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⑦① Applicant: **SGB GROUP LIMITED, 23 Willow Lane, Mitcham Surrey CR4 4TQ (GB)**

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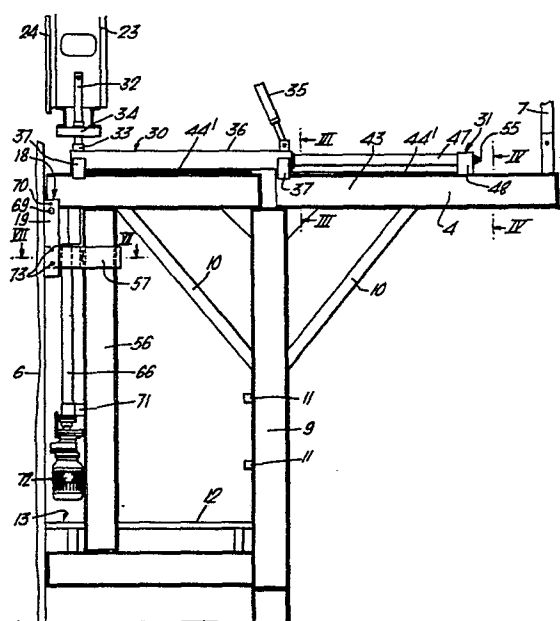
⑦② Inventor: **Blank, Wilhelm Werner August Otto, Hazelaar 4, Helmond (NL)**  
Inventor: **Bierhoff, Anton, Oudartstraat 16, Helmond (NL)**

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⑦④ Representative: **Howden, Christopher Andrew et al, Forrester & Boehmert Widenmayerstrasse 5/IV, D-8000 München 22 (DE)**

⑤④ Improvements in or relating to formwork.

⑤⑦ A device for moving a first part 23 of a formwork assembly relative to a second part 9 is disclosed which comprises at least one shoe 37 mechanically connected to the first part 23 which is slidable along a rail 43, the first part comprising an elongate member 36 having at one end a screw threaded bore which co-operates with a rotatable screw threaded member 47 which is retained 48 so that the screw threaded member can rotate but cannot move longitudinally. Elements having a low coefficient of friction may be provided between the shoes 37 and the rail 43. The invention is described with reference to an arrangement which moves soldiers 23 and also with reference to a self-climbing formwork where a shoe 57 slide along rail 56 on rotation of threaded member 66 by means of electric motor 72.



**EP 0018014 A2**

## IMPROVEMENTS IN OR RELATING TO FORMWORK.

THIS INVENTION relates to formwork, and more particularly, although not exclusively, to climbing formwork.

More particularly one aspect of the invention relates to a formwork assembly including a device for moving a first part of the formwork assembly relative to a second part of a formwork assembly. Another aspect of the invention relates to a formwork assembly, said formwork assembly comprising a main horizontal working platform, and a support structure connected to said horizontal working platform for supporting said working platform in position adjacent a wall or the like to be constructed. A further aspect of the invention relates to a self-climbing formwork assembly, said formwork assembly comprising a working platform, a substantially vertical shutter or form movable at least partially across said platform, and a support assembly for said platform comprising a vertical support arrangement supporting at least one lower working platform.

It has been proposed to provide so-called climbing formwork for use in the construction of tall buildings or other structures formed partially or primarily from cast concrete.

One prior proposed climbing formwork arrangement is described in German Offenlegungsschrift No.2,521,622. The climbing formwork described in this prior specification comprises a horizontal platform, there being a supporting arrangement located underneath the horizontal platform. The horizontal platform and the supporting arrangement are connected to a tie house or bracket that is embedded in a cast concrete wall. Mounted on the

horizontal platform is a vertical form or shutter, this form or shutter comprising spaced vertical support members, commonly termed "soldiers" having co-aligned front faces these front faces supporting a large sheet of plywood or the like. The entire form or shutter is movable across the platform, in a direction which is normal to the plane of the form or shutter, and thus can be moved to a first position in which the form or shutter is co-aligned with the wall portion supporting the horizontal platform, the form or shutter then being used in the casting of a further section of the concrete wall. It is to be understood that a corresponding form or any other appropriate type of form, may be provided on the other side of the wall. When the poured concrete has at least partially cured the form can be moved across the horizontal platform away from the wall to a second position enabling the thus exposed surface wall to be finished, and then the entire climbing formwork assembly (that is to say the horizontal platform the support arrangement and the vertical form or shutter) may be lifted, for example by means of a crane, the assembly being mounted again on the tie house or brackets in the freshly cured wall.

It will be appreciated that this cycle of operation may be repeated, enabling tall structures to be built without having to erect a formwork or shutter that extends over the entire height of the building or structure.

One disadvantage of prior proposed climbing formwork arrangements is that very complex devices have been utilised to move the vertical form or shutter across the horizontal platform. For example, the arrangement disclosed in German Offenlegungsschrift 2,521,622 includes the use of an assembly supported by rollers and a rack - and - pinion device adapted to be used in moving the vertical form or shutter across the horizontal platform. A complex device is provided for locking the form or shutter in the desired position that is to occupy when a

wall is being formed.

It is to be appreciated that in other prior proposed arrangements even more complicated scissor arrangements or turn buckles are provided which are  
5 utilised in moving the vertical form or shutter across the horizontal platform, these devices forming obstacles on the platform both when the form or shutter is in the position that it is to occupy when a wall is being cast, and when the form is in the position that it occupies  
10 when it has been moved away from such a wall. With many of the prior proposed devices it is not possible to stop or locate the movable form or shutter at any desired position, but instead the movable form or shutter must be located at a precisely pre-determined  
15 position, and then locked in position by means of locking bolts or the like.

Whilst the above described prior proposed arrangement utilises a sheet of plywood or the like secured directly to the above described vertical members or  
20 soldiers, it is a common practice in connection with formwork, to use horizontal timber main bearers, or secondary battens, which extend horizontally between the vertical members or soldiers, the plywood or the like being located on the front faces of these timber  
25 main bearers. In different circumstances timber bearers of different sizes are utilised. With many prior proposed arrangements of climbing formwork, as has been mentioned above, the vertical form or shutter can only be located in precisely predetermined positions  
30 and it will be appreciated that this does not facilitate the use of main bearers of different sizes.

A further disadvantage of prior self climbing formwork arrangement is that the self climbing equipment is complex and expensive.

35 According to one aspect this invention provides a device for moving a first part of a formwork assembly relative to a second part of a formwork assembly, the

following features, namely the device comprising a rail or guide member adapted to be attached to the second part of the assembly and a co-operating arrangement connected to the first part of the assembly, the co-operating arrangement comprising at least one shoe adapted to engage said rail or guide member, and adapted to slide there-along, said co-operating arrangement also including a member having an internally threaded bore, the axis of the bore being substantially parallel with the axis of said rail or guide member, the co-operating arrangement also comprising an elongate member threaded over a substantial part of its length adapted to engage said threaded bore and adapted to lie substantially parallel with the axis of said rail or guide member, the end of the threaded member remote from said threaded bore being retained so that the threaded member may be rotated but may not move axially relative to said rail or guide member.

With such an arrangement the first part of the assembly may be moved readily to any desired position with regard to the second part. Also the apparatus may be simple and inexpensive.

Advantageously the shoe may embrace said rail or guide member.

Preferably a material having a low coefficient of friction is provided between said shoe and said rail.

In one embodiment of the invention the shoe and the rail may be coated with grease, or dry grease, but in preferred embodiment of the invention the shoe, or the sliding surface of the rail is provided with an element having a low coefficient of friction and made of a material such as, for example, polytetrafluoroethylene.

Preferably two or more shoes are provided. The shoes may engage a single rail or guide member, but a separate rail or guide member may be provided for

each shoe.

Preferably means are provided for rotating the threaded member which comprise means at the end of the member remote from said threaded bore for engaging a  
5 handle or the like to rotate the member, or alternatively, means for engaging an electric motor adapted to rotate the member.

The first part of the scaffolding assembly referred to above may comprise a movable form or shutter, the  
10 second part of the scaffolding assembly comprising a support structure, so that the scaffolding assembly comprises a so-called climbing formwork arrangement. Alternatively the second part of the structure may comprise a climbing formwork arrangement comprising  
15 a movable form or shutter and various support platforms and a support structure, the first part of the assembly comprising a movable element adapted to engage support plates secured to or embedded in a wall or like structure being constructed by the formwork, so that the scaffold-  
20 ing assembly comprises a self-climbing formwork assembly.

Thus, according to another aspect of this invention provides in a formwork assembly, which formwork assembly comprises a main horizontal working platform, a support structure connected to said horizontal working platform  
25 for supporting said working platform in position adjacent a wall or the like to be constructed, the following features, namely, a plurality of rails or guide members mounted on said working platform, each rail or guide member being associated with a co-operating arrangement  
30 slidable thereon, said co-operating arrangement having at least one shoe engaging with the respective said rail or guide member, each said co-operating arrangement supporting a vertical soldier or the like, and being provided with a member which is fixed relative to said shoe and which  
35 has an internally threaded bore co-operating with an elongate member threaded over a substantial part of its length, said elongate member being substantially parallel

with said rail or guide member and being mounted for rotation but not for axial movement relative to the rail or guide member, means being provided for rotating said threaded member to move the said co-  
5 operating arrangement along said rail or guide member. With such an arrangement the soldiers may readily be moved to any desired position.

Conveniently the means for rotating the elongate member comprise a shaped protrusion at the end of the  
10 member remote from said threaded bore which protrusion can be engaged by a handle or the like. Alternatively said means for rotating the elongate member comprise an electric motor connectable to said elongate member.

Advantageously, each rail is of substantially 'I' configuration, and preferably each shoe has a planar  
15 portion adapted to engage a flat surface of the head of 'I' and two flanges extending adjacent the head of the 'I', said flanges having inwardly directed ends adapted to embrace the head of the 'I'.

20 Preferably two or more shoes are provided in each said co-operating arrangement. Preferably the shoes are mounted on a substantially hollow member, the threaded member being driven into and out of the hollow member on rotation thereof. The hollow member may comprise a  
25 channel section.

Preferably each soldier is connected to one end of a respective hollow member, and advantageously each soldier is adjustably connected to the hollow member in that the height of each soldier above the hollow member can be  
30 adjusted. Advantageously the connection between the soldier and the hollow member comprises a threaded member co-operating with a threaded bore in the base of the soldier, the threaded member being rotatable to adjust the height of the soldier relative to the hollow member.  
35 Preferably two rails are provided, two soldiers being mounted for movement along the rails, which soldiers, together with other soldiers, support formwork.

Preferably means are provided on the forward edge of said main working platform for engaging a support plate or the like embedded in or secured to a wall being constructed.

- 5        Advantageously the said support structure comprises means supporting at least one lower working platform beneath said main working platform, preferably two lower working platforms being provided.

- 10       Advantageously means are provided for tying the support structure to a wall adjacent the support structure to prevent the said formwork assembly from over-turning.

- 15       Advantageously the formwork assembly may be a climbing formwork assembly or a self-climbing formwork assembly provided with means for elevating the assembly.
- 20       Preferably such means comprise means for engaging a tie house or bracket, and means for moving said tie house or bracket engaging means relative to the rest of the assembly to cause the rest of the assembly to rise relative to that tie house or bracket. Advantageously
- 25       means are provided for levelling or plumbing the structure, said means comprising a roller or the like mounted adjacent the innermost edge of part of the support structure, the position of the roller relative to the support structure being adjustable.

- 30       According to another aspect this invention there provides in a self-climbing formwork assembly, said formwork assembly comprising a working platform, a substantially vertical shutter of form movable at least partially across said platform, and a support assembly
- 35       for said platform comprising a vertical support arrangement supporting at least one lower working platform the following features, namely a rail or guide member extending between the lower working platform and the main working platform, there being at least one shoe embracing and slidable along said rail, said shoe having means thereon for engaging a tie house or bracket embedded in or secured to a wall being constructed, said shoe having a



threaded bore therein engageable with an elongate member threaded over a substantial part of its length, said elongate member being substantially parallel with said rail or guide member, and being mounted at one  
5 end thereof for rotation but not for axial movement thereof relative to said rail or guide member, means being provided for rotating said threaded shaft to cause said shoe to slide relative to said rail or guide member.

10        Advantageously the rail is of substantially 'I' configuration and the shoe comprises two plates parallel with the stem of the 'I' and two transverse webs embracing the two heads of the 'I', material having a low  
15 co-efficient of friction being located between the heads of the 'I' and the said webs, the two plates of the shoe extending, on one side, beyond said webs and having a further member connected therebetween which defines said threaded bore and also extending beyond said member  
20 defining the threaded bore to free ends which have thereon said means for engaging a tie house embedded in or mounted on said wall. Preferably the means for engaging the tie house comprise apertures alignable with corresponding apertures in forwardly directed flanges of the tie house.

Preferably the forwardmost edge of the main working  
25 platform is provided with means for engaging an element on the tie house and preferably the means for engaging the element on the tie house comprise an inverted "U" sectioned channel adjacent the lower edge of the forward most lip of the working platform for engaging a belt or  
30 the like extending between forwardly extended flanges of the house.

Preferably means are provided for rotating said threaded member, and advantageously said means comprise an electric motor. Preferably the electric motor is  
35 releasably connected to the assembly so that the electric motor may be utilised repeatedly for operating different self-climbing formworks of the type described at different

parts of a site.

In one embodiment of the invention the formwork comprises a core shutter arrangement.

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

FIGURE 1 is a side elevational view of formwork  
10 assemblies in accordance with the invention;

FIGURE 2 is an enlarged view of part of Figure 1;

FIGURE 3 is a sectional view taken on line III-III  
15 of Figure 2;

FIGURE 4 is a sectional view taken on line IV-IV  
of Figure 2;

20 FIGURE 5 is a cut away view taken on line V-V of Figure 4;

FIGURE 6 A to E are diagrammatic figures showing  
25 formwork in accordance with the invention in various positions during the construction of a wall;

FIGURE 7 is a sectional view taken on line VII-VII  
of Figure 2;

30 and

FIGURE 8 is an enlarged view of part of Figure 1.

The drawings are diagrammatic and are not to scale.  
35

The invention will be described with reference to a specific example, which is the construction of a square or rectangular hollow construction 1 formed of cast concrete. Such construction may form a lift shaft  
5 in a building but in the described embodiment of the invention the construction is to form part of a building such as a block of flats, or an office block, appropriate floors being located in position, spanning the space between the four walls of the rectangular  
10 hollow construction when the four walls have been constructed. Of course, appropriate doors and windows will be formed in the walls, as is well known in the art.

On the outside surface of each wall of the square or rectangular construction 1 a climbing formwork device  
15 2 is provided, and such a climbing formwork device and its mode of operation, will be described in greater detail hereinafter. In the centre of the square or rectangular construction 1 a core shutter 3 is provided, and such a core shutter 3 will also be described herein-  
20 after in greater detail.

The climbing formwork device 2 comprises a first horizontal working platform 4, which is the main working platform, the platform being approximately 5 metres long and approximately 2.5 metres wide. One long edge 5 of  
25 the working platform is intended to be located immediately adjacent a concrete wall 6, that has, for example, just been cast with the aid of the climbing formwork device 2. The other long edge of the working platform is provided with a guard rail 7.

30 A support structure 8 for the first working platform is provided underneath the first working platform 4. The support structure comprises a number of first vertical support members 9 which extend downwardly substantially from the centre of the first working platform 4. These  
35 first support members 9 are braced by inclined bracing members 10, and also support horizontally extending

members 11 which form a guard rail. The support members 9 extend downwardly for a distance of approximately 2 metres and at their lower ends are connected to an inwardly directed first lower working platform 12 which again has a length of approximately 5 metres but has a width of approximately 1.0 metres. One long edge 13 of this first lower working platform is adapted to be located immediately adjacent the wall 6 that has been formed. A number of further support members 14 are provided which extend downwardly from the lower ends of the first support members 9, these further support members 14 again extending downwardly for a distance of approximately 2 metres, and supporting further horizontal members 15 which form a further guard rail. The further support members 14 are connected at their lower ends to a second lower working platform 16 which has a length of 5 metres and a width of approximately 1.0 metres, the corresponding long edge 17 of the second lower working platform being adapted to be located immediately adjacent the wall 6. The guard rails 11, 15 are provided to protect workmen when they are standing on the lower working platforms 12 or 16.

The longitudinal side edge 5 of the first main working platform 4 is provided with means 18 for engaging a support plate 19 that is embedded in or is securely connected to the concrete wall. Since the long edges 13, 17 of the two lower working platforms 12, 16 engage the wall 6, the climbing formwork device 2 is supported in position. In a preferred embodiment of the invention a plumbing device 20 is provided which is located in the lowermost working platform 16, this device comprising a roller protruding from the side edge of the platform and engaging the wall 6. The position of the roller can be adjusted inwardly and outwardly, the roller thus being moved horizontally. As the roller is moved inwardly and

outwardly so the entire climbing formwork device 2 is caused to pivot about the point of connection between the means 18 provided on the first horizontal working platform 4 and the above described support plate 19 secured to or embedded in the wall 6. Thus the orientation of the described device 2 can be adjusted accurately in one direction so that the platform 4 is precisely level.

A tie 21 is provided which can be connected between one of the further support members 14 and a support plate or bolt 19 secured to or embedded in the wall 6. This prevents the lower working platforms from moving away from the wall 6 even of the wind blows and tends to topple the climbing formwork device 2. The tie 21 may comprise a length of wire rope or the like provided with a turn buckle for tensioning purposes or may preferably comprise a push-pull prop device.

Provided on the first working platform 4 is a vertical form or shutter 22. The vertical form or shutter 22 comprises a number of vertical support members 23 which are termed "soldiers" and in this particular embodiment of the invention the soldiers are such as sold by SGB Group Limited under the designation "J.4" soldiers. The soldiers are spaced apart, but the front faces thereof, that is to say the faces located towards the concrete wall 6, are co-aligned and a sheet of plywood 24 or the like is mounted in position on these co-aligned faces. It is to be appreciated, however, that intermediate support battens may be located between the aligned faces at the soldiers and the sheet of plywood or the like. A hop-up platform 26 is provided adjacent the top of the soldiers 23, this hop-up platform 26 being a horizontal platform 27 extending from the rear face of the soldiers and having an appropriate guard rail 28. A concrete chute 29 is defined near the top of the shutter or form to assist in the pouring of concrete into a space defined by the shutter or form.

The lower ends of the soldiers 23 at each end of the row of soldiers is mounted on a respective movable support assembly 30, and the arrangement is such that the two support assemblies may be moved so  
5 that all the soldiers 23, and the form 24 supported thereon, can be moved across the platform 4 away from the wall by operating two jacks 31, each jack 31 being associated with a respective support assembly 30.

If desired the two end soldiers 23 may each be  
10 adjustably connected to the corresponding support assembly 30 by means of a threaded member 32 which is engaged in a housing 33 formed on the support assembly, the threaded member passing through a threaded bore provided in a plate 34 located at the bottom of the  
15 soldier, means being provided for rotating the threaded member 32 to enable the vertical position of the soldier 23 relative to the support assembly 30 to be adjusted. Thus by adjusting these threaded members 32, and by adjusting the above mentioned plumbing device 20, the  
20 soldiers 23 may be made to be precisely vertical, with their bases on a horizontal line.

A supporting prop 35 may be provided inclined angularly between one end of a hollow horizontal member 36 with a nut embedded therein (which forms part of the  
25 support assembly and which will be described hereinafter) and a point part way up the soldier. Such a prop 35 may be of adjustable length to enable the angle of inclination of the soldiers 23 to be adjusted slightly.

Each movable support assembly 30 comprises a  
30 substantially horizontal hollow support member 36 as mentioned above, the respective soldier 23 being mounted in a vertical position at one end of the hollow member 36 by the above described adjustable connection 32, 33, 34. The hollow member 36 extends transversely across the  
35 platform in the direction of movement of the soldier. Mounted on the exterior of hollow member are two sliding shoes 37 although more sliding shoes can be

provided if desired. Each sliding shoe comprises two vertical flanges 38, 39 securely mounted on opposite sides of the hollow member 36, the flanges extending downwardly. The flanges have inwardly directed free ends 40, 41 these inwardly directed free ends embracing the head 42 of the 'I' sectioned member 43 or rail mounted on or forming part of the platform 4.

An element 44 of material of low co-efficient of friction such as polytetrafluoroethylene (sold under the Registered Trade Mark TEFLON) is located in position in each shoe 37, the element being located between the head 42 of the 'I' sectioned rail 43 and the bottom of the horizontal hollow member 36. In a preferred embodiment of the invention a strip 44' of corresponding material of low co-efficient of friction is mounted in position on the top of the 'I' sectioned rail but this is not shown. It will be appreciated, therefore, that the hollow member which supports the soldiers may slide freely across the top of the 'I' sectioned element.

Since the flanges 38, 39 embrace the head of the 'I' the formwork 24 cannot be toppled over by the wind. Also the entire device 2 may be lifted by a crane with the lifting cable 44, the crane being attached to the tops of the soldiers 23, the form or shutter having first been moved to such a position that the formwork device 2 will be substantially vertically balanced when lifted in this way.

At the end remote from the soldier 23 (see Figure 3) the hollow member 36 is provided with a nut 46 embedded in the open end thereof, and an externally screw threaded member 47 which is an elongate member provided with screw threading over a substantial part of its length, is engaged with the nut. The nut 46 is retained firmly in position. The screw threaded member extends to a housing 48 provided on the 'I' sectioned rail 43. The housing 48 (see Figure 4) comprises two upstanding spaced flanges 49 with a cross-piece 50 extending between them. The cross-piece 50 has a circular bore 51 aligned with the axis of the threaded

member 47 but of lesser diameter. A shouldered extension 52 of the threaded member 47 (see Figure 5) passes through the bore, and a collar 53 is retained on the part of the extension 52 which is on the side of the cross-piece 50 remote from the threaded member 47 by means of a grooved pin 54 that passes through a diametric bore in the extension 52 and co-aligned bores in the collar 53. The collar 53 has an external diameter which is greater than the diameter of the bore 51. The portion of the shouldered extension 52 that protrudes beyond the collar 53 terminates in a square sectioned driving peg 55. The arrangement is such that whilst the screw threaded member 47 can be rotated by means engaging the square sectioned driving peg 55, the screw threaded member 47 cannot move axially, since the collar 53 on the shouldered extension 52 retains the shouldered extension 52 on the cross-piece 50. Means are provided for rotating the screw threaded member 47 at said housing 48 such as they handle or the like engageable with the driving peg 55.

The arrangement is such that the screw threaded member 47 forms part of a jack 31, and on rotation of this screw threaded member 47 the hollow member 36 supporting the soldier is driven along as a result of the engagement of the nut 46 embedded therein with the screw threaded member 47. The movement of the jack 31 can be terminated at any desired position and the form or shutter will be effectively locked in that position since any forces tending to move the form or shutter 24 will not cause the screw threaded member 47 to rotate. If desired additional means can be provided for preventing further rotation of the threaded member 47, thus firmly securing the form or shutter in position.

It will be appreciated that by operating the above described jacks 31 in the appropriate manner the form or shutter 24 may be withdrawn from a forward position



that it occupies when a wall 6 is being cast to a retracted position to enable the surface of the cast wall to be finished and to enable the formwork to move upwards. The shutter will move smoothly, and the means for moving the shutter are simple and uncomplicated. The form or shutter may be retained in any desired position. The form or shutter cannot tilt from the vertical position in view of the engagement of the inwardly directed free ends 40, 41 ends of the vertical flanges 38,39 of the sliding shoes 37 with the 'I' sectioned rail 43.

A climbing formwork device 2, as described above, will be utilised, in conjunction with other formwork, in the following way. Initially, conventional formwork or the formwork described above when detached from the two lower working platforms will be utilised to form the first stages of the concrete wall of a building (see Figure 6A). The climbing formwork assembly device 2 described above, but without the lowermost platform 16 will be assembled, for example on a platform created from temporary battens of the like, and will then be lifted into position on the conventionally built wall 6, for example by means of a crane, the mounting means 18 on the upper platform 4 engaging appropriate support plates 19 which have been embedded in the wall. Alternatively the upper platform 4 and the support structure 7 may be assembled in position on the wall and the form may be lifted into position by crane (see Figure 6B). The form or shutter is then moved forwardly across the platform to the desired position, the height of the shutter and the orientation of the shutter being adjusted by the various means described above. Then the shutter is utilised in the formation of a cast concrete wall, concrete being poured through the chute into the space defined by the shutter or form (see Figure 6C). When the concrete is at least partially cured the shutter is retracted by appropriate operation of the

jacks described above enabling various finishing operations to be performed on the exposed surface of the wall (see Figure 6D). Subsequently the formwork is lifted up, the formwork subsequently being re-engaged with a fresh support plate embedded in or secured to the just cast section of the wall. The formwork may be lifted by a crane, or may, as will be described in detail hereinafter, be a self-climbing formwork. A further part 14,16 of the support structure can then be added (see Figure 6E). The casting operation can then be repeated, (see Figure 6F) whilst workmen standing on the two lower working platforms can carry out any necessary final procedures so that the surface of the wall is in a desired condition and also can fit the push pull tie prop 21, before the formwork is moved away from that section of the wall (see Figure 6G).

In the presently described embodiment of the invention the formwork device, is adapted to be a self-climbing formwork assembly, as will be described in greater detail. However, it is to be understood that self-climbing feature may be omitted, the formwork then being lifted, when necessary, by a crane. However, the presently described arrangement is such that the formwork can be raised up a wall without the use of a crane. In this embodiment a vertical 'I' sectioned beam or rail 56 is provided which extends between the lower surface of the main working platform 4 and the first lower working platform 12. The 'I' sectioned beam or rail 56 is spaced inwardly slightly from the edge 13 of the platform 12 located adjacent the wall that is being formed. A shoe assembly 57 is slidably mounted on the 'I' beam or rail 56 the shoe assembly 57 comprising two forwardly extending spaced plates 58,59 which are interconnected by transverse webs 60,61 that embrace the 'I' sectioned beam or rail 56, elements 62,63 of material of low co-efficient of friction, such as polytetrafluoroethylene, (as sold under the Registered Trade Mark "TEFLON") being located between the transverse

webs 60,61 and the opposed end flanges of 'I' beam or rail 56. A nut 64 is firmly mounted in position between the two forwardly extending plates 58,59, the nut having a threaded bore 65 therein which received  
5 a threaded shaft 66, the threaded shaft extending downwardly parallel with the 'I' sectioned beam 56. At the forward end of the two parallel plates 58,59 forming the shoe two aligned apertures 67 are provided. The apertured ends of the plates are dimensioned to fit  
10 between correspondingly apertured oppositely directed flanges 68 provided on the support plate 19 that is secured to the wall, the flanges 68 on the support plate thus being directed away from the wall and being parallel with each other. Bolts or the like may be passed  
15 through the co-aligned holes to connect the elements 19,58,59 together. A transverse bolt 69 is provided which extends between the two flanges 68 of the support plate 19 and the first or upper working platform is provided with an inverted "U" shaped channel 18 at the  
20 forward edge thereof adapted to engage said bolt 69. Further apertures 70 are provided in the flanges 68 on the support plate and in the main working platform to accommodate a security pin when co-aligned.

The lower end of the said threaded shaft 66 is retained  
25 in a roller bearing which is mounted on a housing 71 that is welded or otherwise secured to the 'I' beam or rail 56 in such a way that the threaded member can be rotated but cannot move axially. Means are provided for releasably mounting an electric motor 72 adjacent the lower end of the  
30 threaded shaft 66 to drive the threaded shaft.

In its initial position (as shown in Figure 2) the shoe 57 is connected by means of bolts 73 to a support plate 19 which is embedded in or secured to a wall 6 that is being constructed. The transverse bolt 69 of the  
35 support plate engages the inverted "U" shaped channel 18 which is located at a position adjacent the forward edge of the platform 4. When the climbing formwork is to

be elevated or moved upwardly the security pin is removed and the electric motor 72 is operated to draw the shoe 57 sliding on the 'I' beam downwardly towards the electric motor. Since the shoe is connected by  
5 bolts to the support plate 19 in the wall, the effect of operating the electric motor is to cause the entire formwork device 2 to rise, the inverted "U" shaped channel 18 moving away from the transverse bolt 69 of the support plate 19. When the formwork device 2 has been  
10 elevated by a predetermined amount the formwork device 2 is again connected to the wall by engaging the inverted "U" shaped channel 18 at the front edge of the first working platform 4 with another support plate 19 which is embedded in or secured to the wall at an appropriate  
15 position. The sliding shoe 57 is returned to its initial position relative to the formwork, which means that the forward apertured ends of plates 58,59 of the shoe are inserted between the flanges 68 of the fresh support plate 19, and bolts can again be located in position to  
20 connect the two components together. Thus the formwork has climbed upwardly and a fresh cycle of operation can commence.

The levelling or plumbing device 20 provided on the lowermost platform of the support assembly (see  
25 Figure 8) in this embodiment comprises a hollow upstanding spigot 74 adjacent the free edge of the lowermost platform. A threaded shaft 75 passes through a bore in the forward wall of the spigot, respective nuts 76,77 being provided on the shaft 75 on either side of the wall of the spigot  
30 74. The threaded shaft 75 terminates in a "U" shaped bracket 78, the spigot being connected to the base of the "U", the arms of the "U" extending forwardly and supporting between them a roller 79 having a horizontal axis of rotation. By rotating the nuts 76,77 on the shaft 75 the  
35 position of the roller 79 relative to the edge of the lowermost platform 16 may be adjusted. The arrangement is such that the roller 79 protrudes slightly forwardly

beyond the edge of the platform 16 to enable the entire assembly to be plumbed, the roller rolling along the wall as the platform rises.

Turning now to the core shutter 3 it is to be appreciated that the core shutter comprises a substantially square or rectangular platform 80 having a shape and size corresponding to the shape and size of the square or rectangular opening to be left in the middle of the square or rectangular construction 1 that is being formed. The platform 80 has retractable shoes 81 which protrude from the side edges thereof, the shoes being adapted to move to a retracted position when the platform 80 is to be elevated, but being adapted to protrude into recesses 82 formed in the concrete when the platform 80 is to be maintained in position. The shoes 81 may, of course, be hinged or may be slidable within hollow members forming part of the core shutter 3. Thus, when the platform 80 is in an initial position the shoes 81 provided at the edges of the platform project outwardly into the recesses 82 formed in the concrete of the wall and the platform is supported by the shoes. Forms or shutters 83 are mounted on the platform 80 and are movable to positions in which they are in position for use in the preparation of a cast wall. However, in view of the fact that four shutters must be moved inwardly from the sides of a square or rectangle it is not envisaged that the sliding shoe arrangement described above will be utilised but other conventional arrangements will be provided for moving the shutters.

It will be appreciated that the core shutter 3 will be moved upwardly before upward movement of the previously described climbing formwork 2, to enable the forms or shutters on the core section to be cleaned readily. The said climbing formwork 2 will then be moved upwardly so that the form on the climbing formwork and the corresponding form on the core shutter are located in position to define a segment of a wall

that is to be cast. The core shutter is provided with a lower platform 84 beneath the main working platform 80. The core shutter 3 is also provided with self-climbing devices 85 adapted to engage with appropriate support plates and corresponding precisely with the self-climbing devices described above in connection with the self-climbing formwork.

The forms of the formwork and the core shutter may be provided with conventional pairs of aligned "U" channels on the rear faces thereof to accommodate ties.

It is to be appreciated that in the described and illustrated embodiments of the invention there is space on the main working platform 4 for workmen to pass behind the forms or shutters, even when they are in the retracted position. A minimum number of components protrude upwardly from the main working platform 4, minimising the risk of the components being damaged, and also minimising the number of components that can impeded workmen. The moving parts of the construction move smoothly and are not greatly exposed to drops of concrete or concrete dust. It will be appreciated that in the described formwork two or three different sizes of main timber bearers or secondary battens may optionally be used since the soldiers 23 may be stopped at any desired position.

Whilst the invention has been described with reference to embodiments in which elements of polytetrafluoroethylene are provided between the sliding shoes and the rails in the jacks forming part of the device to move the shutter and the self climbing device, any other material with a low co-efficient of friction, such as grease or dry grease may be used.

## CLAIMS

1. A formwork assembly including a device for moving a first part of the formwork assembly relative to a second part of a formwork assembly, characterised in that said device comprises a rail or guide member (43) adapted to be attached to the second part of the assembly and a co-operating arrangement connected to the first part of the assembly, the co-operating arrangement comprising at least one shoe (37) adapted to engage said rail or guide member (43), and adapted to slide there-along, said co-operating arrangement also including a member (46) having an internally threaded bore, the axis of the bore being substantially parallel with the axis of said rail or guide member (43), the co-operating arrangement also comprising an elongate member (47) threaded over a substantial part of its length adapted to engage said threaded bore and adapted to lie substantially parallel with the axis of said rail or guide member (43), the end of the threaded member (47) remote from said threaded bore being retained (31) so that the threaded member may be rotated but may not move axially relative to said rail or guide member.
2. A formwork assembly according to claim 1 characterised in that the first part of the assembly comprise a movable form or shutter (24), and the second part of the assembly comprises a support structure (8).
3. A formwork assembly according to claim 1 characterised in that the second part of the structure comprises a climbing formwork arrangement comprising a movable form or shutter (24) and various support platforms (12,16) and a support structure (9), and the first part of the assembly comprises a movable element (57) adapted to engage support plates (19) or the like secured to or embedded in a wall (6) or the like structure being

constructed by the formwork, so that the assembly comprises a self-climbing formwork assembly.

4. A formwork assembly, said formwork assembly  
5 comprising a main horizontal working platform, and a support structure connected to said horizontal working platform for supporting said working platform in position adjacent a wall or the like to be constructed, characterised in that a plurality of rails or guide  
10 members (43) are mounted on said working platform (4), each rail or guide member (43) being associated with a co-operating arrangement slidable thereon, said co-operating arrangement having at least one shoe (37) engaging with the respective said rail or guide member  
15 (43), each said co-operating arrangement supporting a vertical soldier (23) or the like, and being provided with a member (46) which is fixed relative to said shoe and which has an internally threaded bore co-operating with an elongate member (47) threaded over a substantial  
20 part of its length, said elongate member (47) being substantially parallel with said rail or guide member (43) and being mounted for rotation but not for axial movement relative to the rail or guide member (43), means  
(55) being provided for rotating said threaded member to  
25 move the said co-operating arrangement along said rail or guide member (43).

5. A formwork assembly according to any one of claims 1, 2 or 4 characterised in that each rail or  
30 guide member (43) is of substantially 'I' configuration, and each shoe (37) has a planar portion adapted to engage a flat surface of the head of 'I' and two flanges (38,39) extending adjacent the head of the 'I', said flanges having inwardly directed ends (40, 41) adapted to embrace  
35 the head of the 'I'.



6. A formwork assembly according to any one of claims 1, 2, 4 or 5 characterised in that two or more shoes (37) are provided in each said co-operating arrangement; the shoes (37) being mounted on a substantially hollow member (36), the threaded member (47) being driven into and out of the hollow member on rotation of the threaded member (47).
7. A formwork assembly according to any one of the preceding claims characterised in that the formwork assembly is a self-climbing formwork assembly provided with means for elevating the assembly, said elevating means comprising means (57) for engaging a tie house or bracket (19), and means (72) for moving said tie house or bracket engaging means (57) relative to the rest of the assembly to cause the rest of the assembly to rise relative to that tie house or bracket (19).
8. A formwork assembly according to any one of the preceding claims characterised in that means are provided for levelling or plumbing the structure, said means comprising a roller (78) or the like mounted adjacent the innermost edge of a part of the support structure, the position of the roller (78) relative to the said support structure being adjustable.
9. A formwork assembly according to any one of the preceding claims characterised in that the means (55) for rotating the elongate member (47) comprise a shaped protrusion (55) at the end of the member remote from said threaded bore which protrusion can be engaged by a handle or the like.
10. A self-climbing formwork assembly, said formwork assembly comprising a working platform, a substantially vertical shutter or form movable at least partially across said platform, and a support assembly for said

platform comprising a vertical support arrangement supporting at least one lower working platform characterised in that there is a rail or guide member (56) extending between the lower working platform (12) and the main working platform (4), there being at least one shoe (57) embracing and slidable along said rail (56), said shoe having means (67) thereon for engaging a tie house or bracket (19) embedded in or secured to a wall (6) being constructed, said shoe having secured thereto a member with a threaded bore (65) therein engageable with an elongate member (66) threaded over a substantial part of its length, said elongate member (66) being substantially parallel with said rail or guide member (56), and being mounted (71) at one end thereof for rotation but not for axial movement thereof relative to said rail or guide member (56) means (72) being provided for rotating said threaded member (66) to cause said shoe (57) to slide relative to said rail or guide member (56).

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11. A formwork assembly according to any one of the preceding claims characterised in that a material (44,62,63) having a low coefficient of friction is provided between said shoe (37,57) and said rail or guide member (43,56).

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12. A formwork assembly according to claim 11 characterised in that said material (44,62,63) comprises an element of polytetrafluoroethylene.

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13. A formwork assembly according to claim 10 characterised in that the rail (56) is of substantially 'I' configuration and the shoe (57) comprises two plates (58,59) parallel with the stem of the 'I' and two transverse webs (60,61) embracing the two heads of the 'I', material (62,63) having a low coefficient of friction being located between the heads of the 'I' and the said

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5.

webs (60, 61), the two plates (58,59) of the shoe extending, on one side, beyond said webs and having a further member (64) connected therebetween which defines said threaded bore (65) and also extending  
5 beyond said member defining the threaded bore to free ends which have thereon said means (67) for engaging a tie house (19) embedded in or mounted on said wall (6).

14. A formwork assembly according to claim. 10  
10 or 13 characterised in that the forwardmost edge of the main working platform (4) is provided with means for engaging an element on the tie house, the means for engaging the element on the tie house comprising an inverted "U" sectioned channel (18) adjacent the lower  
15 edge of the forwardmost lip of the working platform (4) for engaging a bolt (69) or the like extending between forwardly extended flanges of the tie house (19).

Fig. 1.

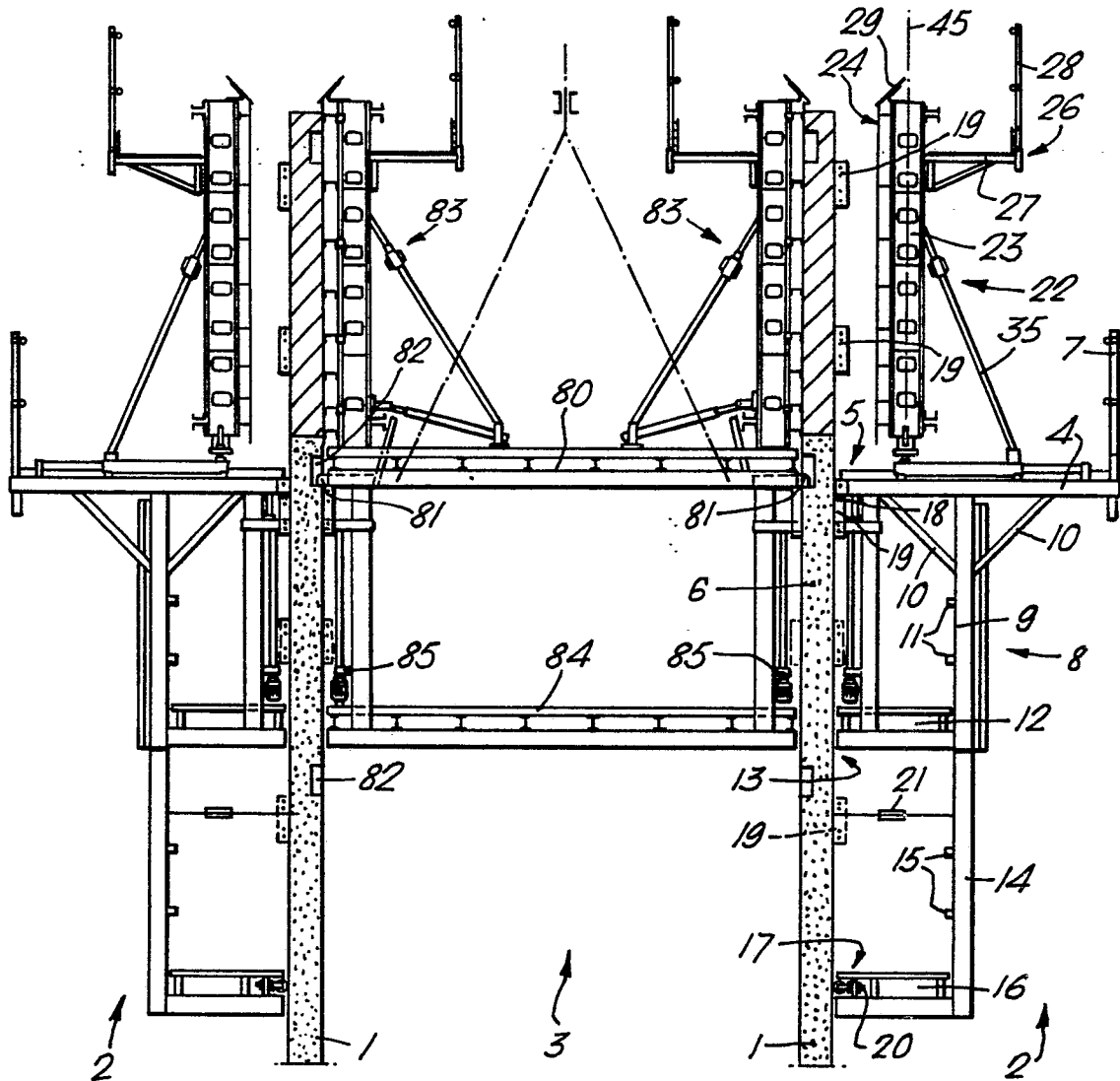


Fig. 2.

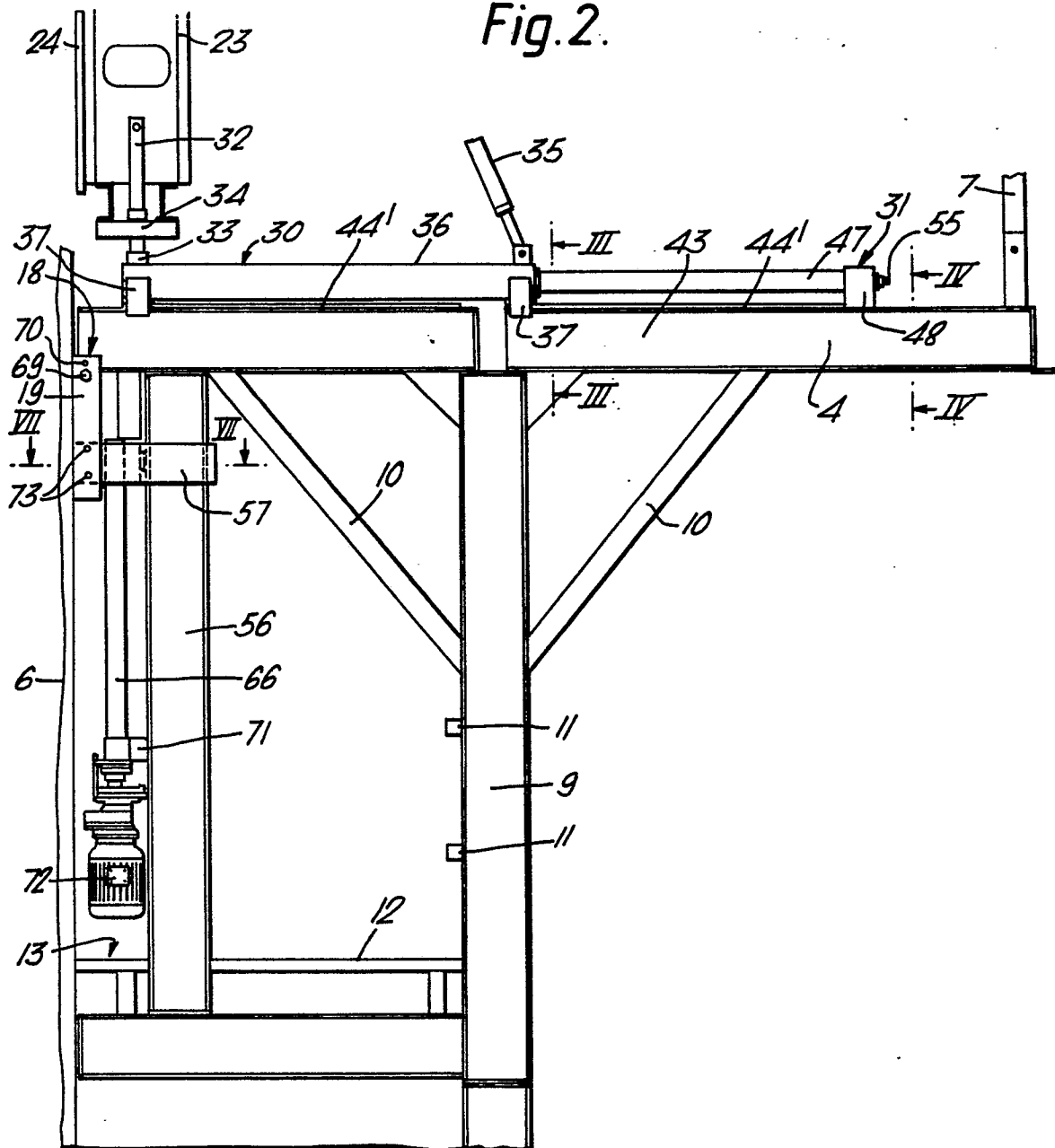


Fig. 3.

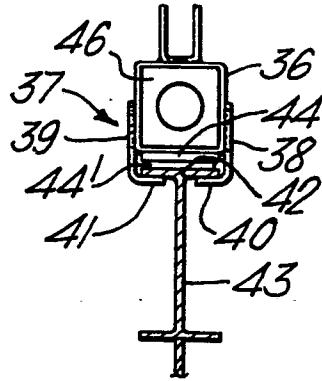


Fig. 4.

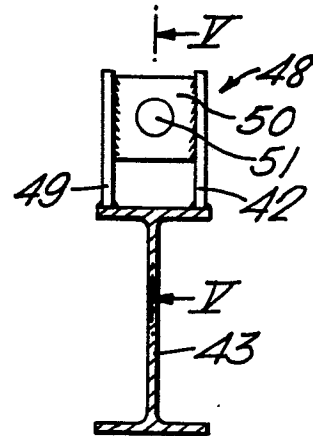


Fig. 5.

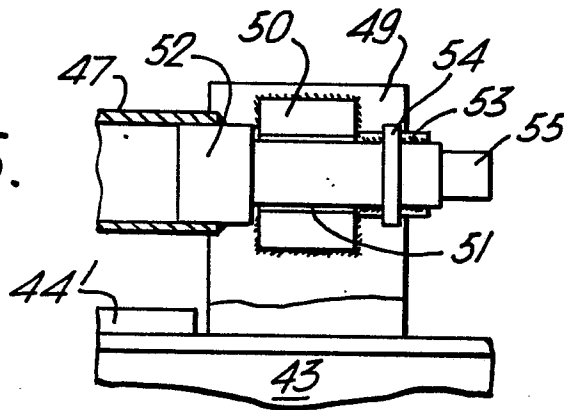


Fig. 7.

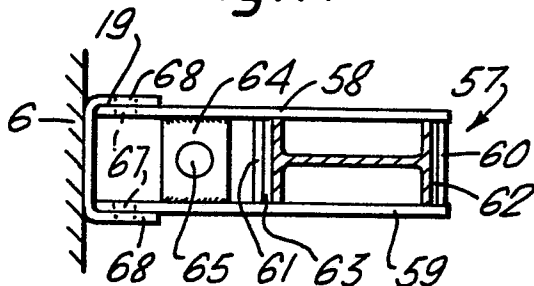


Fig. 8.

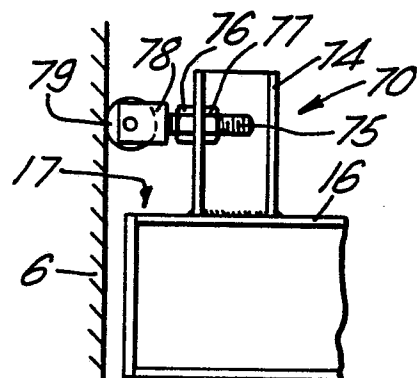


Fig. 6.

