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

(11) Publication number: **0 252 748**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **87306098.2**

(22) Date of filing: **10.07.87**

(51) Int. Cl.4: **E 04 G 7/26**
E 04 G 7/30, E 04 G 11/48

(30) Priority: **11.07.86 GB 8616977**

(43) Date of publication of application:
13.01.88 Bulletin 88/02

(84) Designated Contracting States: **DE ES FR NL SE**

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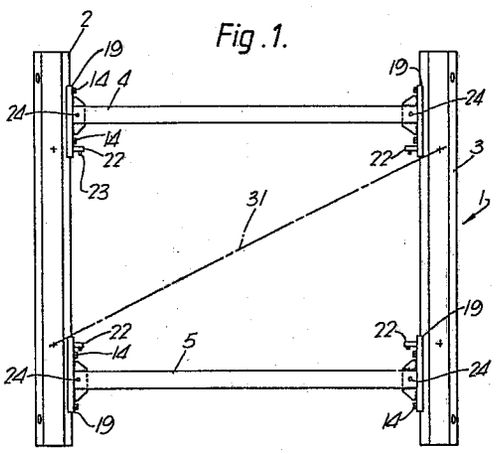
(54) **A support system.**

(57) A falsework support system is made from a number of frames. Each frame has two vertical legs interconnected by a plurality of horizontal transoms. Each transom has, at each end thereof, a vertical connecting element. The vertical connecting element is releasably connected, at two points which are spaced apart in the vertical direction, to a respective leg of the frame.

Fig.1.



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Description

"A support system"

THE PRESENT INVENTION relates to a support system and more particularly relates to a support system adapted to support falsework. In particular the support system is of the type known as a frame support system.

When constructing buildings or the like it is common practice to erect a form which effectively defines a mould onto which liquid concrete may be poured. Appropriate reinforcements may be present as the concrete sets, and the concrete, as it sets, is retained in a desired position by the form. Consequently the concrete sets or cures to constitute a reinforced concrete structure that comprises part of the building being constructed.

Most buildings of this type consist of flat floors with appropriate reinforced concreted beams. However, this type of falsework may be utilised in the construction of buildings of many different designs.

Whilst falsework of the type described above may be supported by simple props, in recent years it has been more common to utilise a support system that incorporates a number of frames. Typically these frames are pre-fabricated, being welded together from appropriate components. Typically the frames will all have a constant width, so that they can readily be assembled one on top of the other, but the frames may come in a number of different heights. This enables a selected number of frames of different sizes to be assembled together to support the falsework at any desired height above the floor. Adjustable screwjacks are provided either at the bottom or at the top of the frames, or possibly both at the bottom and at the top, to enable fine adjustments to be made. Also, of course, the screwjacks enable the falsework to be lowered down from the concrete when the concrete has been cured.

It is now conventional for frames of this type to be assembled in rows, with the frames being linked together by cross braces. However, linkbars or diagonals may be used to link the frames together, and the frames may be built to form square towers.

Since, in most cases, a heavy load has to be supported by the falsework support arrangement, heavy duty frames have to be provided. However, since the frames have to be moved into position by hand, it is preferred that each frame should be of only a moderate weight. Thus the designer of the frames is faced with conflicting requirements.

For many years, steel frames were utilised to provide the requisite strength, but these frames were found to be very heavy. Recently frames formed of aluminium alloy components which have been welded together have been utilised, in order to provide frames which are lighter. However, such frames are more costly than the steel frames, and also the alloy frames have been found to be very prone to damage.

It is to be understood that if a screwjack is to be freely movable within a circular tube, the tube must be free of all dents. Thus, if an alloy tube which accommodates a screw jack does become dented it is necessary either to repair the frame, or to replace it.

It has been found that due to the rough handling that frames of this type received on a building site, a lot of repair and maintenance of the frames is required. Maintaining the aluminium frames can be very difficult, and also, because of problems arising from metal fatigue, it is sometimes dangerous to utilise a frame that has been repaired. Also, by repeatedly welding components to the frame, the safe load carrying capacity of the frame is reduced.

In order to achieve frame stiffness in the frame systems presently utilised, it is conventional for such frames to have welded-in diagonals. It is costly to provide such welded-in diagonals, and these diagonals constitute an obstacle which prevent people passing through the frames at various levels.

According to this invention there is provided a frame for a falsework support system, said frame comprising two vertical legs interconnected by a plurality of horizontal transoms, each transom having, at each end thereof, a vertical connecting element, the vertical connecting element being releasably connected, at two points spaced apart in the vertical direction, to a respective leg of the frame.

Preferably each vertical connecting element is in the form of a plate, the plate being connected to the respective leg by means of bolts. The plate may be a flat plate or a plate with a specially shaped cross-section so that the plate can snugly abut the respective leg.

Conveniently each leg is a hollow tubular form, each bolt having its head located within the hollow leg.

Advantageously the interior of the leg defines at least one recess adjacent the exterior wall of the tube, the recess being dimensioned to receive the heads of said bolts, rotation of the bolts thus being prevented.

Conveniently the configuration of the tube is such that the portion of the tube defining the recess is located beyond a circle having a predetermined radius and having a centre coincident with the axis of the tube, the circle representing a free unobstructed space within the tube.

Preferably the outer periphery of the tube is of substantially octagonal form, at least one face of the tube being associated with the inwardly directed projections which define said recess.

In an alternative embodiment the tube is of substantially circular configuration having at least one radially outwardly extending projection defining said recesses.

Preferably one or more additional structural elements are each clamped to any one of the projections or between adjacent projections present on one or more legs of the frame.

Conveniently the legs are formed of light weight alloy.

Preferably the horizontal transoms are formed of conventional scaffolding tube.

Advantageously the frame may be provided with one or more screw jacks at the bottom and/or at the top of each leg.

Preferably the vertical connecting element provided at the end of each transom is provided with means adapted releasably to receive a brace or the like.

Conveniently the brace receiving means comprise a spigot securely attached to said connecting means, the spigot being provided with means to retain said bracing means thereon.

Advantageously said retaining means comprise a pivoted locking lever contained within an axial recess in the spigot and movable to a position in which the lever projects outwardly from the spigot.

Preferably said retaining means comprise a nut or the like, the exterior of the spigot being threaded to receive said nut.

Preferably the frame may be provided with means to connect the frame to a similar frame mounted above the said frame.

Conveniently the frame may be provided with a detachable cross brace and/or link bars and/or diagonals mounting element, detachably mounted in position on the frame, and provided with means to receive the cross brace.

Preferably the cross brace receiving means comprise a spigot and means to retain a cross brace in position on the spigot.

Preferably the cross brace receiving means are bolted to the end of a transom.

According to another aspect of this invention there is provided a frame for use in a frame support system for faslework, said frame comprising two upright members interconnected by a plurality of horizontal transoms, each transom being connected to the adjacent frame member by means of a connecting element, each con necting element incorporating means adapted lockingly to receive the brace or the like.

Preferably the means adapted to receive a brace or the like comprise a spigot and means to retain a cross brace or the like on the spigot.

Conveniently said retaining means comprise a pivoted locking lever mounted in an axial slot or recess formed in the spigot.

Preferably the retaining means comprise a nut, the exterior of the spigot being threaded to receive said nut.

The invention also relates to a falsework support assembly comprising a plurality of frames as described above.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is an elevational view of a frame in accordance with the invention;

Figure 2 is a cross-sectional view of the upright member utilised in fabricating the frame of Figure 1;

Figure 3 is an enlarged view showing the junction between the upright member of Figure 1 and a transom;

Figure 4 is a view corresponding to Figure 3 showing an additional brace lock;

Figure 5 illustrates a modified brace lock;

Figure 6 illustrates a support arrangement incorporating the present invention;

Figure 7 is a front view of the further support arrangement incorporating the invention;

Figure 8 is a side view of the support arrangement shown in Figure 7;

Figure 9 is a front view of another support arrangement incorporating the invention;

Figure 10 is a side view of the support arrangement of Figure 9;

Figure 11 is a cross-sectional view of an alternative embodiment of an upright member for use in forming the frame;

Figure 12 is a part sectional view illustrating a modified brace lock joined to part of the upright member of Figure 11;

Figure 13 is a side elevational view of the brace lock of Figure 12; and

Figure 14 is a front elevational view of the brace lock of Figure 12.

Referring now to Figure 1 of the accompanying drawings a frame assembly 1 comprises two upright members or legs 2, 3. Interconnecting the legs are an upper horizontal transom 4 and a lower horizontal transom 5.

Each leg 2, 3 is formed of a strong alloy, and has a hollow cross-section as illustrated in Figure 2.

The leg 2 has an outer octagonal peripheral portion 6, four orthogonal faces of which are provided with inwardly directed protrusions 7, 8, the protrusions on each face defining between them a recess or channel 9. The recess or channel 9 is dimensioned to receive snugly the head 10 of a bolt 11 which can pass through an aperture 12 formed at an appropriate location in the outer wall 6 of the leg 2. The dimension of the channel 9 is such that the head 10 of the bolt cannot rotate when it is in position.

The bolt is adapted to receive a nut 14 utilised to secure a transom 5, in position, as will be described hereinafter.

The inwardly directed projections 7, 8 terminate with outwardly directed arcuate flanges 15, 16 which serve to define a central circular area 17 which is clear of all obstruction, the periphery 18 of the circular area being of such a size that a screwjack can readily be received within the central area 17 of the tube.

It is to be appreciated that the inwardly directed projections 7, 8 and the lips 15, 16 can engage the engagement portion of a screwjack whilst permitting the elongate screw portion of the jack to move freely within the tube. If the tubular leg 2 is subjected to a knock and is thus dented, it is unlikely that the dent will extend into the central area 17 of the tube, and thus even if the leg is dented it will still be possible to utilise the leg in a satisfactory manner with the screwjack.

Each of the horizontal transoms 4, 5, terminates with a vertical end plate, the plate being designed to

form a stiff node between the transom and the leg. The end plate 19 provided at one end of the transom 5 is illustrated in Figure 3. The end plate 19 is a vertical plate securely welded to the end of the horizontal transom 5, and maintained securely in position by means of triangular reinforcing webs 20, 21.

The vertical plate 19 (as can be seen from Figure 2) has a configuration such that the plate can be brought firmly into engagement with one of the said orthogonal faces of the leg 2, the plate having peripheral lips which abut the next two adjacent faces of the octagonal leg.

The plate 19 is secured firmly to the leg 2 by means of two bolts 11, as shown in Figure 2, and associated nuts 14. In connecting the plate 19 to the leg 2 the bolts are passed manually down in the interior of the leg 2 and are located in pre-formed apertures 12 in the walls of the leg 2. The plate 19 is then mounted in position, with the bolts passing through appropriate apertures formed in the plate 19, and the nuts 14 are then located in position and tightened.

Welded to the plate 19 is a projecting spigot 22 which has a locking lever 23 pivotally mounted in an axial slot formed in the spigot 22. The locking lever 23 may move pivotally from a totally retracted position to a position in which it projects from the spigot as shown.

A bolt hole 24 is provided in the end of the horizontal transom 5, the hole 24 extending horizontally and being located in the region of the transom 5 that is reinforced by the reinforcing webs 20, 21.

It will be understood that a frame of the type described will be very rigid, by virtue of the fact that the vertical plates 19 provided at the ends of the transoms 4, 5 are each securely connected to the adjacent upright or leg 2, 3 at two spaced positions. Thus the frame will be relatively stiff and will resist any attempt to make the frame "lozenge".

It will be appreciated that frames of the type described may have screwjacks mounted in the lower ends of the vertical legs 2 or in the upper ends of the vertical legs 2. Since the frames are fabricated from components which are bolted together if any one component becomes damaged, it is posisble to unbolt the component to facilitate the repair of the component, or to replace the damaged component with a new component. Whilst the legs 2 and 3 may be formed of an appropriate alloy, each transom may be formed of tubular steel, and may therefore be formed of conventional scaffolding tube. This enables conventional scaffolding couplers to be utilised to connect conventional scaffolding components to the transoms.

It will be understood that frames in accordance with the invention may easily be fabricated with transoms of any appropriate length. Thus it may be possible to have available relatively narrow frames, with short transoms, or relatively wide frames, with longer transoms.

Frames as described may be interconnected by link bars or the like. Each link bar may be provided with means at the ends thereof adapted to be mounted on the spigots 22. As the link bar is mounted on a spigot 22 the locking lever 23 will be pivoted upwardly into the retracted position in which it is received in the axial slot to permit the link bar to be mounted on the spigot and the locking lever will subsequently return to a depending position in which a free end of the locking lever 23 projects downwardly out of the axial slot thus preventing the link bar from being inadvertently disengaged from the spigot 22.

Figure 4 illustrates a detachable brace connector 25 which has arcuate horizontal arm 26 having an aperture through which passes a bolt 27 which also passes through the bolt hole 24 provided at the end of the transom 5. The bolt thus secures the horizontal arm 26 in position, the arm 26 being configured so that it lies immediately adjacent the outer periphery of the octagonal leg 2. The arm 26 supports a vertical plate 28 having a configuration similar to the configuration of the plate 19. Thus the plate 28 has a main portion lying adjacent one face of the octagonal leg 2, and also has, at each side thereof, inclined flanges lying adjacent the next two adjacent faces of the octagonal leg.

At the upper end of the plate 25 is provided a protruding spigot 29 having the same configuration of the spigot 22, the spigot 29 thus having a depending locking lever 30 corresponding to the locking lever 23. It can be seen that a diagonal element 31, of tubular form, having a flattened end region 32 defining an aperture 33 can be mounted on the spigot 29, and can be retained in position by means of the locking lever 30. The diagonal element 31 may be telescopic, and extends diagonally across the frame, as shown in phantom in Figure 1.

Additional bracing elements may also be mounted on the spigot, the additional bracing element extending in the directions indicated by the lines 33, 34 or 35, for example. Of course, the design of the bracing arrangement utilised in any particular situation is within the ability of the man skilled in the art.

Figure 5 illustrates a modified embodiment of the invention, illustrating a spigot 36 which may be in the position of the spigot 22 described above or which may be in the position of the spigot 29 described above. The spigot 36 is mounted on a plate 37 (equivalent to the plate 19 or to the plate 25). The spigot is provided with a pivoted locking lever 38 (equivalent to the pivoted locking lever 23 or 30) and mounted on the spigot are a plurality of bracing elements 39. The bracing elements have flattened ends so that they fit snugly adjacent one another. In this embodiment of the invention the exterior of the spgiot 36 is threaded, as at 40, and a wing nut 41 may be mounted on the spigot. The wing nut may thus be tightened against the flattened ends of the bracing members 39, thus providing a secure connection.

It will be appreciated that in utilising the embodiment of Figure 5, if a temporary structure is to be erected, the bracing elements may be mounted on the spigot 36 and may be retained by the locking lever 40. However, if a structure of a more permanent nature is to be erected, a wing nut 41 can be threadedly engaged with the threaded exterior 40 of the spigot 36 and may be tightened against the flattened ends of the bracing members.

Figure 6 illustrates a scaffolding arrangement incorporating frames in accordance with the invention. A frame 1, as described above, is provided with screwjacks 42, 43 which project downwardly from beneath the frame, the screwjacks 42, 43 being associated with base plates 44, 45 which rest on the ground.

At the top of the frame two further screwjacks 46, 47 are provided which extend upwardly above the frame, these screwjacks being associated with head plates 48, 49 which support beams 50 upon which the falsework rests. The screwjacks and the beams may be of a conventional design.

Whilst the frame 1 is illustrated as having a specific size, by selecting the length of the transoms 4 and 5 appropriately the frame 1 could be smaller, as indicated at 51, or larger, as indicated at 52. Appropriate diagonal reinforcing elements may be provided if desired.

Figure 6 illustrates that in a falsework support system incorporating frames in accordance with the invention it is possible to utilise a single prop 53 constituted by a tubular element 54 having same cross section as one of the legs of the frame. The prop is provided with appropriate screwjacks 55, 56.

The frame 57 shown to the right hand of Figure 6 illustrates how frames in accordance with the invention may be interconnected by means of linking means comprising scaffolding tubes 58 connected to the transoms 4, 5 of the frame by means of conventional scaffolding fittings. It will thus be appreciated that the frames of the invention are very versatile and permit the assembly of many different arrangements of support frame work.

Figures 7 and 8 illustrate one frame work support assembly made from frames in accordance with the invention. It can be ssen that in this assembly a plurality of frames 1 are mounted one above the other. The frames are interconnected by means of connectors 59 and connecting pins 60 which are conventional items known in the art.

In the arrangement illustrated in Figure 7 there are three sets of frames 1 which are spaced apart by appropriate distances. The various sets of frames may be interconnected by means of horizontal linkbars 61, which may be connected to appropriate detachable brace connector 25, as illustrated in Figure 4. Additionally diagonal braces 62 may be provided, if the load requires such diagonal braces to be provided. Plan bracing may also be provided, if required. The structure is illustrated supporting primary beams 63 and secondary beams 64, as is conventional.

As can be seen from Figure 8 a plurality of rows 65 of frames may be provided, and the frames of the rows may be interconnected by horizontal link bars 66 and/or cross braces and/or by diagonal lacing 67. The structure illustrated in Figures 7 and 8 may be termed a "bird cage" frame support arrangement.

Figures 9 and 10 illustrate an arrangement in which four rows 68 of frames are provided, the spacing between the rows being non-uniform. As can be seen from Figure 10 each row 68 consists of two pairs of superimposed frames 1. The frames in the rows are interconnected by a horizontal scaffolding tube 69 which are connected by means of appropriate connector 70, which may be a conventional scaffold coupler to the transoms of the frames 1. Again diagonal bracing 71 can be provided if required. This diagonal bracing may be formed from integral one-piece diagonal braces, or from telescopic braces, the braces being connected to a detachable brace connector. Alternatively the diagonal braces may comprise convention scaffold tubes connected to the horizontal transoms by conventional fittings.

Figure 11 illustrates a cross-section of an alternative member 72 which may be utilised to form a leg of a frame in accordance with the invention. The member 72 is formed of an appropriate alloy, and has a cross-section which defines four rectangular protrusion 73. Each protrusion 73 has an outer wall 74 which projects beyond the width of the protrusion 73 to form two projecting flanges 75.

Each protrusion 73 defines a channel 76 on the interior of the member dimensioned to receive the head of the bolt in a non-rotating manner.

As in the previously described embodiment appropriate bolt holes will be pre-drilled in the member to facilitate the connection, to the member 72, of a transom with an associated vertical end plate. However, in utilsing the embodiment of Figure 11 it is possible for a detachable brace coupler 77 to be connected directly to a projection 73 by means of a clamp. The clamp consists of a first element 78 comprising a plate having, at one side, a forwardly directed flange 79 terminating in an inwardly directed lip 80. Bolt holes are provided in the flange 79. The element is intended to cooperate with a second element consisting of an apertured plate which may have a shaped section 81 having an inwardly directed lip 82 at one end edge thereof, the set components being assembled so that the inwardly directed lips 80, 82 engage behind the flanges 75 provided on the front plate 74 of the projection 76, bolts 83 being passed through the apertures and being tightened to draw the components together. It can be seen that in the illustrated embodiment two bolts 83 are provided in a symmetrical arrangement, associated with nuts 84. A spigot 85, corresponding to the spigots described above, is mounted on the first element 78. The spigot 85 is shown partly cut away in the drawings.

The described detachable brace coupler may be located at any position on the leg, or any selected projection. A similar clamping arrangement may be used to mount other coupling devices in position, including a conventional scaffold coupler.

Alternatively a clamping device may be located between two adjacent projections on the leg and may be expanded to engage the projections, the clamping device thus being clamped in position.

Claims

1. A frame for a falsework support system, said frame comprising two vertical legs (2) interconnected by a plurality of horizontal

transoms (5), characterised in that each transom has, at each end thereof, a vertical connecting element (19), the vertical connecting element being releasably connected, at two points (14) spaced apart in the vertical direction, to a respective leg of the frame.

2. A frame according to claim 1, wherein each vertical connecting element is in the form of a plate (19), the plate being connected to the respective leg by means of bolts (14), and wherein each leg is a hollow tubular form (6), each bolt having its head (10) located within the hollow leg, and wherein the interior of the leg defines at least one recess (12) adjacent the exterior wall of the tube, the recess being dimensioned to receive the heads of said bolts, rotation of the bolts thus being prevented.

3. A frame according to claim 2 wherein the outer periphery of the tube (6) is of substantially octagonal form, at lest one face of the tube being associated with the inwardly directed projections (15, 16) which define said recess.

4. A frame according to any one of the preceding claims, wherein the vertical connecting element provided at the end of each transom is provided with means (22, 23) adapted releasably to receive a brace (31) or the like.

5. A frame according to claim 4, wherein the brace receiving means comprise a spigot (22) securely attached to said connecting means, the spigot being provided with means (23) to retain said brace or the like thereon.

6. A frame according to any one of the preceding claims, provided with a detachable brace mounting element (25), detachably mounted in position on the frame, and provided with means (29) to receive the brace, or the like.

7. A frame according to claim 6, wherein the brace receiving means comprise a spigot (29) and means (30) to retain a brace in position on the spigot.

8. A frame for use in a frame support system for falsework, said frame comprising two upright members (2) inteconnected by a plurality of horizontal transoms (5), each transom being connected to the adjacent frame member by means of a connecting element (19), each connecting element incorporating means (22, 23) adapted lockingly to receive the brace or the like.

9. A frame according to claim 8, wherein the means adapted to receive a brace or the like comprise a spigot (22) and means (23) to retain a cross brace or the like on the spigot.

10. A frame according to claim 9 wherein said retaining means comprise a pivoted locking lever (23) mounted in an axial slot or recess formed in the spigot.

Fig .1.

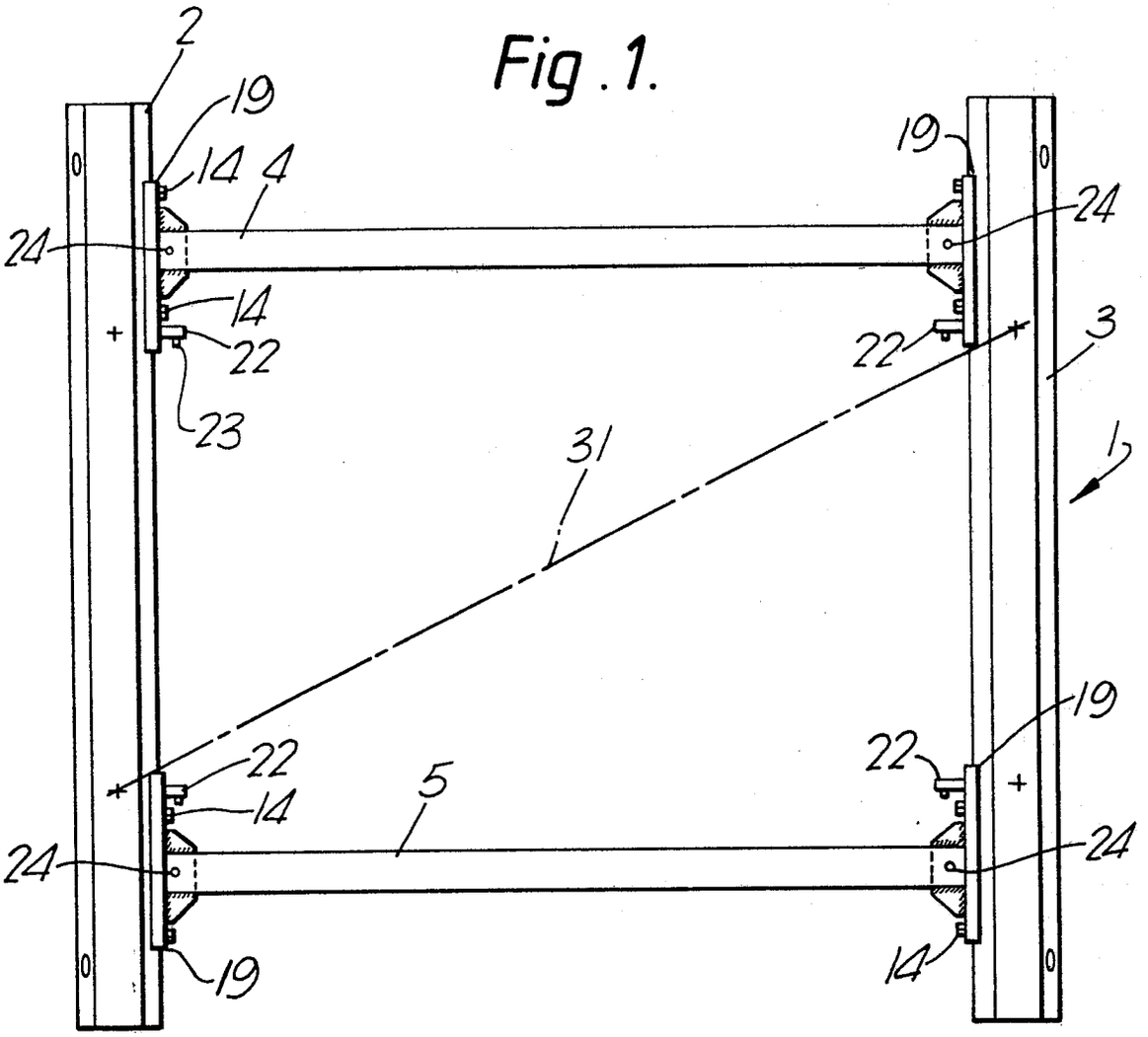
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Fig .2.

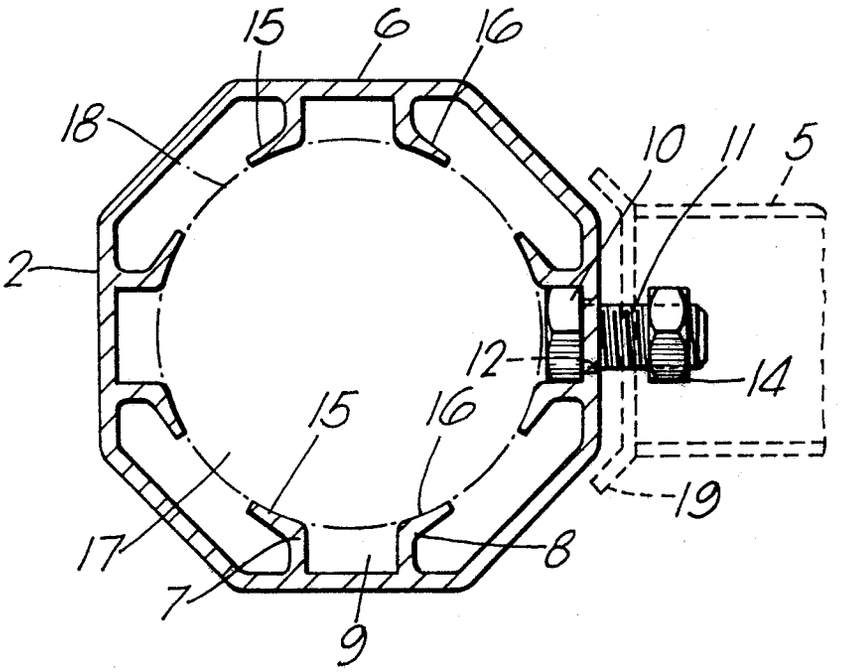
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Fig.3.

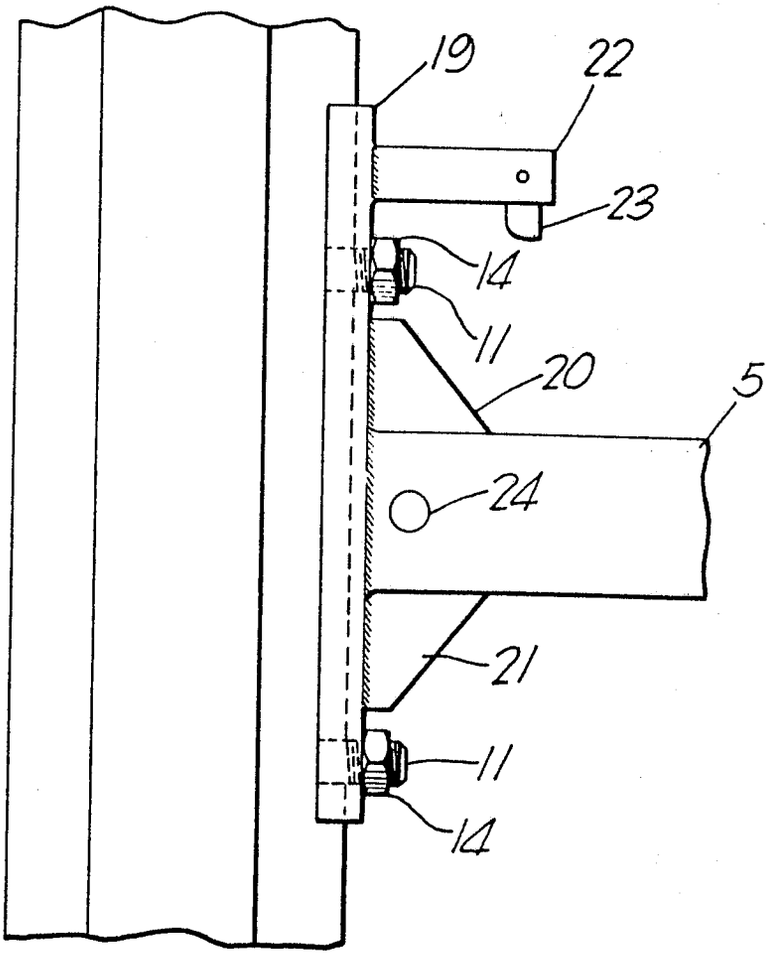

Fig. 4.

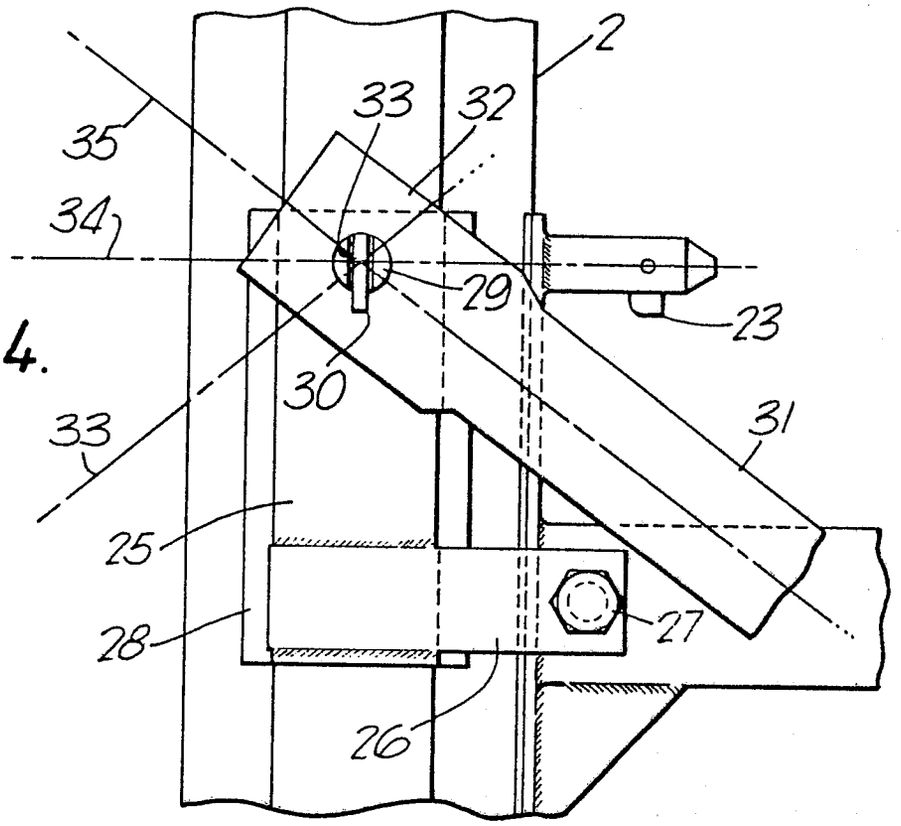

Fig.5.

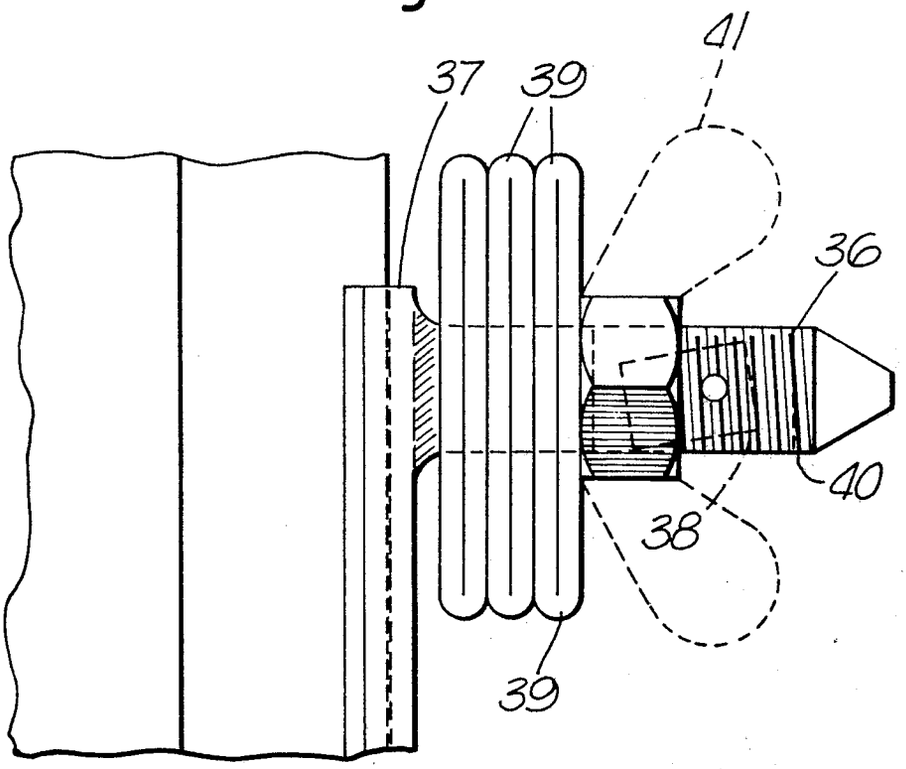
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Fig.6.

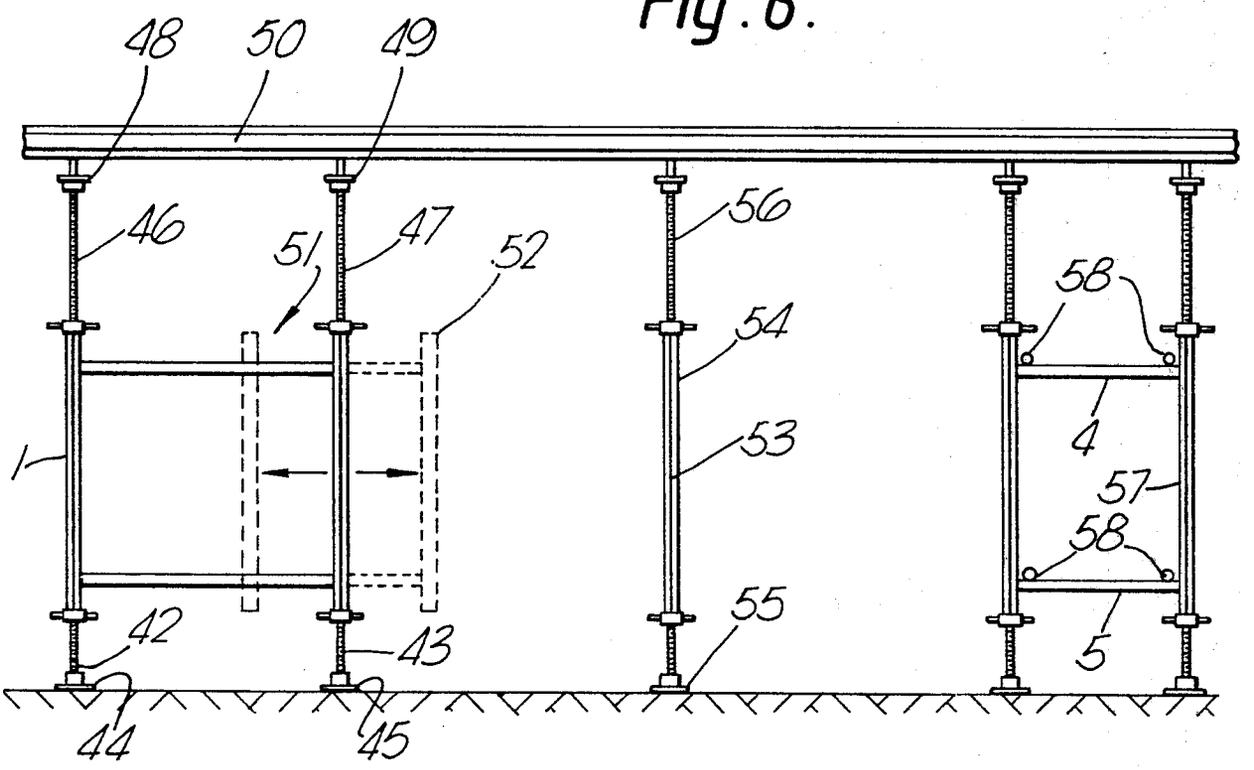
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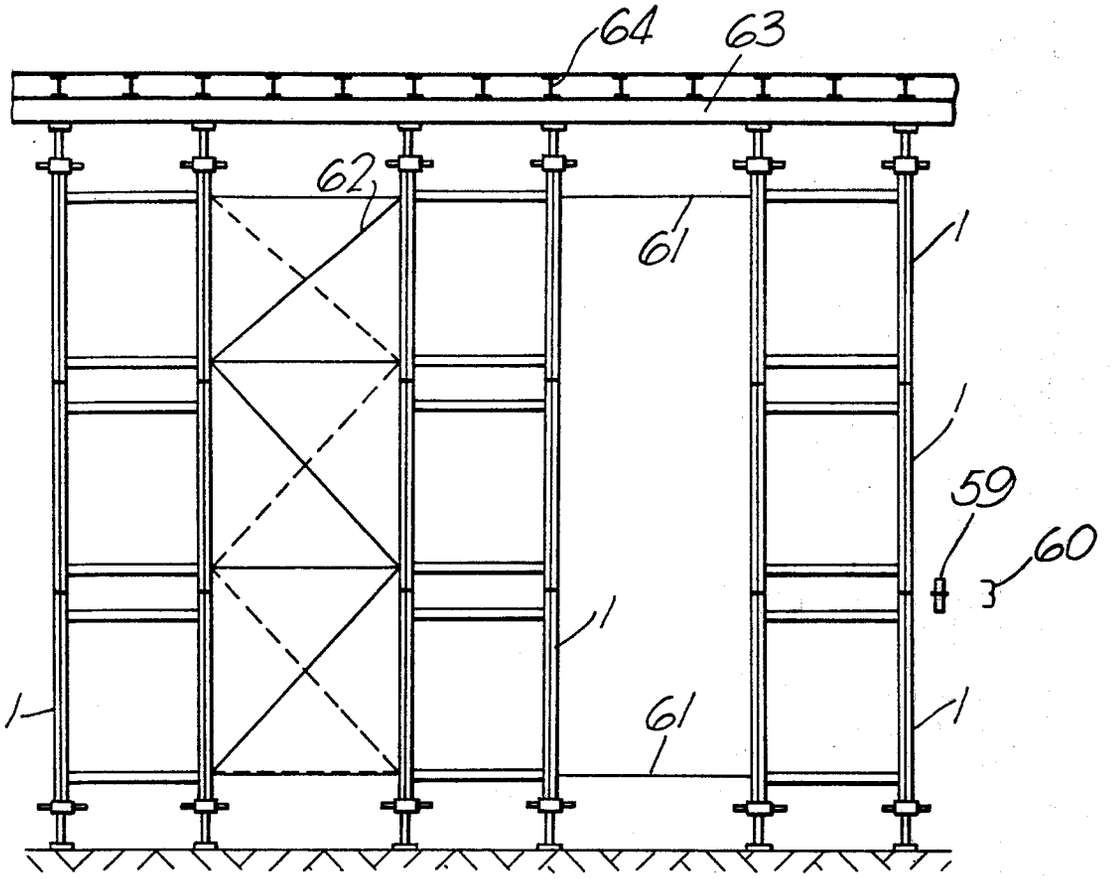
Fig .7.



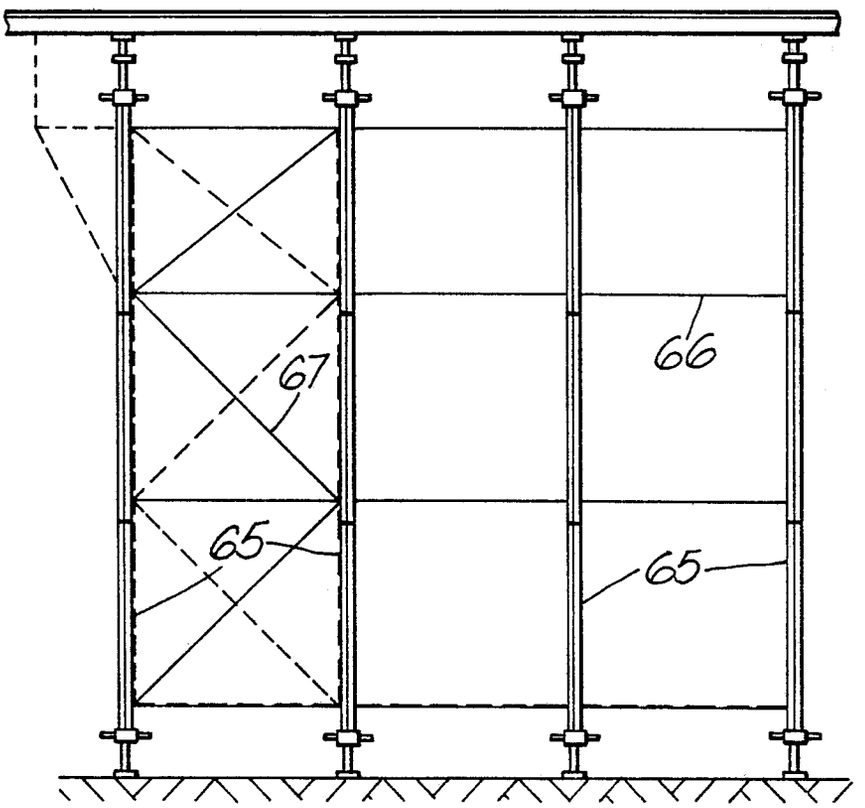


Fig .8.

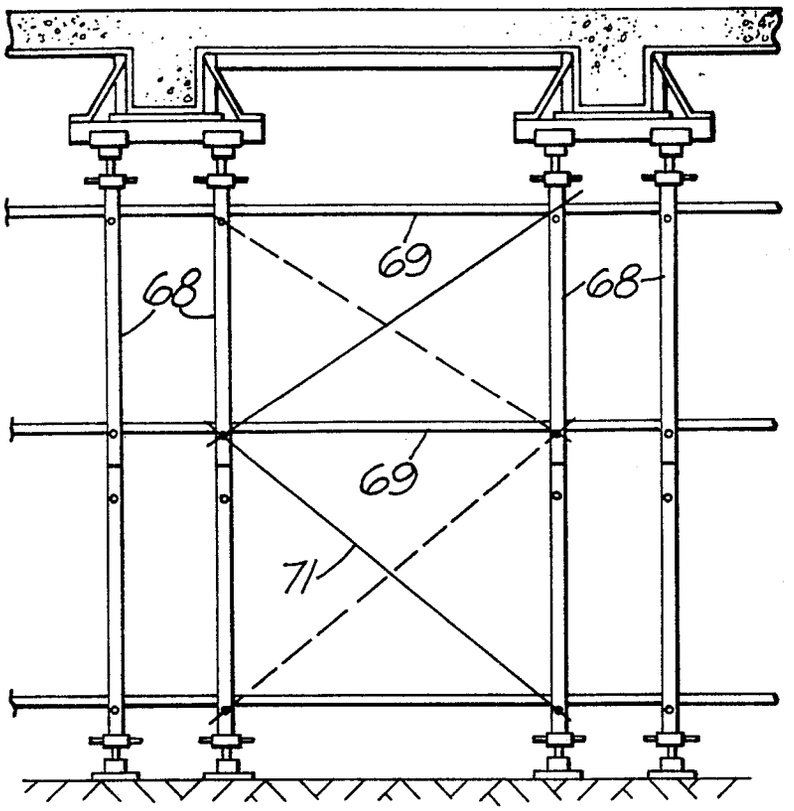


Fig.9.

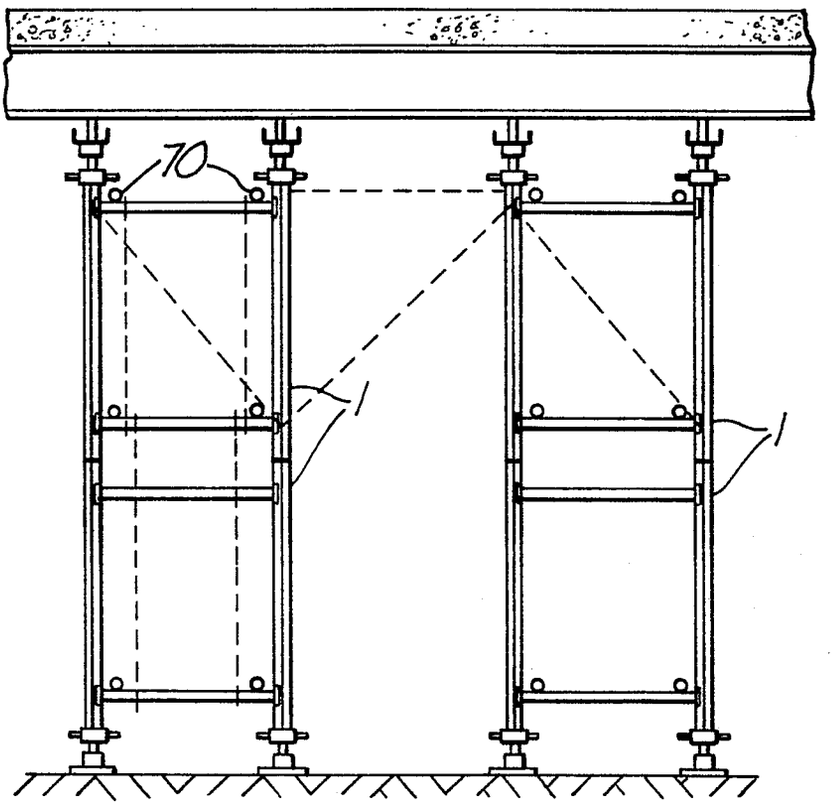


Fig.10.

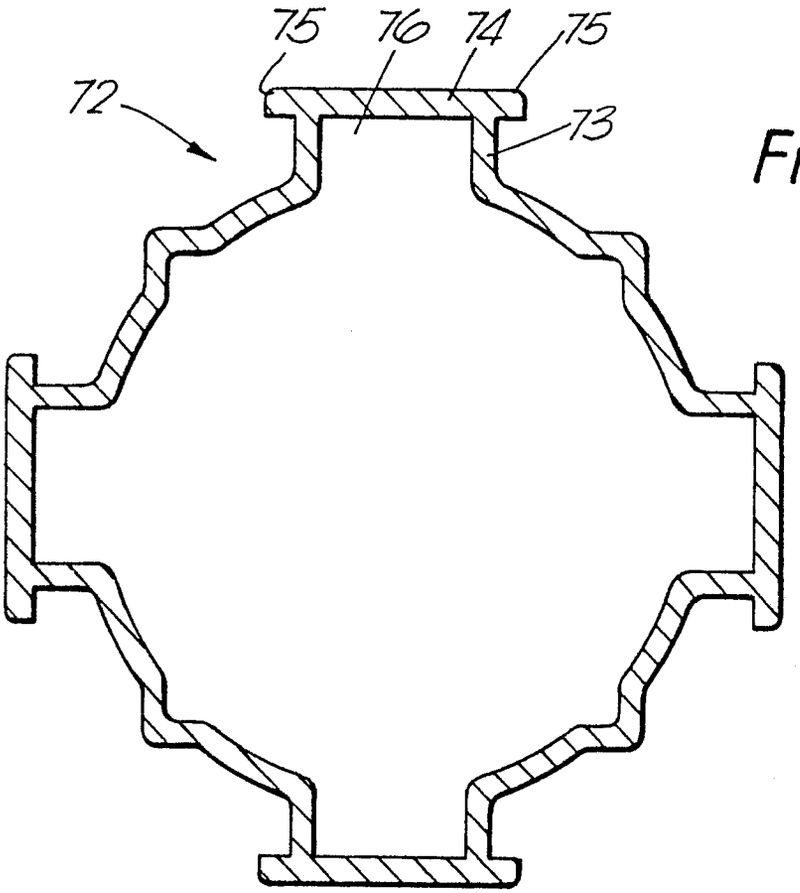


Fig.11.

Fig.13.

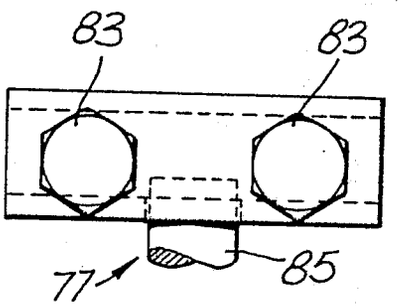


Fig.12.

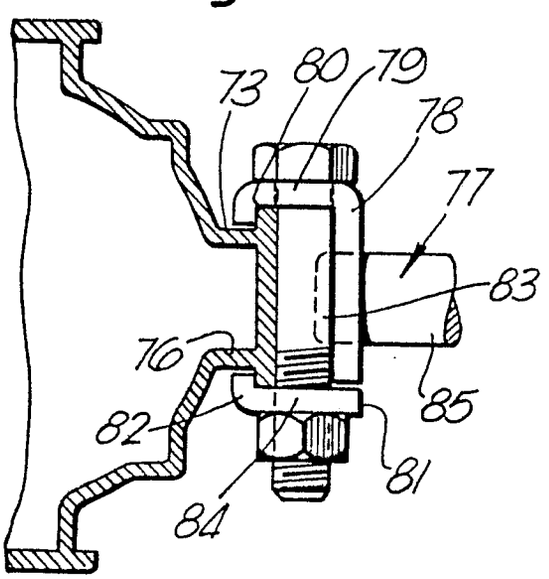


Fig.14.