may vary, although acceptable heights are in the range of 1.5 meters or 1.8 meters. The weight of the frames varies depending upon their use; however, with a 1.8 meter frame including slide lock assemblies, it weighs approximatey 20 kilograms, whereas the weight of a 1.4 meter frame including lock assembly weighs approximately 18 kilograms. The frame capacity of the type shown in Figure 1, having the leg of Figure 2, determined on a three frame high assembly, is in excess of 6,800 kilograms per leg. That is, 13,600 kilograms per

frame for a structure three frames high. This provides a safety factor of at least 2.5. The spacing between the frames as determined by the cross-brace members may be greater than the known standard steel welded frame. For example, for a normal height garage floor slab of approximately 2.5 meters having a thickness of 26 centimeters and a weight of approximately 730 kilograms per square meter, this can be supported by a minumum number of shoring frames, according to this invention, giving a supported area slab of approximately 6.4 square meters per leg. With prior welded steel frames, having a one meter width, a support ratio of 4.1 square meters per leg is required.

Another comparison which may be made is that a three frame high assembly having an overall height of nearly 6 meters and an overall weight per tower (three frames) of 60 kilograms and a frame width of 1.8 meters, has a comparable loading capacity per frame, as extra heavy-duty welded steel shoring frames having the same height, a width between frame legs of approximately 1.2 meters, and weighing approximately 160 kilograms. In other words, a lower weight frame, according to this invention, will support a greater area than the much heavier welded steel shoring frames which have been used in the past. Further, shoring frames, according to the present invention, may be stacked to shoring heights of 50 meters or more, where once again the weight of the shoring in place and the amount of handling to get the shoring in place are considerably less when compared to welded steel shoring frames previoulsy known.

CLAIMS

1. A frame for supporting vertical loads comprising a pair of spaced aluminum tubular legs joined by a brace arrangement and means for mechanically connecting said brace arrangement to said legs, said brace arrangement being adapted to stabilize said legs when under load, characterized in that each of said legs has spaced wall portions which are substantially symmetrical about a plane containing the longitudinal axes of said frame legs and which provide areas for mechanical connection of said connector means, as secured to portions of said brace arrangement, to said legs, each said connector means straddling said leg for connection to said spaced wall portions with at least portions of its interior surface being adjacent at least corresponding portions of leg exterior surface between said spaced wall portions.

2. A frame according to claim 1, characterized in that each of said connector means, as it straddles said leg, has a spaced pair of lug portions extending from said connector means and which overlie said spaced wall portions, said interior surface portions of said connector means being held adjacent said corresponding leg exterior portions by mechanical connection of said lug portions to respective said spaced wall portions.

3. A frame according to claim 1, characterized in that said spaced wall portions of said leg are stepped so as to displace areas of said stepped wall portions for mechanical connection of said connector means to

said leg, outwardly of the leg longitudinal axis to accommodate securement means without substantially obstructing the leg interior.

4. A frame according to claim 1, characterized in that said frame leg is circular, said connector means having lug portions which provide an interior arcuate surface for mating fit with the circular exterior surface of said leg, as said connector straddles said leg, said lug portions being mechanically connected to said spaced wall portions of said leg on opposite sides of said plane.

5. A frame according to any one of claims 1 through 4, characterized in that said spaced wall portions are recessed and adapted to receive and engage corresponding portions of fasteners used in fastening said connector means to said leg.

6. A frame according to claim 1, characterized in that said frame leg has a planar face with diverging wall portions which include said spaced wall portions, opposing sidewalls extending rearwardly from said divergent wall portions, said opposing sidewalls being interconnected by a rear wall portion.

7. A frame according to claim 6, characterized in that said diverging wall portions include stepped portions to displace said areas of mechanical connection outwardly of leg axis to accommodate securement means without substantially obstructing leg interior.

8. A frame according to claim 1, characterized in that said leg has flat surface portions equally spaced on opposite sides of said plane, said connector means having flat interior surface portions which abut said leg flat surface portions with said connector means secured to said leg.

9. A frame according to claim 1, characterized in that said leg has four sidewalls interconnected by four corner portions, two of said sidewalls opposing one another being symmetrical about said plane, said opposing sidewalls having opposing stepped wall portions which increase the strength of said opposing leg sidewalls and which provide said areas for mechanical connection of said connector means to said leg, at least portions of the leg exterior surface of the sidewall between said opposing sidewalls being adjacent corresponding portions of connector interior as connected to said leg.

10. A frame according to claim 9, characterized in that all four sidewalls of said leg are stepped to increase the strength of such sidewalls.

11. A frame according to claim 9, characterized in that said at least portions of leg exterior between said opposing sidewalls are symmetrical about said plane.

12. A frame according to claim 11, characterized in that said sidewall between said opposing sidewalls is flat and symmetrical about said plane as containing

said portions of leg exterior, said connector means having a flat surface for abutting said flat sidewall as connected to said leg.

13. A frame according to claim 9, characterized in that said sidewall between said opposing sidewalls is stepped outwardly to provide a flat exterior surface which is symmetrical about said plane, said connector means having a flat surface for abutting said outwardly stepped wall portion as connected to said leg, said opposing stepped wall portions being perpendicular to said flat exterior surface.

14. A frame according to claim 13, characterized in that said connector means has spaced lug portions which extend out from said flat surface of said connector means, said lug portions being mechanically connected to said opposing stepped wall portions with said flat surface of said connector means abutting said flat exterior surface of said sidewall.

15. A frame according to claim 14, characterized in that said opposing stepped wall portions are flat interiorly and exteriorly of said leg to facilitate mechanical connection of said lugs to said stepped wall portions.

16. A frame according to claim 15, characterized in that said leg is extruded to provide said opposing stepped wall portions and said flat exterior surface along the length of said leg to enable connection of said connecting means at any desired position along said leg.

17. A frame according to claim 16, characterized in that said four corner portions are thickened relative to the thickness of adjacent sidewalls.

18. A frame according to claim 17, characterized in that said lugs of said connector means have flat parallel inner surfaces which are spaced apart sufficiently to be adjacent said opposing stepped wall portions.

19. A frame according to claim 18, characterized in that said lugs are bolted to said opposing stepped wall portions by a pair of bolts for each wall portion, said bolts being threaded exteriorly into threaded devices located interiorly of said leg which are fixedly interconnected to one another.

20. A frame according to claim 19, characterized in that said threaded devices are two threaded apertures formed in a plate, said apertures being aligned with holes formed in said opposing stepped wall portions and corresponding portions of said lugs of said connector means.

21. A frame according to claim 1, characterized in that said brace arrangement comprises two parallel spaced cross-members and a diagonal brace member interconnecting said spaced cross-members, four connector means connecting the four ends of said spaced cross-members to said spaced legs.

22. A frame according to claim 21, characterized in that brace cross-members are tubular, each of said connector means comprising a projection insertable within a corresponding end of said spaced tubular cross-members to locate said cross-member on said connector means and to which said cross-member is secured.

23. A frame according to claim 22, characterized in that said projection on said connector means comprises two spaced plate portions which are of a height to permit insertion in the ends of said tubular cross-members which are rectagular in cross-section.

24. A frame according to claim 23, characterized in that said diagonal member is tubular and has its end portions adapted to overlap corresponding ends of said spaced cross-members and being secured to said connector means.

25. A frame according to claim 21, characterized in that said cross-members include a slotted area extending the length of each member for receiving and cooperating with a portion of a fastener means to facilitate mechanical connection of elements to said cross-members.

0049096

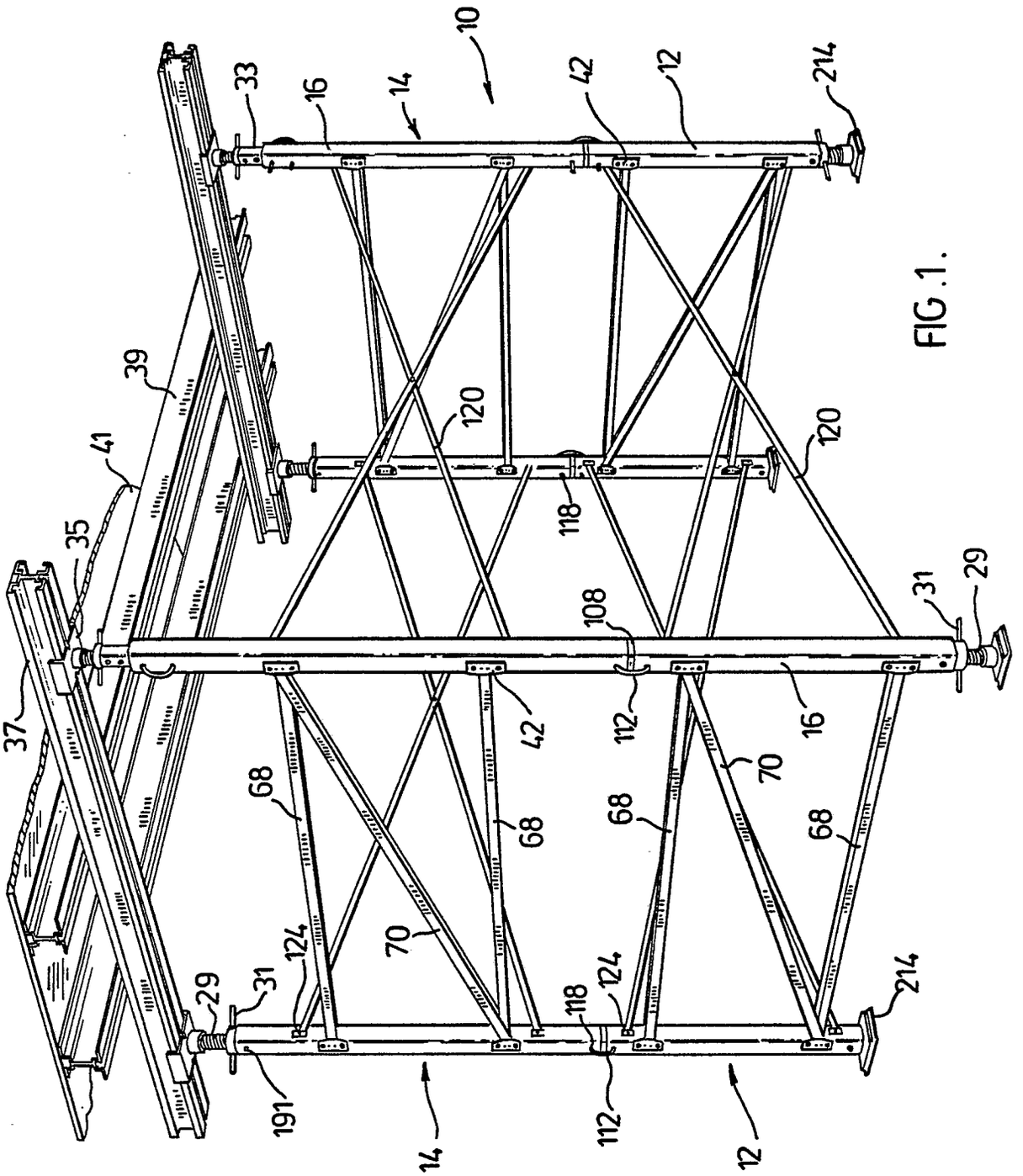


FIG.1.

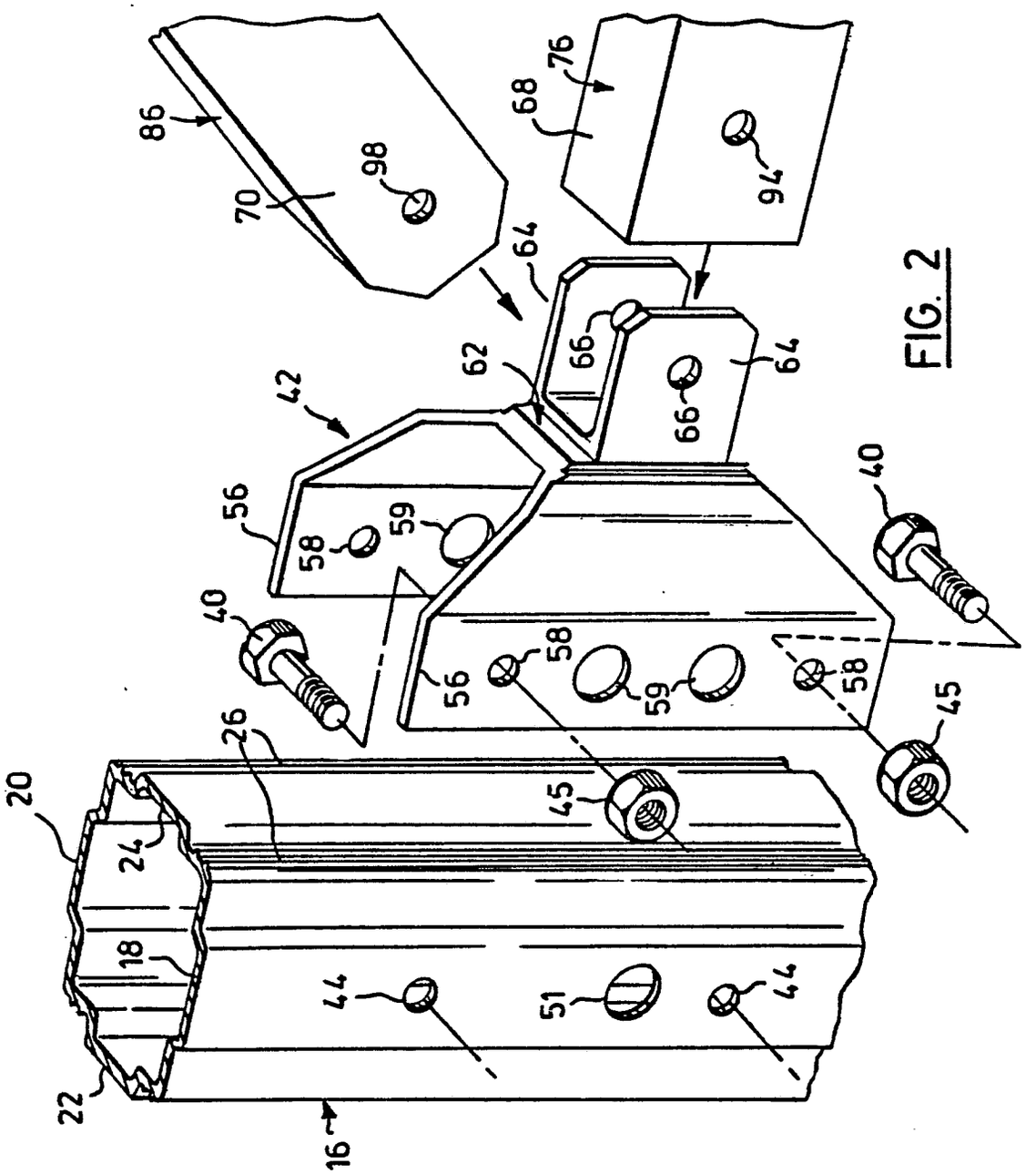

86
70
98
68
76
94
64
62
66
66
64
42
56
58
59
40
40
56
58
59
58
45
26
45
20
24
18
44
51
44
22
16

FIG. 2

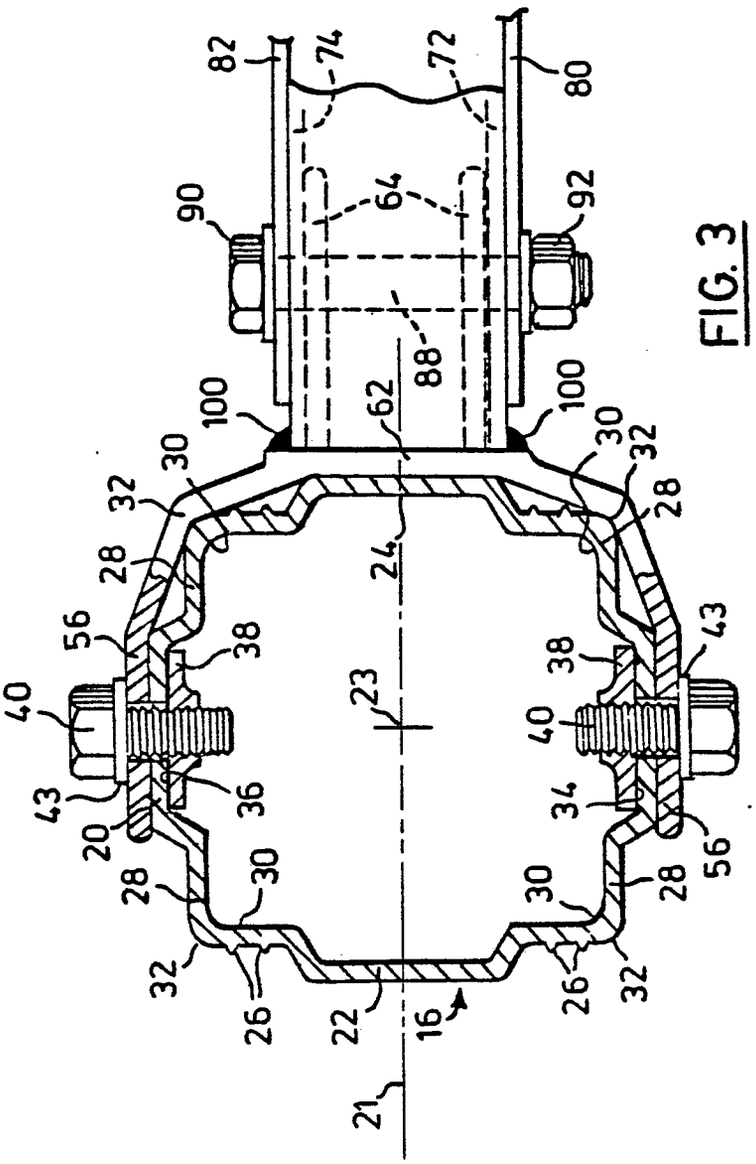

82
74
72
80
90
64
92
88
62
100
100
30
32
30
32
28
28
24
56
38
38
43
40
23
40
43
36
34
20
56
28
30
30
28
32
26
26
32
22
16
21

FIG. 3

0049096

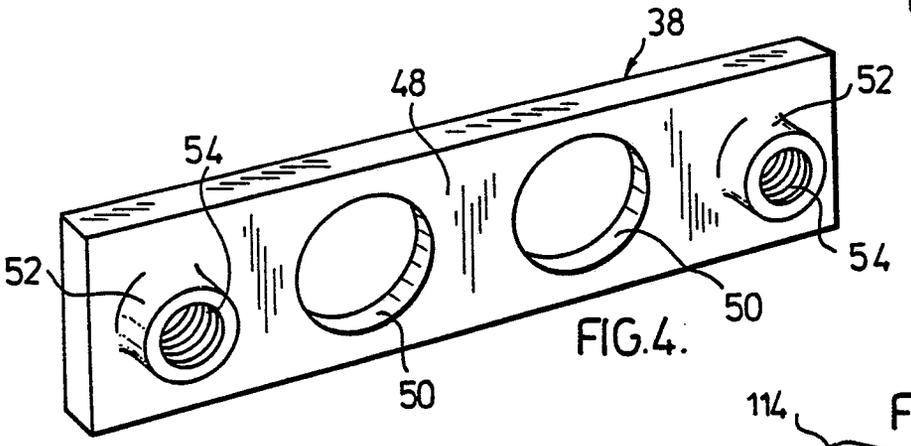


FIG.4.

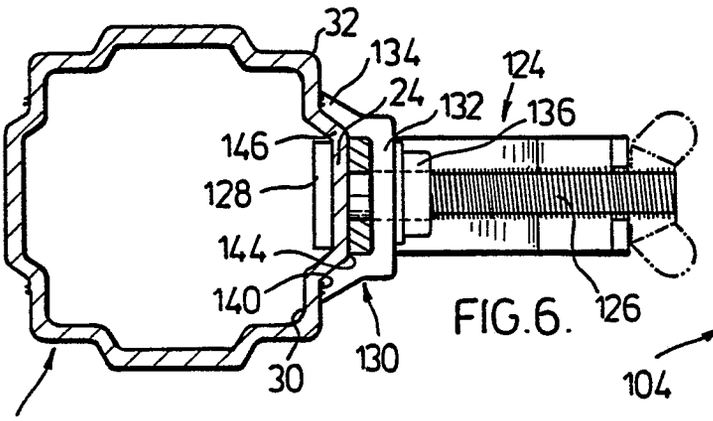


FIG.6.

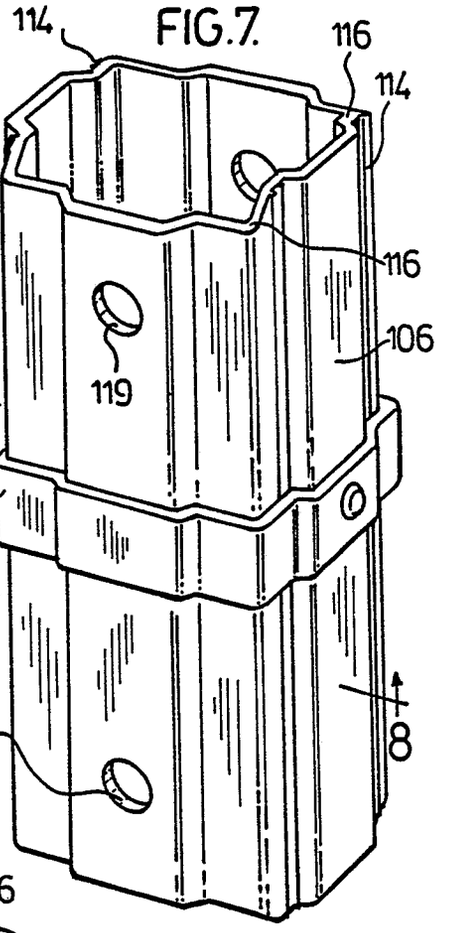


FIG.7.

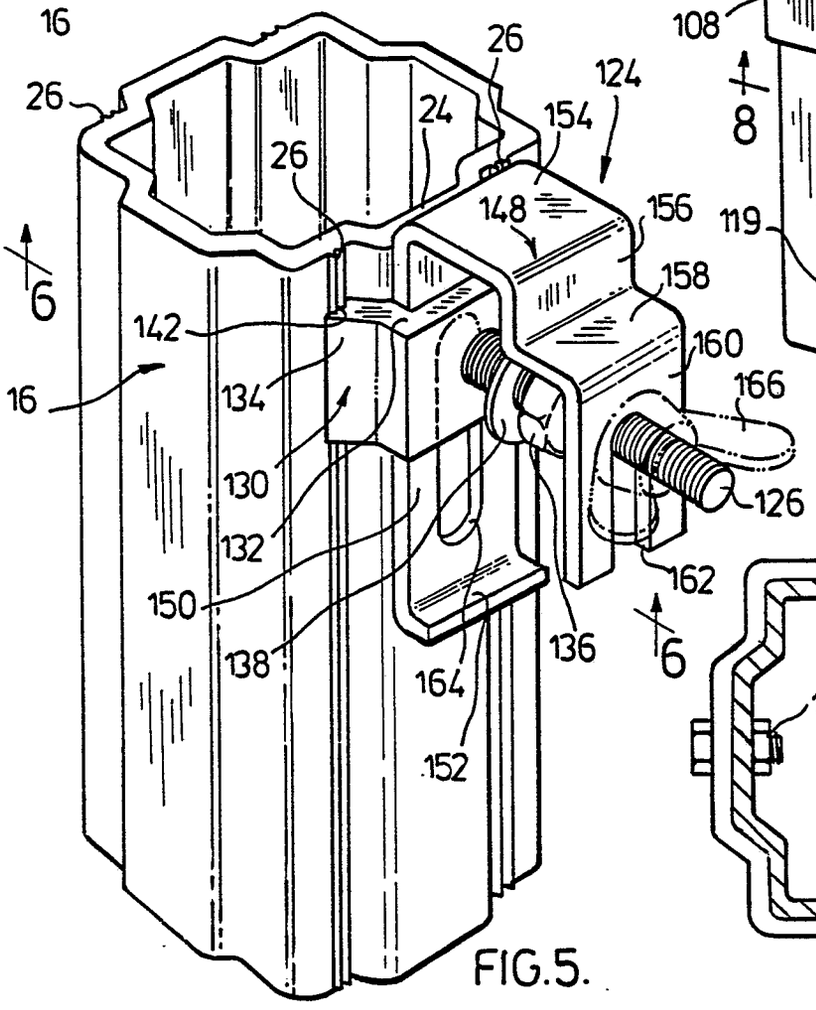


FIG.5.

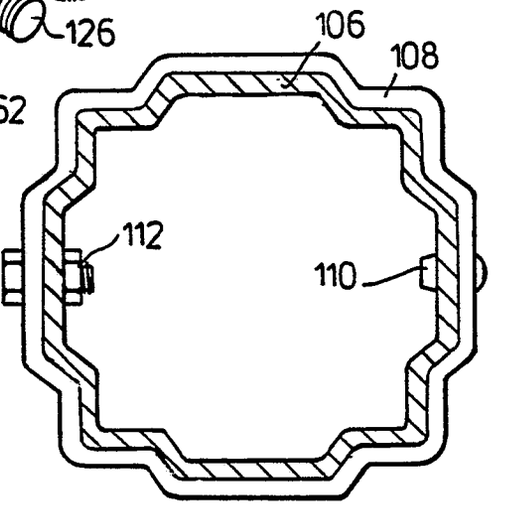


FIG.8.

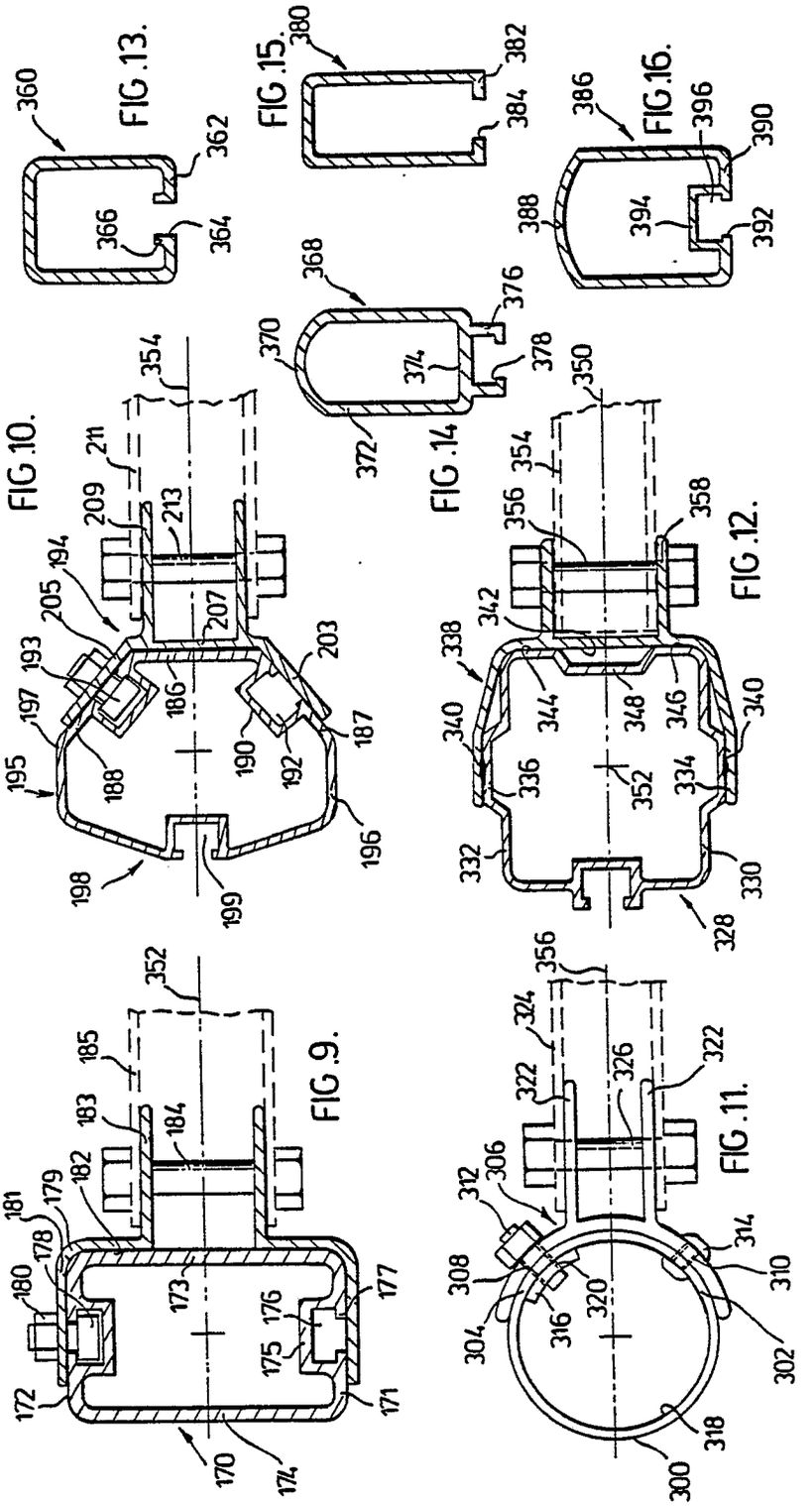


FIG.9.
FIG.10.
FIG.11.
FIG.12.
FIG.13.
FIG.14.
FIG.15.
FIG.16.

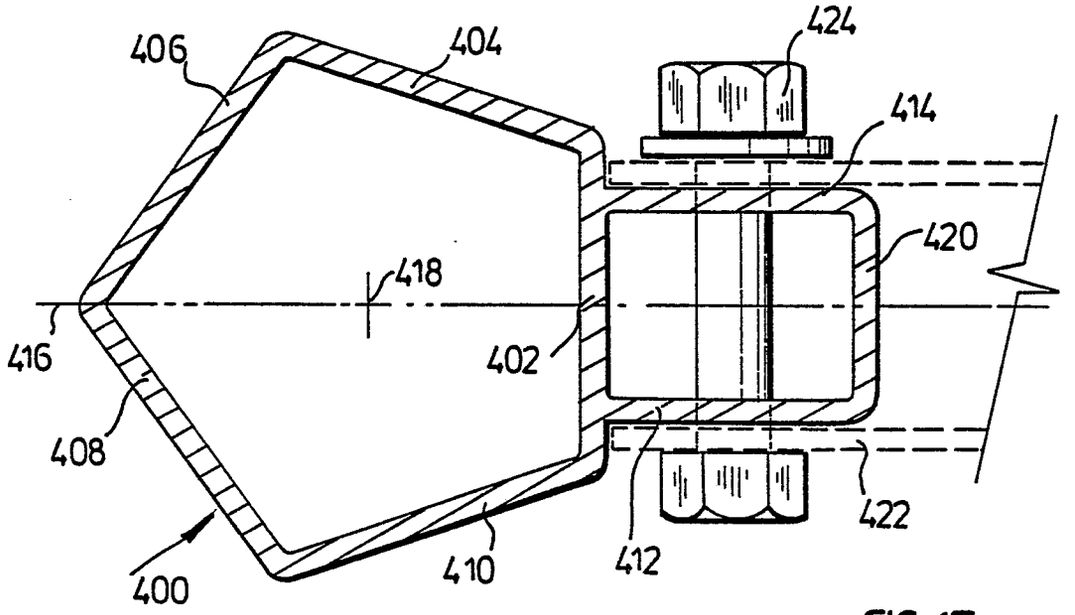


FIG .17.

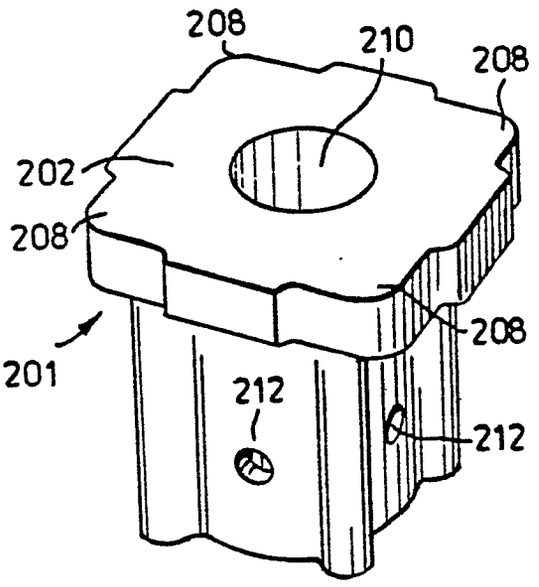


FIG .18

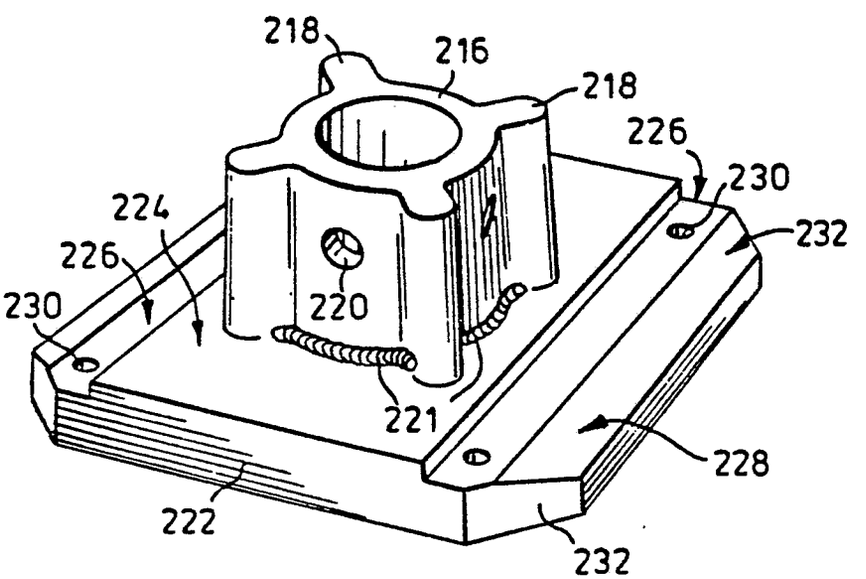


FIG .19.

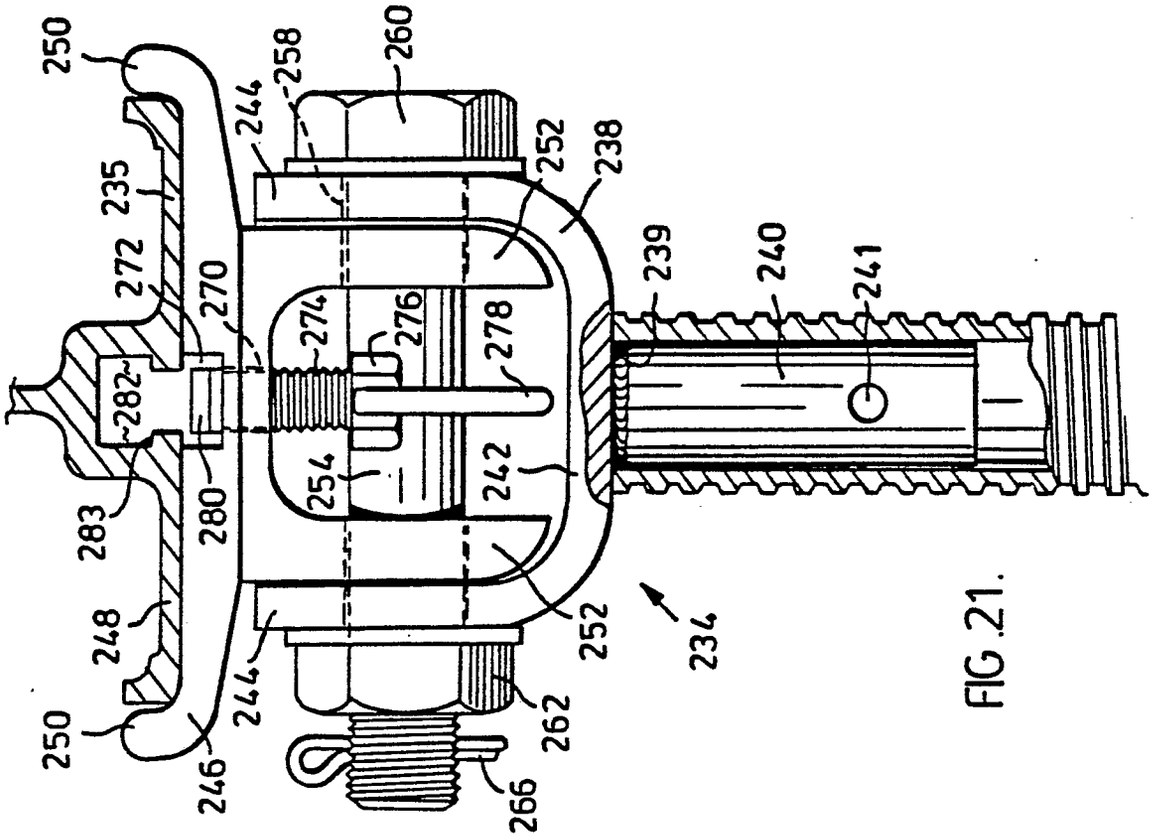

250
258
260
244
252
238
235
239
240
241
272
270
274
276
278
282
283
280
254
242
248
246
262
266
234

FIG.21.

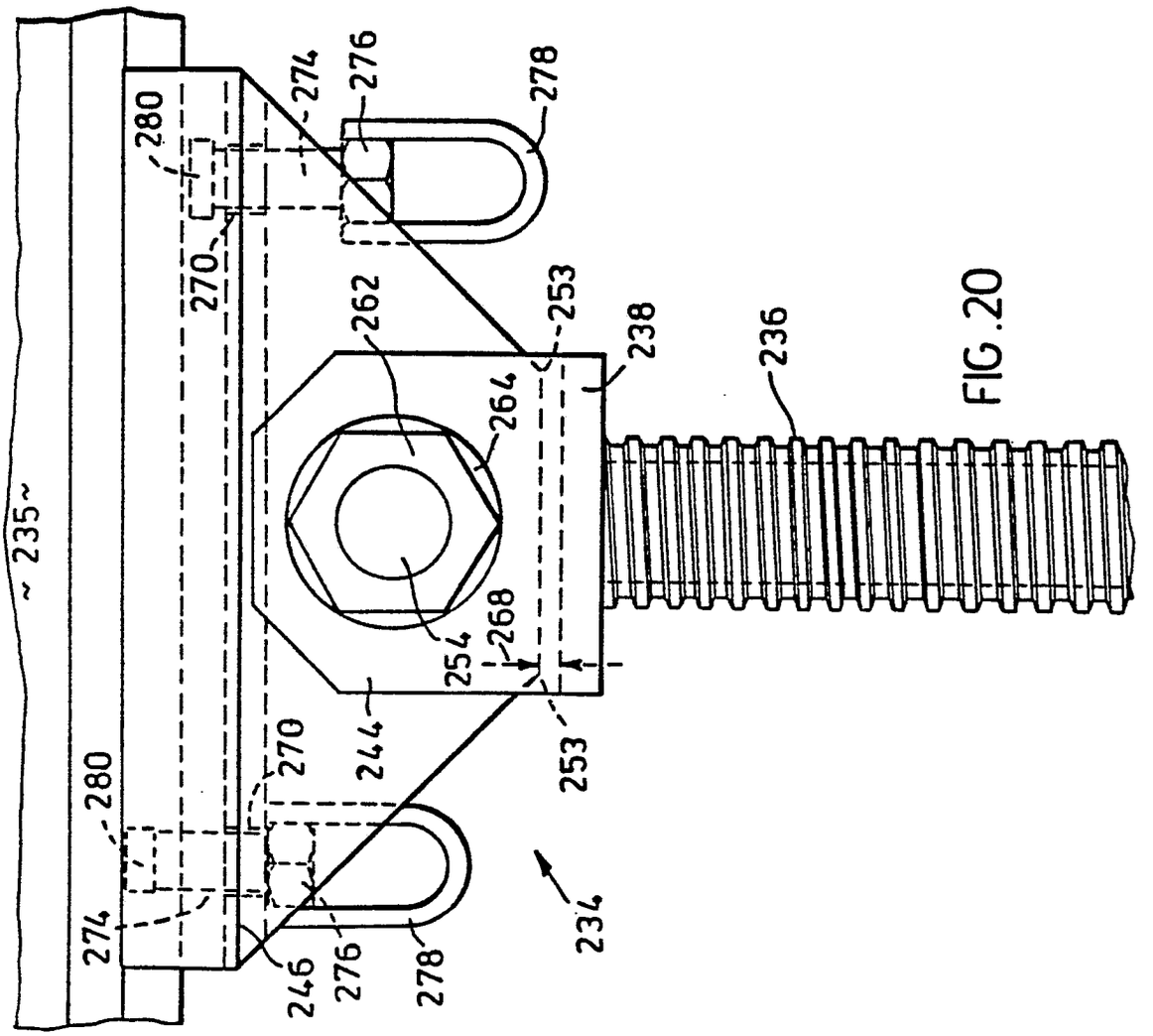

~235~
280
274
276
278
270
262
253
238
236
264
254
268
244
246
234

FIG.20

European Patent Office

EUROPEAN SEARCH REPORT

0049096 Application number

EP 81 30 4358.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	FR - A - 1 123 790 (R.-I.-L. TAILLEFER) * fig. 2 *	1,2,4,14,19
X	US - A - 2 804 673 (F.B. FEX) * whole document *	1,2,4,14
D,A	US - A - 3 787 020 (P.J. AVERY) * whole document *	
D,A	US - A - 3 966 164 (S.S. DASHEW) * whole document *	
D,A	US - A - 4 144 690 (P.J. AVERY) * whole document *	
A	US - A - 4 106 256 (D.L. CODY) * whole document *	
A	US - A - 4 156 999 (P.J. AVERY) * whole document *	
	US - A - 4 036 466 (R.A. VAN METER) * whole document *	1,21,22,24
	US - A - 2 846 085 (G.J. JOHNSON) * fig. 3 *	2,4,19
	DE - A - 2 302 561 (E. FÖLL) * fig. 3, 6 *	1,4

./..

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

E 04 G 11/48
E 04 G 7/06
E 04 G 1/12

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

E 04 G 7/00
E 04 G 11/00
E 04 G 1/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	16-12-1981	KRABEL

EPO Form 1503.1 06.78

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	AT - B - 263 317 (P. PLÜCKEBAUM) * fig. 3, 4 * -- DE - A - 1 901 880 (SPEEDRACK INC.) * fig. 4 * ----	3,5, 8-13, 15 3,5, 7-9, 16	TECHNICAL FIELDS SEARCHED (Int. Cl.³)