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(54) Formwork for concrete structure

(57) Formwork apparatus (100) for forming a detail in a concrete structure comprises at least one formwork shuttering panel (101) and a forming element such as a boot (104) movably mounted relative to the shuttering panel (101). Forming element (104) is supported by an arm (105) which in turn is supported by a clamp (102) which is removably attached to upper edge (103) of the shuttering panel (101)

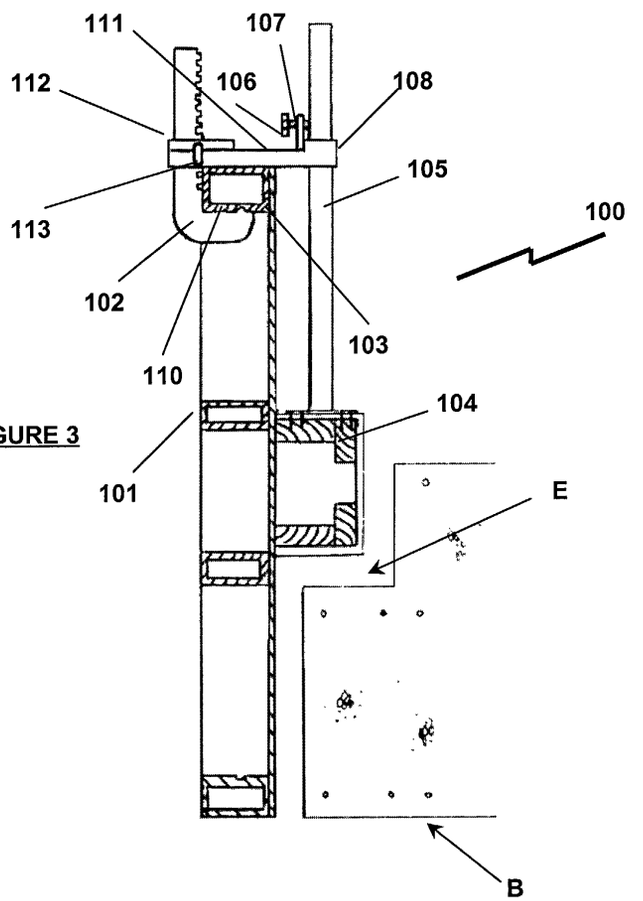

FIGURE 3

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Description

[0001] The present invention relates to improvements to formwork for concrete structures and in particular to formwork for forming a detail in an in-situ reinforced concrete structure.

[0002] In concrete structures, such as apartment buildings, multi-storey car parks, shopping centres and the like there are major requirements for producing concrete structures in situ having details such as recesses, ledges, steps, angles or voids which for ease of description will be referred to as details generally.

[0003] For example to support pre-cast concrete floor slabs, it is necessary to produce a detail such as a recess along the edge of each supporting reinforced concrete (R.C.) beam so as to accommodate the ends of the slabs. For contiguous slabs it is also necessary to provide a recess at each side of the beam so as to produce an inverse T shaped beam. Recesses in R.C. beams or other concrete structures can also be used to accommodate steel structures, block work or brickwork, either structural or finished work.

[0004] Currently, these recesses are produced by constructing timber box structures know as boots which occupy the recess spaces during the pouring and hardening of the concrete and the formation of the beams. The timber boots are manufactured on site by cutting 20mm thick plywood sheets, nailing then together to form box structures and nailing the boots to the formwork panels. Subsequently, the boots have to be dismantled and renailed to the formwork for the next section of beam. Forming the recesses in this manner involves a high labour content and does not guarantee accurate results. Furthermore, the quality of the work deteriorates and consistency is difficult to achieve, the more the boots are used. The boots accumulate grout as a result of repeated use and they lose their shape and begin to come apart. Also the repeated nailing, removing the nails and renailing the boots damages the surfaces of the plywood thereby giving a poor finish to the concrete. Consequently, new boots have to be constructed from fresh plywood periodically thereby increasing labour and material costs.

[0005] A typical concrete structure requiring the use of formwork as discussed is shown in Figure 1 and comprises two reinforced concrete beams A and B. Beam A has one recess C and beam B has two recesses D and E. A hollow core pre-cast slab F is supported by the recesses C and D. To produce the final structure, a screed of concrete G is laid on top and covers the slabs F and beams A and B.

[0006] The manner in which the recesses are formed in beam B is shown in Figure 2 which is a cross-sectional side view showing how the formwork is located about the beam with forming elements H and I attached to shutters J and K of the formwork.

[0007] The object of the invention is to alleviate the disadvantages with the prior art formwork used for forming a detail in in-situ concrete structures.

[0008] The present invention provides formwork apparatus for forming a detail in a concrete structure comprising at least one shuttering element used to define a side wall of the concrete structure, a forming element having the shape of the required detail, the forming element being movably mounted relative to the shuttering element.

[0009] Advantageously, the forming element is mounted on an elongate arm or shaft removably engageable with a clamp mounted on the shutter, the forming element being adjustable along an axis parallel to the side wall of the shuttering element.

[0010] Conveniently, the clamp is removably engageable with a portion of the shuttering element remote from the side wall of the shuttering element.

[0011] Preferably, the forming element is manufactured from a strong material, such as steel, stainless steel or a durable plastics materials.

[0012] Conveniently, the forming element, for example a boot, is faced with timber such as a high quality finished plywood to provide a contact and release surface for hardened concrete. Concrete generally hardens sufficiently after one day to allow the formwork to be released, however, the concrete does not reach its full strength until about 28 days approximately.

[0013] The invention also provides a method of forming a detail in a concrete structure comprising securing a shuttering element in position to define a side wall of the concrete structure, suspending a forming element having the shape of the required detail from the shuttering element in a manner which enables the forming element to be movably mounted relative to the shuttering element.

[0014] The movable forming element of the invention is fully adjustable to different heights to produce recesses or structures of different sizes. The invention lends itself to a systemized approach to formwork. The clamp arrangement can be easily integrated into formwork for use on a construction site.

[0015] The invention will hereinafter be more particularly described with reference to and as shown in the accompanying drawings, which show by way of example only, a number of embodiments of recess formwork according to the invention.

[0016] In the drawings:

Figure 3 is a cross-sectional end view of a first embodiment of recess formwork juxtaposed a recessed beam;

Figure 4 is a plan view of the first embodiment of the recess formwork;

Figure 5 is a front side view of the first embodiment of recess formwork;

Figure 6 is a cross-sectional end view of a second

embodiment of recess formwork according to the invention;

Figure 7 is a cross-sectional plan view of the first embodiment of recess formwork;

Figure 8 is a rear side view of the second embodiment of recess formwork;

Figure 9 is a front side view of the second embodiment of recess formwork;

Figure 10 is a perspective view of the first or second embodiment arranged to form an external corner forming element; and

Figure 11 is a perspective view of the first or second embodiment arranged to form an internal corner forming element;

Figure 12 is a front side view of a third embodiment of a recessed formwork according to the invention;

Figure 13 is a cross-sectional side view of the third embodiment;

Figure 14 is a cross-sectional side view of a fourth embodiment and Figure 15 is a cross sectional view of a modified forming element of the fourth embodiment;

Figure 16 is a cross-sectional and view of a fifth embodiment of recess formwork juxtaposed a recessed beam;

Figure 17 is a plan view of the fifth embodiment of the recess formwork and;

Figure 18 is a front side view of a portion of the recess formwork.

Figure 19 is a cross-sectional end view of a sixth embodiment of recess formwork juxtaposed a recessed beam;

Figure 20 is a plan view of the sixth embodiment;

Figure 21 is a front side view of a portion of the sixth embodiment;

Figure 22 to 24 are a series of side views illustrating how a parapet wall is formed in accordance with the prior art;

Figure 25 is a cross-sectional end view of a seventh embodiment of recess formwork juxtaposed a parapet wall/upstand;

Figure 26 is a plan view of the seventh embodiment;

Figure 27 is a front side view of a portion of the seventh embodiment;

Figure 28 is a cross-sectional end view of an eighth embodiment of recess formwork juxtaposed a beam with a tapered portion;

Figure 29 is a plan view of the eighth embodiment; and

Figure 30 is a front side view of a portion of an eighth embodiment.

[0017] Referring to the drawings, and initially to Figures 3 to 5, the first embodiment 100 comprises a formwork shuttering panel 101, a clamp 102 removably attached to the upper edge 103 of the shuttering 101, a boot 104 having attached or bolted thereto an arm 105 which is movably secured in position by a threaded locking stud nut 106 held by bracket 107. The clamp 102 comprises a pair of clamp jaws 110 and 111 which are adjustable to clamp a range of different widths, and a locking mechanism 112 which is readily secured by a locking wedge 113. Stud nuts could be used in place of the wedge 113. When the clamp 102 is fastened in place it gives rigidity and a firm anchor for the system to work successfully and effectively. No play or movement is allowed between the clamp 102 and the shuttering panel 101.

[0018] To adjust the height of the boot 104, the lock nut 106 is loosened, and the suspended arm is moved vertically through the housing 108 parallel to the face of the shuttering panel 101. The upper end of the arm 105 is provided with a handle (not shown) to give the user a firm grip when setting the forming element height.

[0019] In use, the assembly 100 is clamped to the upper edge 103 and the forming element is lowered to the required depth for the formation of the recess E. No nailing or any other fixing is necessary to hold the forming element in place. It will be appreciated that the assembly 100 is integrated with the formwork shuttering 101 in a modular system in the sense that the shuttering 101 can be used without the assembly 100 depending on requirements.

[0020] The assembly 200 forming the second embodiment is shown in Figure 6 and includes a formwork shuttering 201 and a housing 202 mounted on a bracket 210 which is permanently fixed to upper edge 203 of the shuttering 201. Boot 204 having an arm 205 attached to its upper surface is movably secured in the housing 202 by means of bolt 208. This is used in a similar fashion to the first embodiment and the boot 204 is lowered to the required depth to form a recess in an in situ reinforced concrete beam. Eyes 212 are fixed to the top of the shuttering panel 201 for use in securing the panel into place.

[0021] Figure 10 illustrates how the assembly 100 or 200 can be used to form an external recessed corner by arranging the shuttering panels 101/201 at the desired obtuse angle α. The forming elements 104/204 are also aligned at the same angle α, typically 90°.

[0022] Figure 11 illustrates how an internal recessed corner is formed by arranging the shuttering panels 101/201 at a reflex angle β and consequently the forming elements 104/204 are aligned at the same angle β, typically 270°.

[0023] In the third embodiment shown in the Figures 12 and 13, the assembly 300 comprises a shuttering panel 301 and a boot 304 which is secured to the steel panel 301 by means of a series of magnets 305 which are connected together by a rod 306. The magnets 305 are contained within plastic blocks 307 which are provided with hinged lifting flaps through which the rod 306 passes. The lifters sit in recesses in the blocks 307 to allow the magnets to grip the steel face of panel 361 evenly.

[0024] When detaching forming element 304 from panel 301, the rod 306 is pushed in one direction over a short distance of 50mm-100mm which causes the lifters to protrude from the plastic blocks 307 and thereby forcing the magnets 305 away from the steel panel face of the shuttering to release the boot 304.

[0025] Figure 14 illustrates a fourth embodiment 400 in which boot 404 is secured to panel 401 by an attachment means such as a bolt running in a vertical slot (not shown). The forming element 404 is movable relative to the panel 401 so as to define the depth for the recess of the concrete structure. The boot 404 comprises a frame 415 to which three plywood faces 416 are attached by screws.

[0026] The embodiment 500 shown in Figure 15 is similar to embodiment 400 and is a typical example of how boot 504 can be increased in size to suit other applications. A recessed plywood cover 525 is attached over the plywood face 516 and expands the dimensions of the unit. The cover 525 is versatile, long lasting and can accommodate nailing unlike steel faced panels.

[0027] The embodiment 600 shown in Figures 16, 17 and 18 is very similar to the first embodiment 100 and like parts in the embodiment 600 are given like numerals. The additional features in the embodiment 600 will now be expanded.

[0028] The elongate arm 105 passes through housing 108 on end of clamp 102. The housing 108 which accommodates arm 105, pivots on pins 620 on either side of arm housing 108. The pins 620 are attached to outer side wall of housing 108 and are surrounded by the end of the clamp 102 which divides into the shape of two forks 632, each one accommodating a pivot pin 620.

[0029] This design allows the arm housing 108 free movement to and fro from the face of shuttering panel 101, when the locking stud 106 nut is loose.

[0030] The elongate arm 105 fits comfortably inside the housing 108 allowing no play but ease of movement when adjusting height of forming element occurs.

[0031] Adjusting the height of the forming element 104 is completed quickly and effectively by means of a coarse threaded bar mechanism 640. This threaded bar 640 is placed parallel to lever arm 105 on one side (see Figure 18). The coarse threaded bar 640 is fixed parallel to the arm 108, and it also travels the length of the arm. It is held in position by two brackets 642, 643, one 642 on top and one 643 on the bottom. The coarse threaded bar 640 cannot rotate. It passes through another bracket 645 at clamp level. Bracket 645 is fixed permanently to side of arm housing 108, it is sturdy and contains a hole which is larger in diameter than the threaded bar 640, which passes through it. Contained on the threaded bar 640 is a large nut 646 which sits on the bracket 645 at clamp level, and it is used for adjusting the height when required.

[0032] When nut 646 is turned clockwise or anti-clockwise, the nut 646 feeds the coarse threaded bar 640 through itself upwards or downwards. This in turn adjusts the height of the forming element 104 in a safe and efficient manner. The complete apparatus, including the arm 105, forming element 104 and coarse threaded bar 640 moves together.

[0033] The coarse threaded bar 640 was chosen for speed when adjusting. This design also prevents elongate arm 105 and forming element 104 falling downward when locking stud nut 106 is loose thereby providing a good safety aspect. Several arms 105 and several forming elements 104 can be adjusted simultaneously thereby requiring a low labour content, and giving accurate results.

[0034] Adjusting height mechanism of embodiment 600 can also be replaced by a hydraulic or spring loaded design depending on the application. A hydraulic design would be very suitable to a pre-cast yard or factory environment where accuracy, high production, low labour and speed are the keys to successful completion of orders and contracts.

[0035] The sixth embodiment 700 shown in Figures 19 and 21 portrays the same principle and concept as in Figures 16 to 18. These embodiments give the same results, and are closely related and give alternative embodiments for different situations.

[0036] In Figures 19 to 21, elongate arm 705 and housing 708 on clamp 702 are circular in section. The lever arm 705 has no coarse threaded bar attached because adjusting is based on a formwork prop design and fine adjusting is completed in the housing area. Locking stud nut 706 on clamp works in the same manner as in Figure 16.

[0037] As mentioned above lever arm 705 is round in the sixth embodiment. As before the arm 705 fits and travels comfortably through the housing 708 in a vertical manner. The lever arm 705 has one other feature. Circular holes 711 are located at regular intervals along the arm. Different holes 711 are chosen for different heights. This is the first of a two step process in adjusting the

forming element 704. The second step is completed with the threaded collar 715 on the housing 708 where a solid steel pin 720 travels through the lever arm 705 and housing 708, resting on each side of the upper surface of the collar 715, where vertical slots 721 are found on the housing. The second step is a fine adjustment, the first being coarse, bringing the forming element 704 within 60mm of the desired level.

[0038] The housing 708 sits on pins 723 as before and is allowed to move freely when locking stud nut 706 is loose. The housing 708 is longer in length than the corresponding housing in Figure 16. This gives the lever arm 705 extra support and rigidity, however the most important feature is found on the lower end of the housing 708 which has a coarse thread 725 on its exterior. It also has two slots 721 opposite one another in the outer wall of the housing 708. A threaded collar nut 715 is located on the exterior The collar 715 can travel the length of the slots 721 due to the coarse thread 725 on the exterior of the housing 708. This is how fine adjusting takes place. When the forming element 704 is placed roughly near the desired level, a hole 711 on the lever arm 705 will present itself in the slot area 721 of the housing 708. The collar nut 715 is turned clockwise or anti-clockwise placing it underneath the line of the hole 711 in the lever arm 705. A steel pin 720 is placed from left to right through one slot 721 on one side, through the lever arm 705 and out the other side. It rests on the top surface of the collar 715, which is smooth. Fine adjustment can then be carried out when collar nut 715 is turned further in a clockwise or anti-clockwise direction forcing the steel pin 720 upwards or downwards in the slots 721, carrying with it the lever arm 705 and boot 704 attached.

[0039] Referring now to Figures 22 to 24 and to the seventh embodiment 800 shown in Figures 25 to 27, the apparatus of the invention can lend itself to other situations where a boot is not required but a clamp and lever arm could stabilize and support shuttering in a unique or detailed situation of a building design as shown in Figure 25 where up-stands/parapet walls on a roof slab, are to be cast simultaneously with an insitu floor slab.

[0040] In R.C. construction, work is broken down into stages to complete projects. The more stages/steps taken, the longer completion takes. It is accepted the more simultaneous concreting of a building design that occurs the faster a project is completed. Often during R.C. construction minor work such as up-stands, plinths and parapet walls are skipped to maintain progress and complete the main structure of a building. However, these up-stands or parapet walls are often completed at a later stage before window/external glazing is fitted.

[0041] A typical example explained with reference to Figures 22 to 24 highlights why it occurs. Firstly, a floor slab is placed. The next day a 40mm - 100mm high kicker wall Q is placed where an engineer's drawing indicates a typical layout. The kickers Q provide a grip for the bottom of the shutters R, maintain a straight line, prevent the shutters R moving or rising during pouring and also maintain correct thickness of a wall along any distance. The final stage is completed a day later when concrete is poured and allowed to harden between the shuttering panels R which are tied together opposite one another, either side of the kicker Q, along a chosen distance.

[0042] The prior art process outlined above takes two-three days to complete the upstand wall/parapet wall S in Figure 24. However, utilising the clamp and lever arm design of the seventh embodiment, a lateral support beam 831 provides rigidity and a solid support for the internal shuttering panel 832 which is attached firmly by means of clamp 834. The complete support design with height adjustable features are located at regular intervals along the shuttering panels to provide maximum support and quality results.

[0043] The complete process of pouring floor slab P and up-stand wall S takes just one day, 1/3 of the time, using the clamp and lever arm design by incorporating a lateral support 831 which accommodates the internal shuttering panel. No wooden shutters are required. Large panels can be used along the outside perimeter of the slab P because the mechanism 800 can be adjusted downward to suit design specifications. Any size panels 832 i.e. 300mm/ 450mm/ 600mm can be used to form the internal face of the up-stand wall S depending on the height requirements. Accurate adjusting can be completed fast and efficiently by adjusting the coarse threaded bar 840 upwards or downwards. The bottom edge of the internal panel 832 is set at the finish level of the concrete slab. The complete apparatus can be lifted into place as one unit. No hard labour is required in adjusting the internal panels to the correct height.

[0044] Less fixings, less labour and less materials are required, therefore costs to the contractor will be lower. Over the length of time the project takes, production is increased and program time saved through completing detailed work at stage one, where floor slabs or roof slabs are being poured with total focus on going forward eliminating snagging work in the structure.

[0045] The apparatus utilizes all sizes of panels, therefore giving a better return all round through maximum usage. The seventh embodiment 800 based on the adjustable boot apparatus is instrumental in perfecting the results outlined above. With this design panels are also free to be used in other situations e.g. forming beams.

[0046] The eight embodiment 900, shown in Figures 28 to 30 shows how clamp 902 and lever arm 905 can be integrated to complete sloped or tapered details in (R.C.) construction. Vertical adjustment of complete apparatus is completed using the coarse threaded bar mechanism 910 when locking stud 906 is loosened. All items including lever arm 905, panel 915 and brackets 917 and 919 move together. Elongate arm 905 travels comfortably through housing 908 on clamp 902.

[0047] Panel 915 is attached to the bottom end of the elongate arm 905 in place of a boot (recess former). The

bottom end of the lever arm 905 sits comfortably between two brackets 919 where a solid steel pin/bolt 920 travels through the lever arm 905 and brackets 919, therefore holding and supporting lower end of tapered panel 915. The pin 920 at the lower end of the lever arm 905 also acts at a pivot point allowing different angles to be chosen where necessary. Brackets 917 and 919 and base plate 925 are bolted onto the back of the panel 915 forming the sloped edge.

[0048] To complement the design a push/pull mechanism 910 is temporarily attached as shown in Figure 28. One end is bolted to the top of the lever arm 905 and the other end sits between two brackets 917 on a base plate 925 which is bolted to the top end of the panel 915 forming the sloped edge. A further solid steel bolt/pin 920 travels through the centre of the brackets 917 including the push/pull end. This pin 920 also acts as a pivot point when adjusting of the angle of the panel takes place.

[0049] Adjustment of the angle is completed quickly and effectively when turn buckle 930 of the mechanism 910 is turned clockwise or anti-clockwise. This causes the top end of the panel 915 to move downwards or upwards, increasing or decreasing the slope required. Locking stud nut 906 behind lever arm 905 must be loose when any adjusting is being carried out. The push/pull mechanism 910 also acts as a support prop for panel 915, giving extra strength and rigidity to the complete apparatus. Push/pull mechanism 910 comprises turn buckle 930 and two threaded bars 936, 937 engaged with the turn buckle 935 at either end. They are used with large wall formation e.g. walls from 2.7 metres high to 8 metres high and can be obtained in many different sizes/lengths.

[0050] When locking stud nut 906 is tight, it forces the bottom end of the lever arm 905 with panel 915 attached inwards guaranteeing quality work results with no grout loss, and rigidity during pouring of concrete.

[0051] Using the above embodiments of formwork for forming recesses or other details in concrete structures or combinations of different embodiments, it is possible to have a very versatile system which can be easily integrated with various proprietary formwork systems.

[0052] It is to be understood that the invention is not limited to the specific details described above which are given by way of example only and that various modifications and alterations are possible without departing from the scope of the invention as defined in the appended claims.

Claims

1. Formwork apparatus for forming a detail in a concrete structure comprising at least one shuttering element used to define a side wall of the concrete structure, a forming element having the shape of the required detail, the forming element being movably mounted relative to the shuttering element.

2. Formwork apparatus for forming a detail in a concrete structure as claimed in claim 1, in which the forming element is mounted on an elongate arm or shaft removably engageable with a clamp mounted on the shutter, the forming element being adjustable along an axis parallel to the side wall of the shuttering element.

3. Formwork apparatus for forming a detail in a concrete structure as claimed in claim 2, in which the clamp is removably engageable with a portion of the shuttering element remote from the side wall of the shuttering element.

4. Formwork apparatus for forming a detail in a concrete structure as claimed in any one of the preceding claims, in which the forming element e.g. a boot is manufactured from a strong material, such as steel, stainless steel or a durable plastics materials.

5. Formwork apparatus for forming a detail in a concrete structure as claimed in any one of the preceding claims, in which the forming element is faced with timber such as plywood to provide a contact and release surface for hardened concrete.

6. Formwork apparatus for forming a detail in a concrete structure as claimed in any one of the preceding claims including a mechanism for moving and adjusting the forming element so as to adjust the size of the required detail.

7. A method of forming a detail in a concrete structure comprising securing a shuttering element in position to define a side wall of the concrete structure, suspending a forming element having a shape of the required detail from the shuttering element in a manner which enables the forming element to be movably mounted relative to the shuttering element.

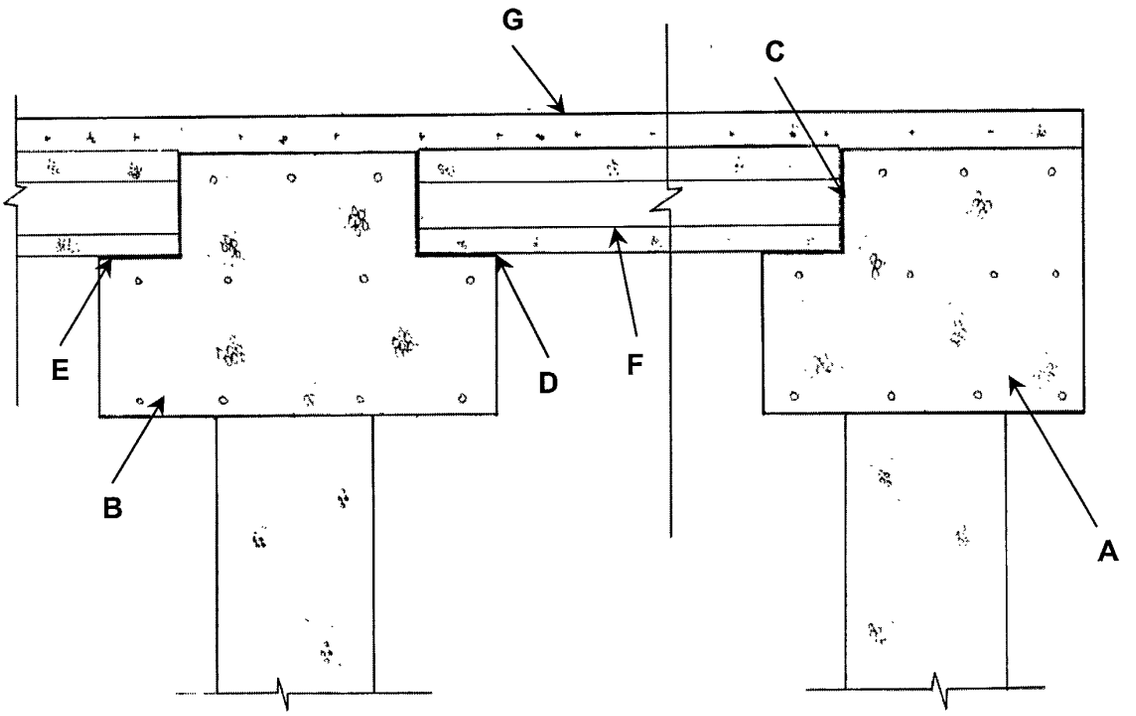

FIGURE 1

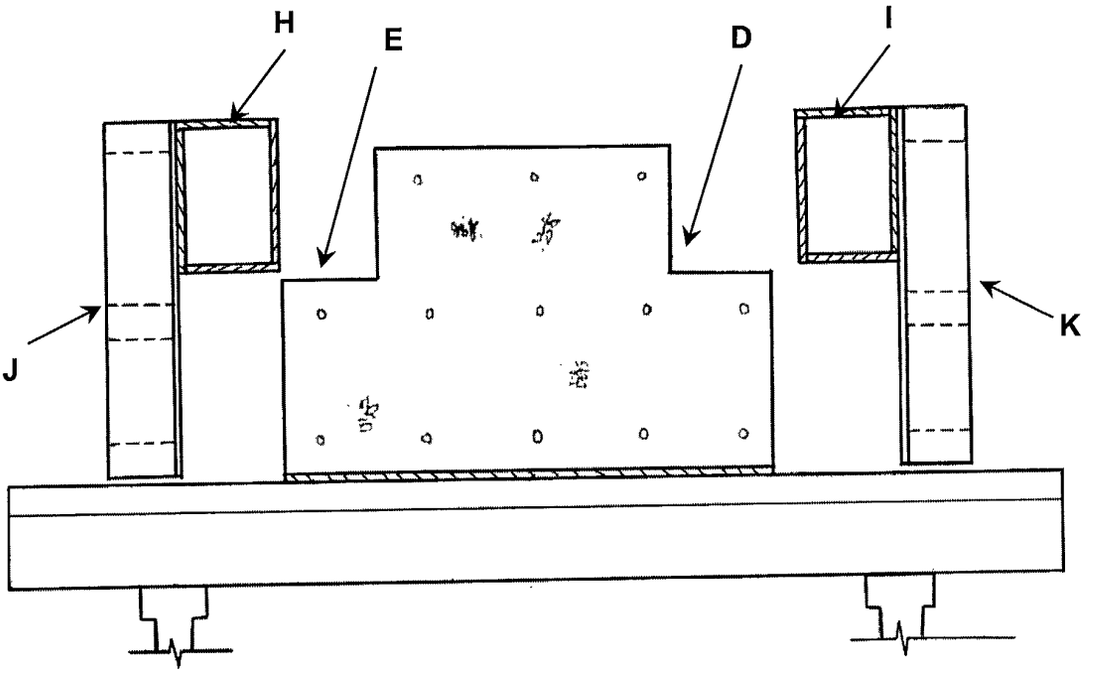

FIGURE 2

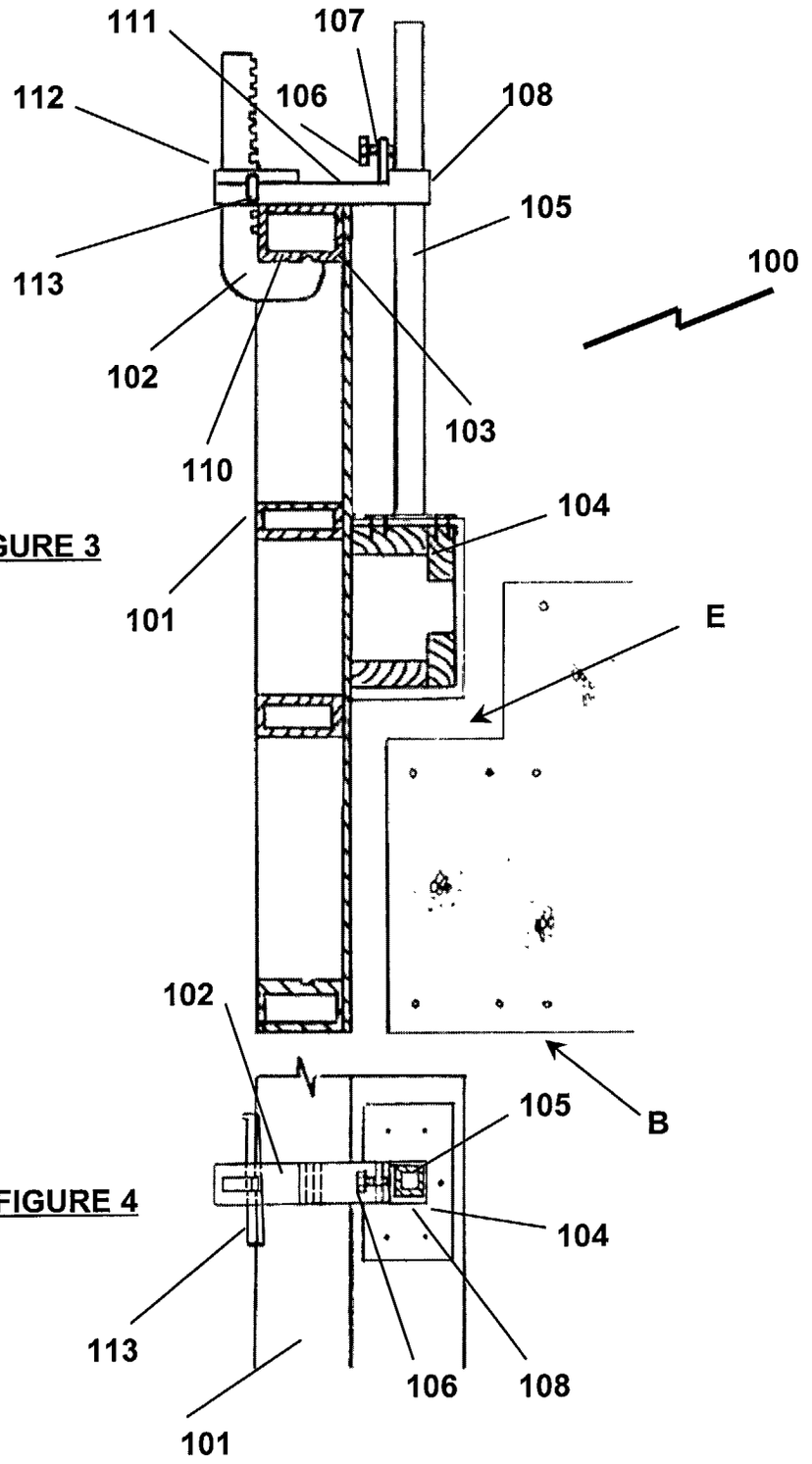

FIGURE 3

FIGURE 4

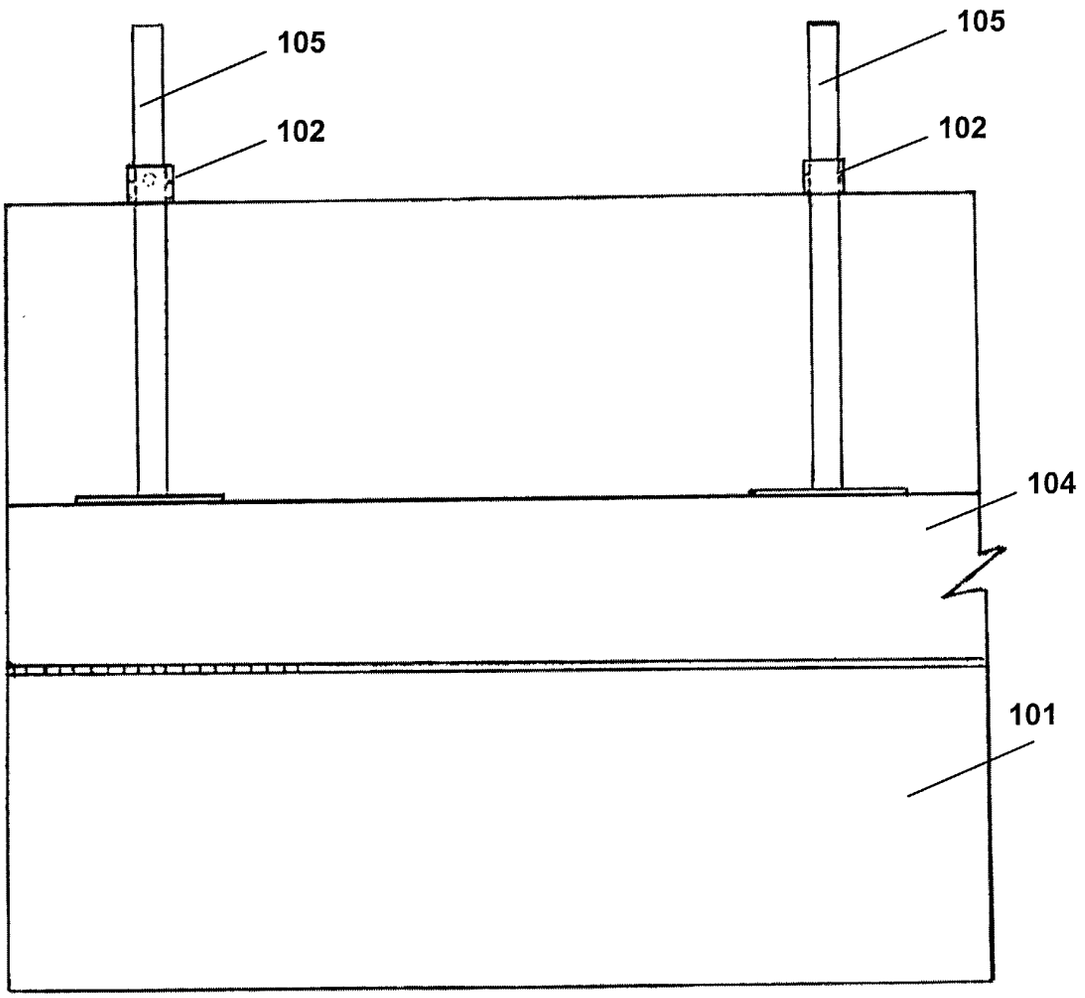

FIGURE 5

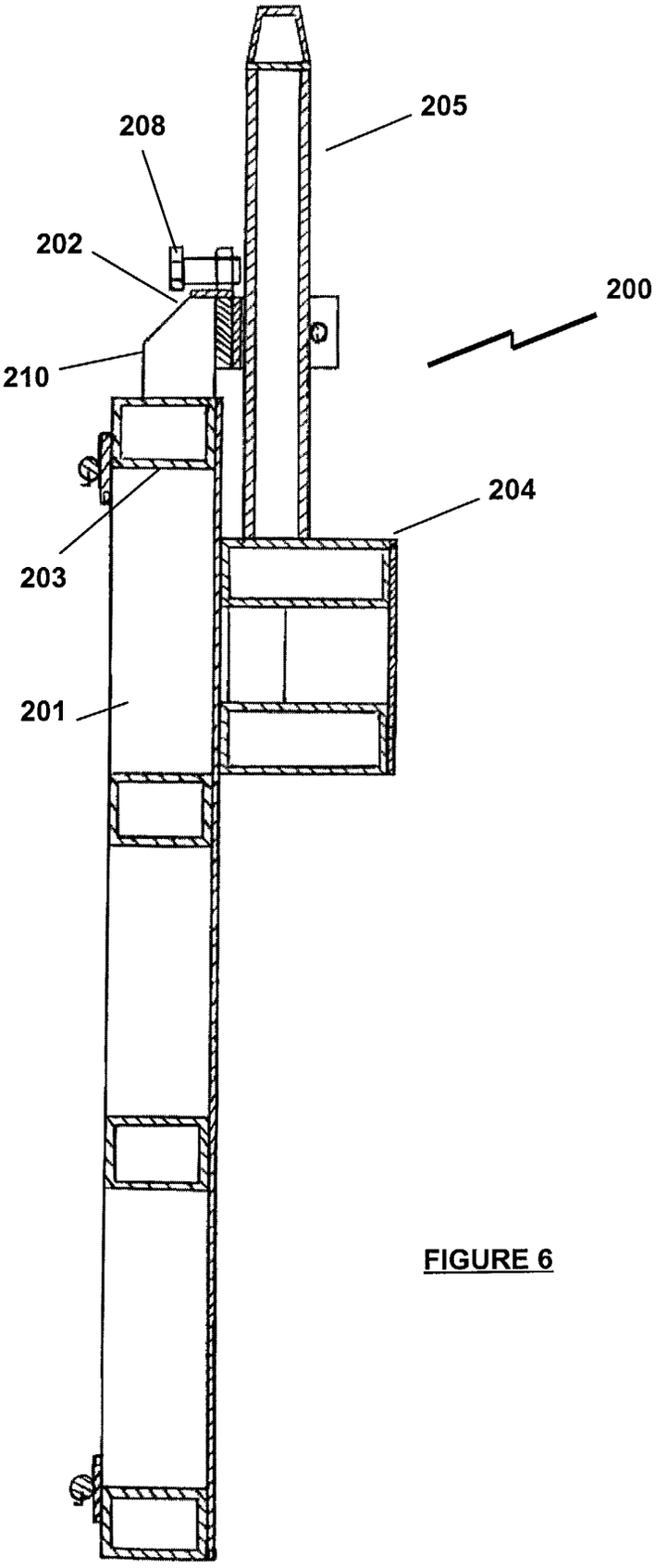

FIGURE 6

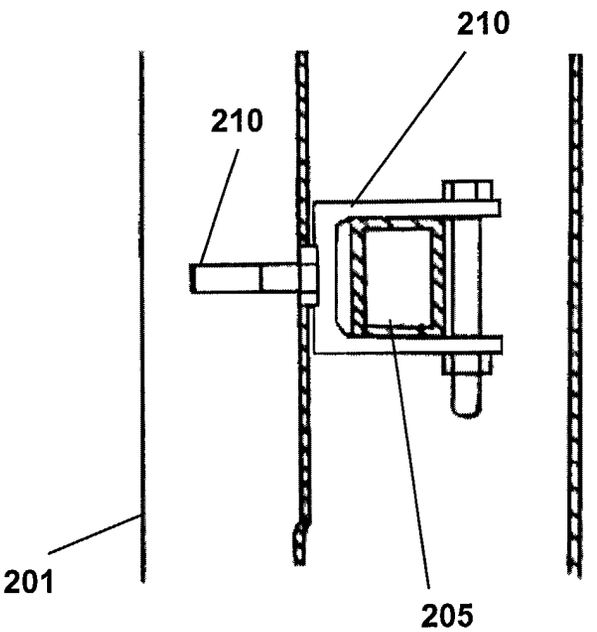

FIGURE 7

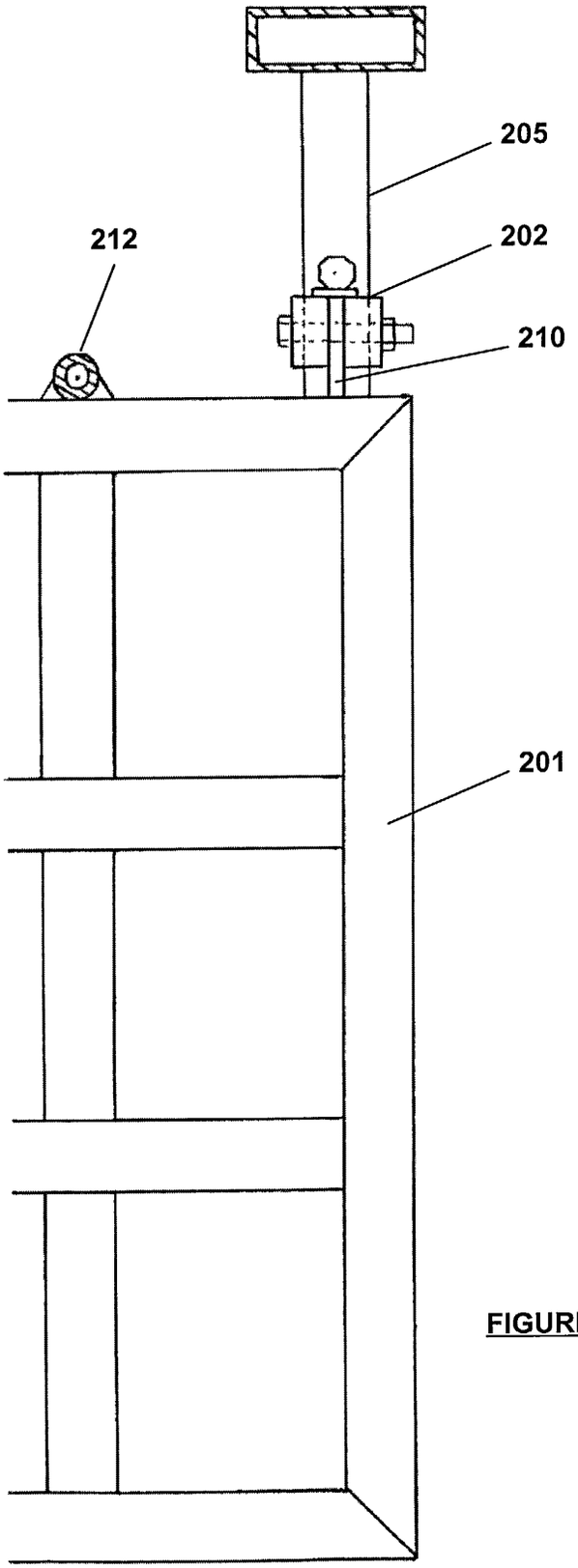

FIGURE 8

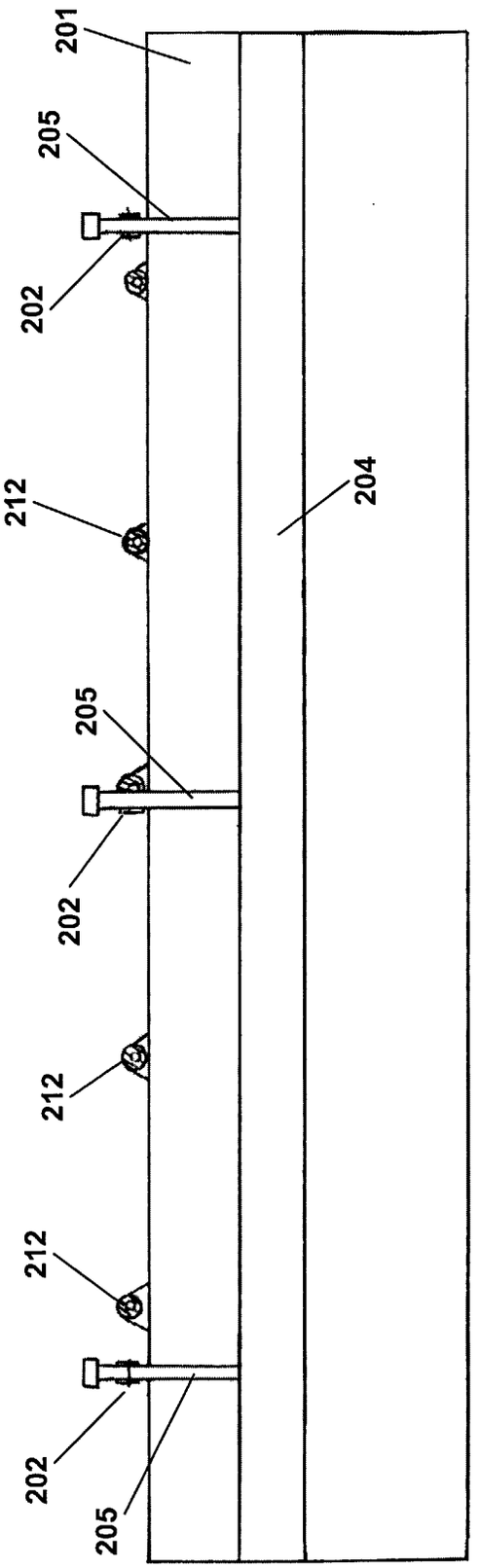

FIGURE 9

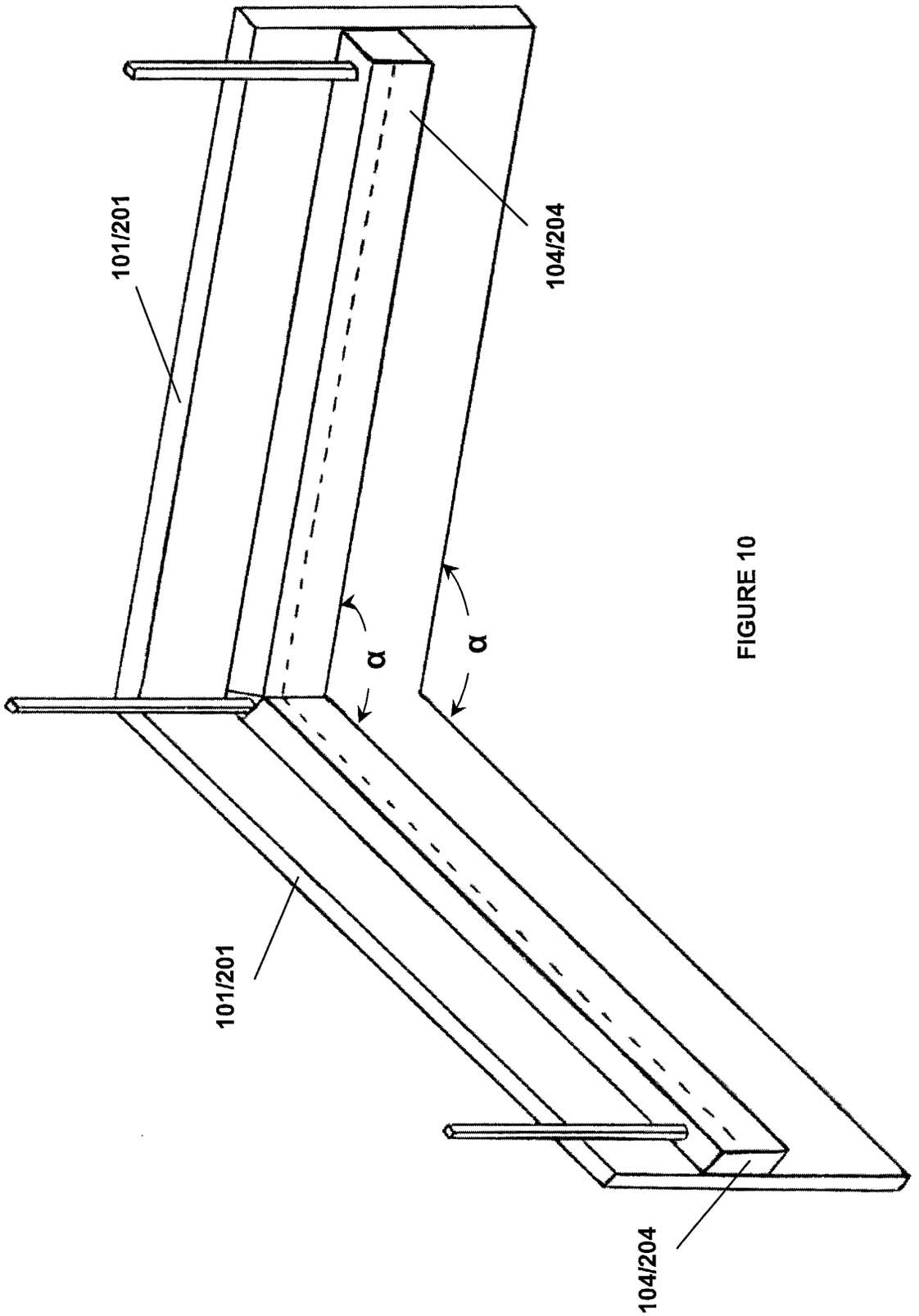

FIGURE 10

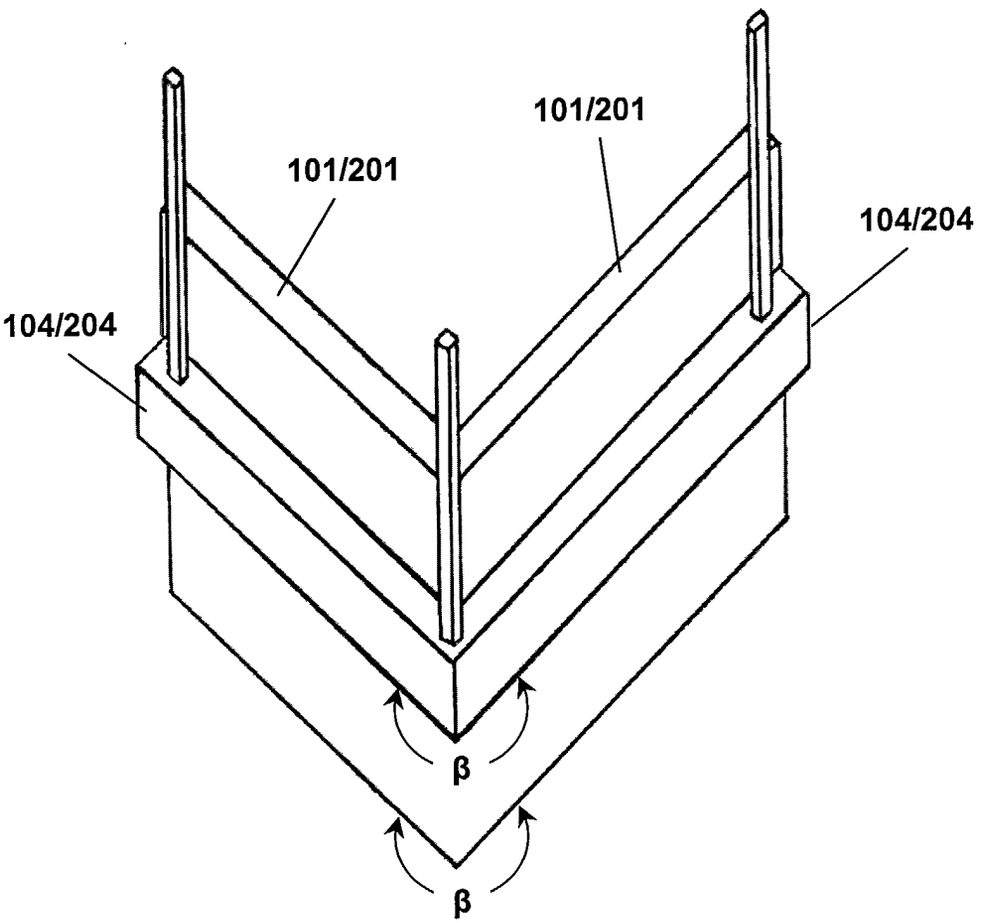

FIGURE 11

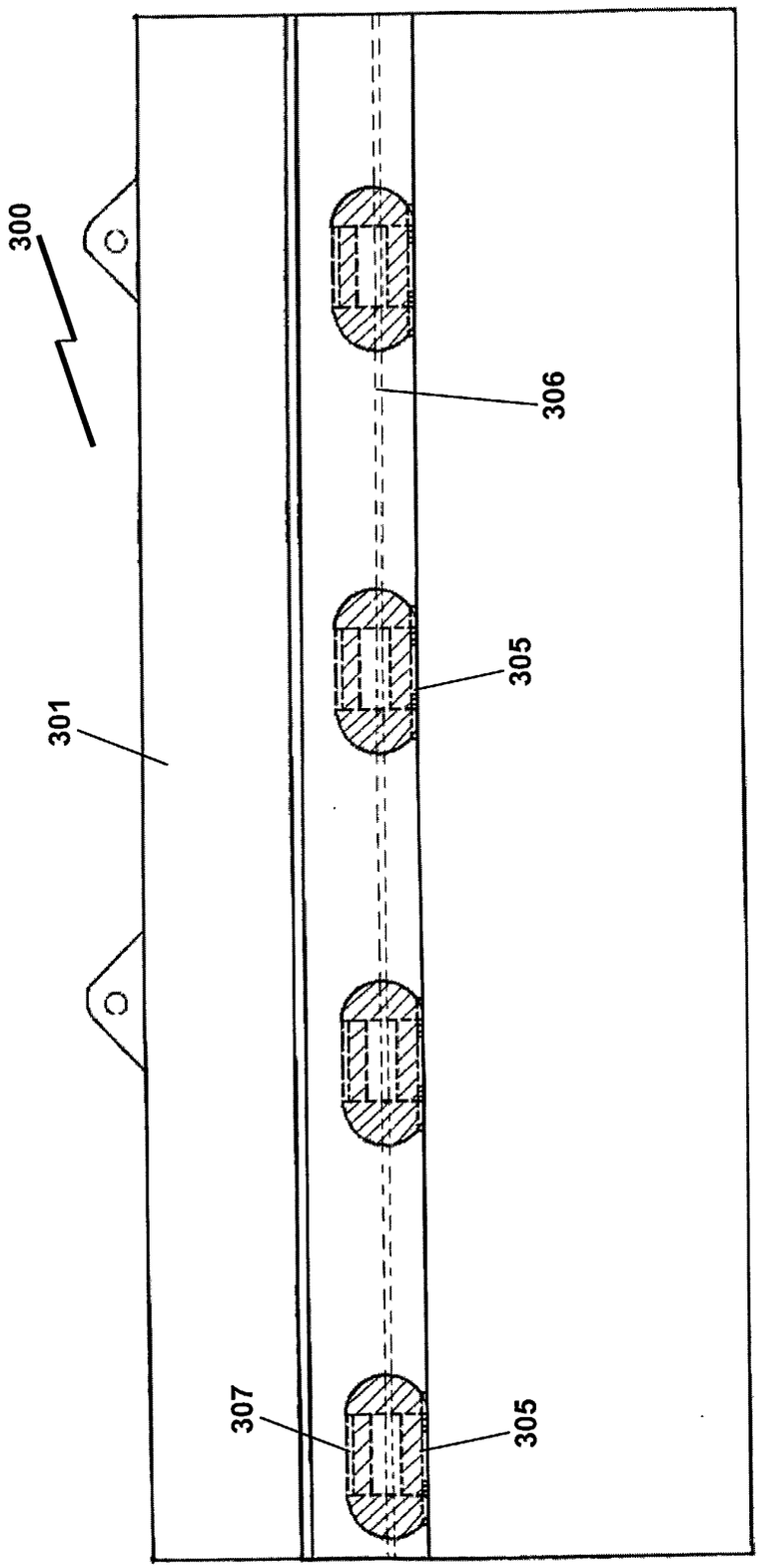

FIGURE 12

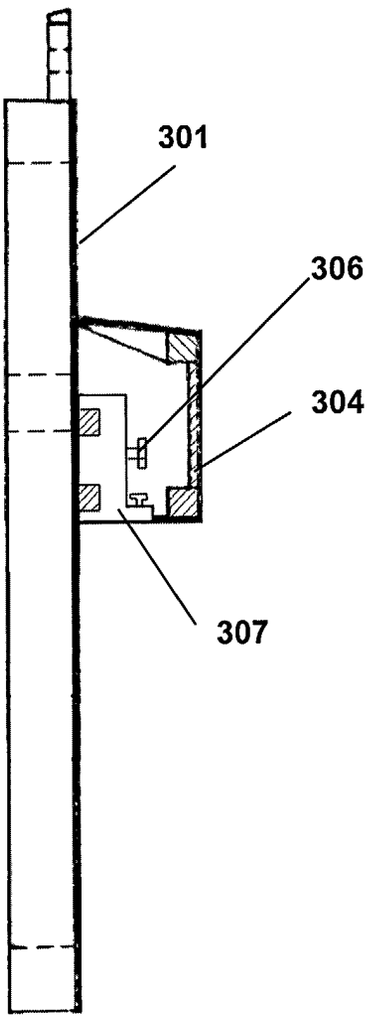

FIGURE 13

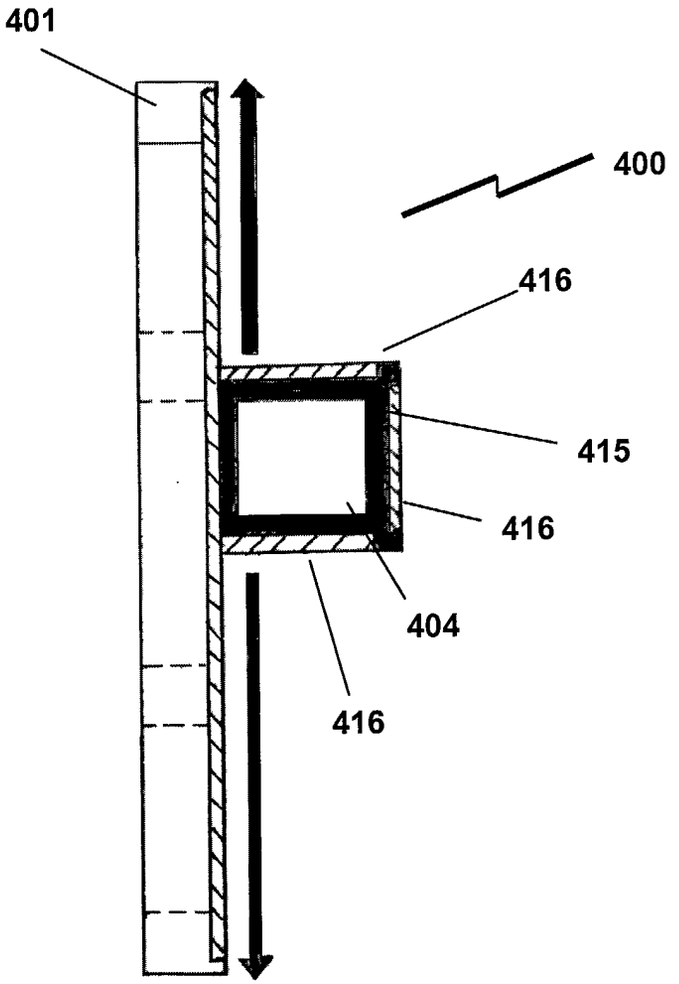

FIGURE 14

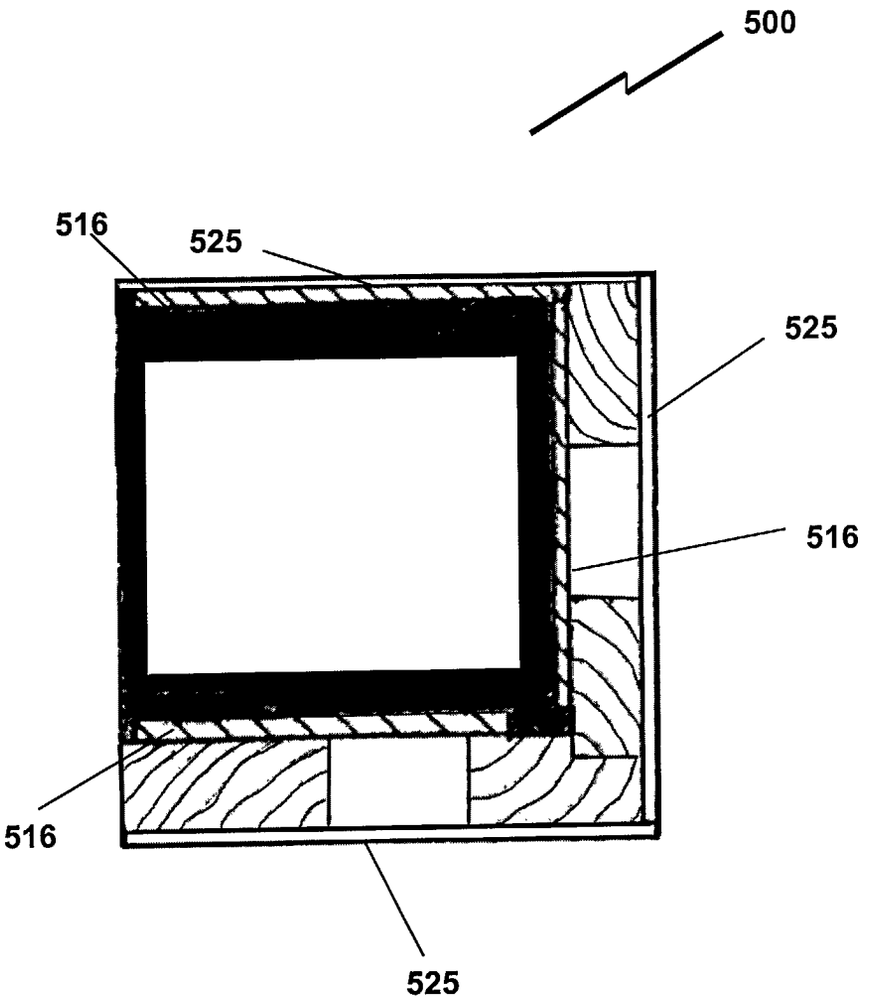

FIGURE 15

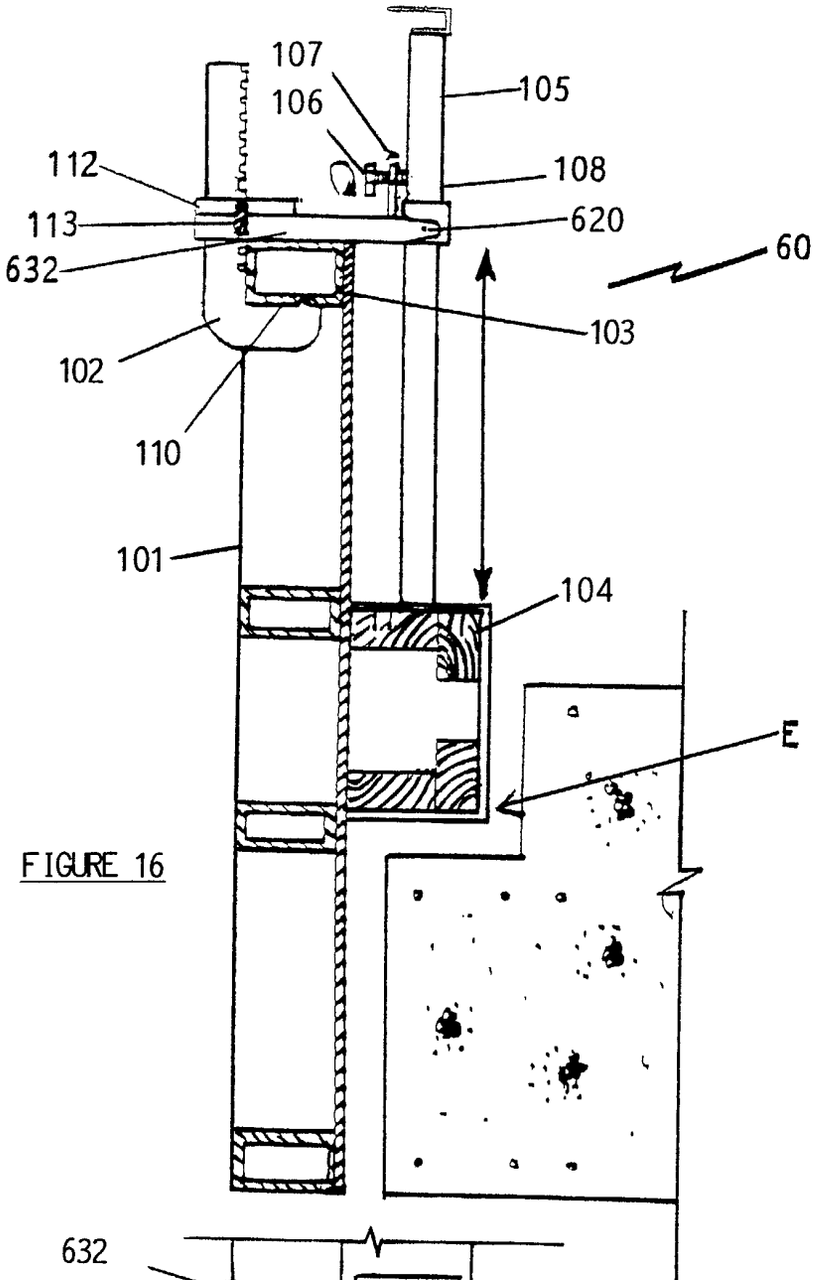

FIGURE 16

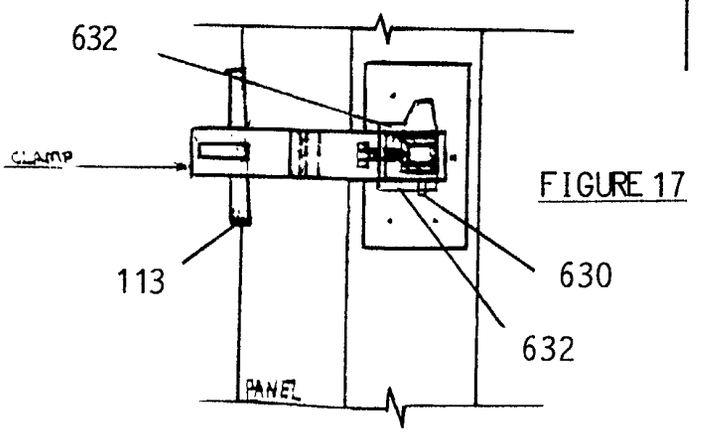

FIGURE 17

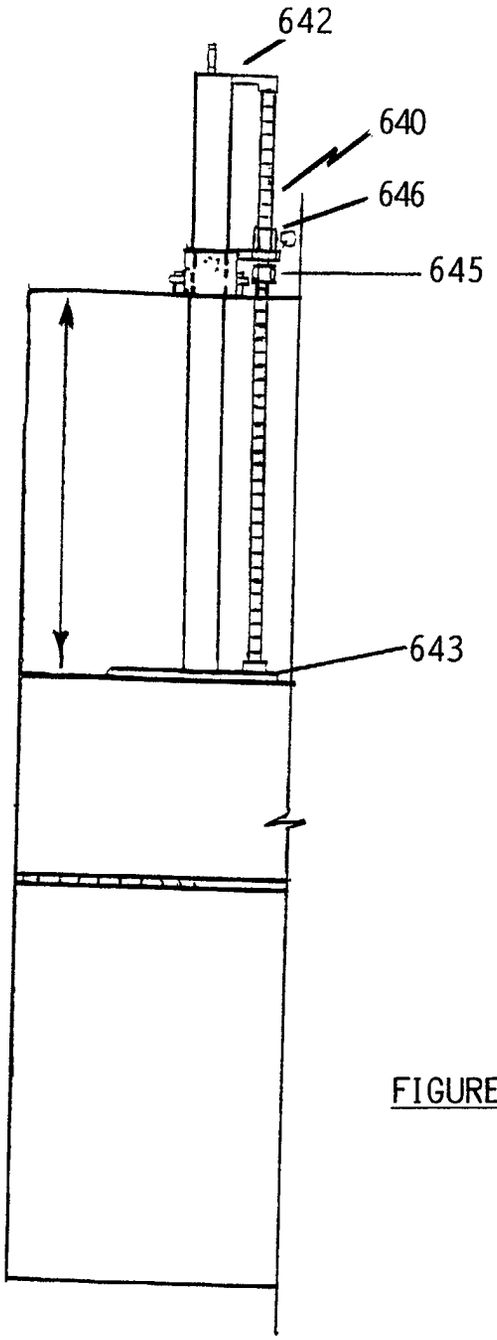

FIGURE 18

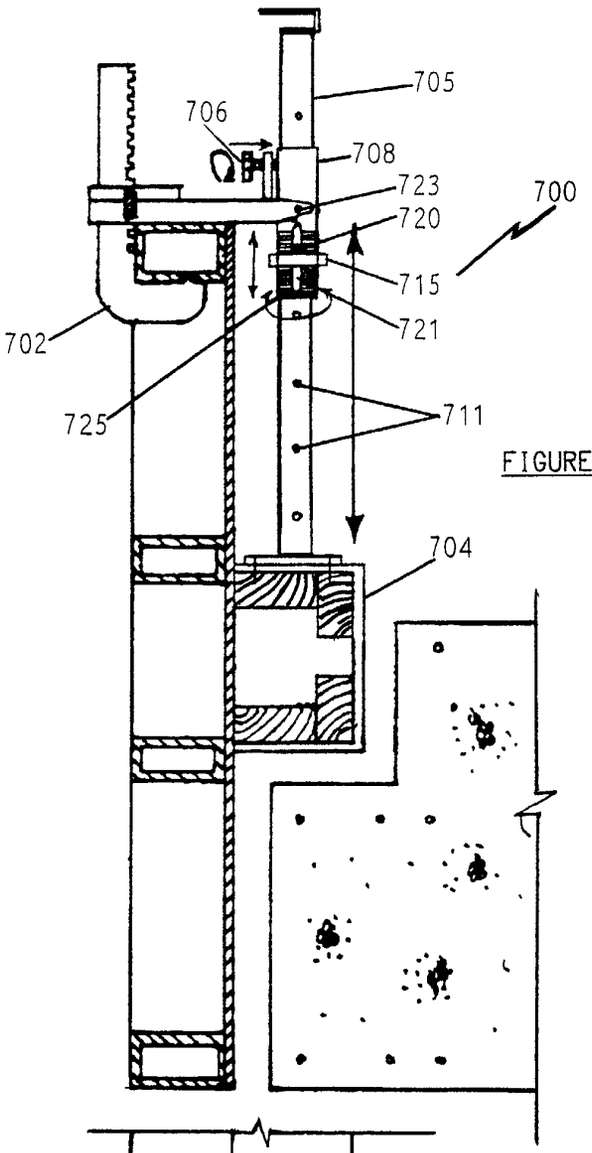

FIGURE 19

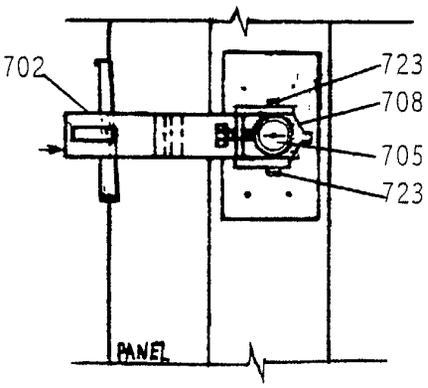

FIGURE 20

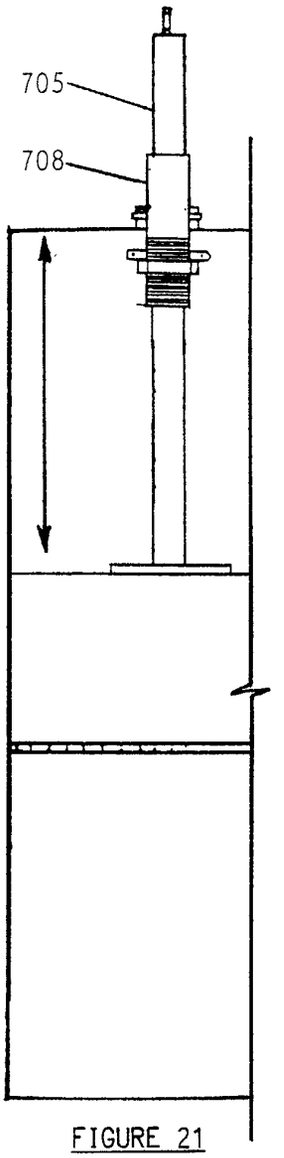

FIGURE 21

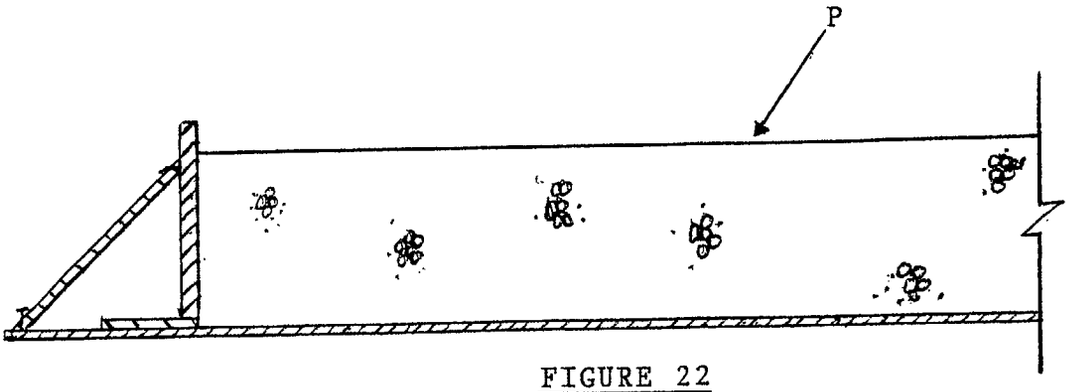

FIGURE 22

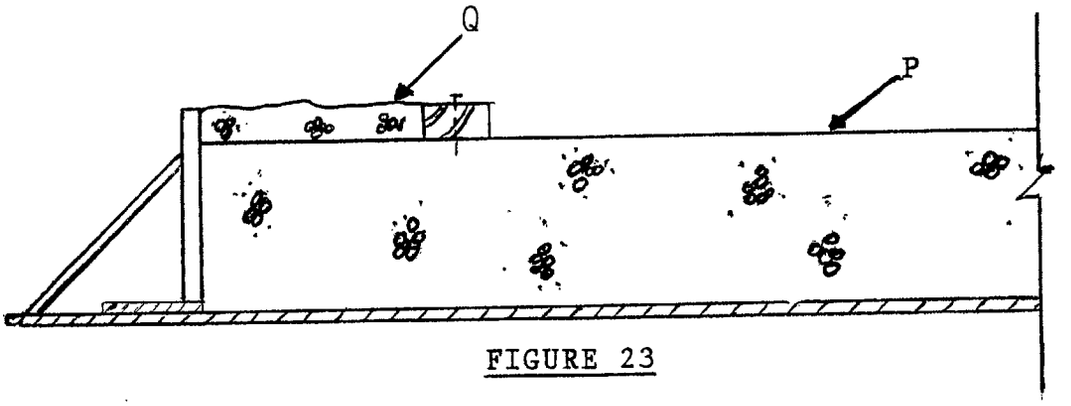

FIGURE 23

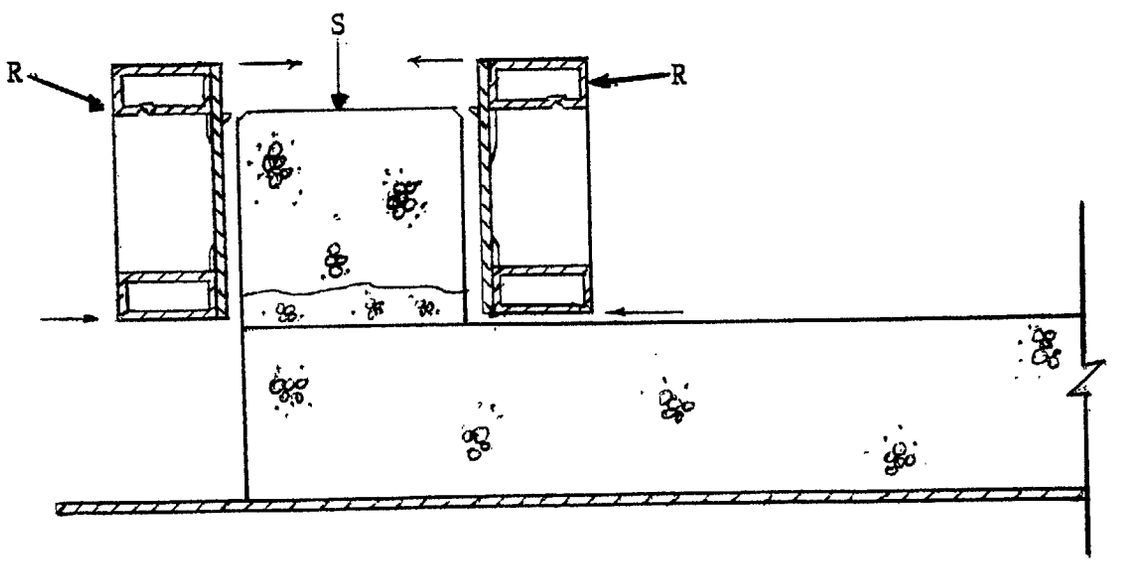

FIGURE 24

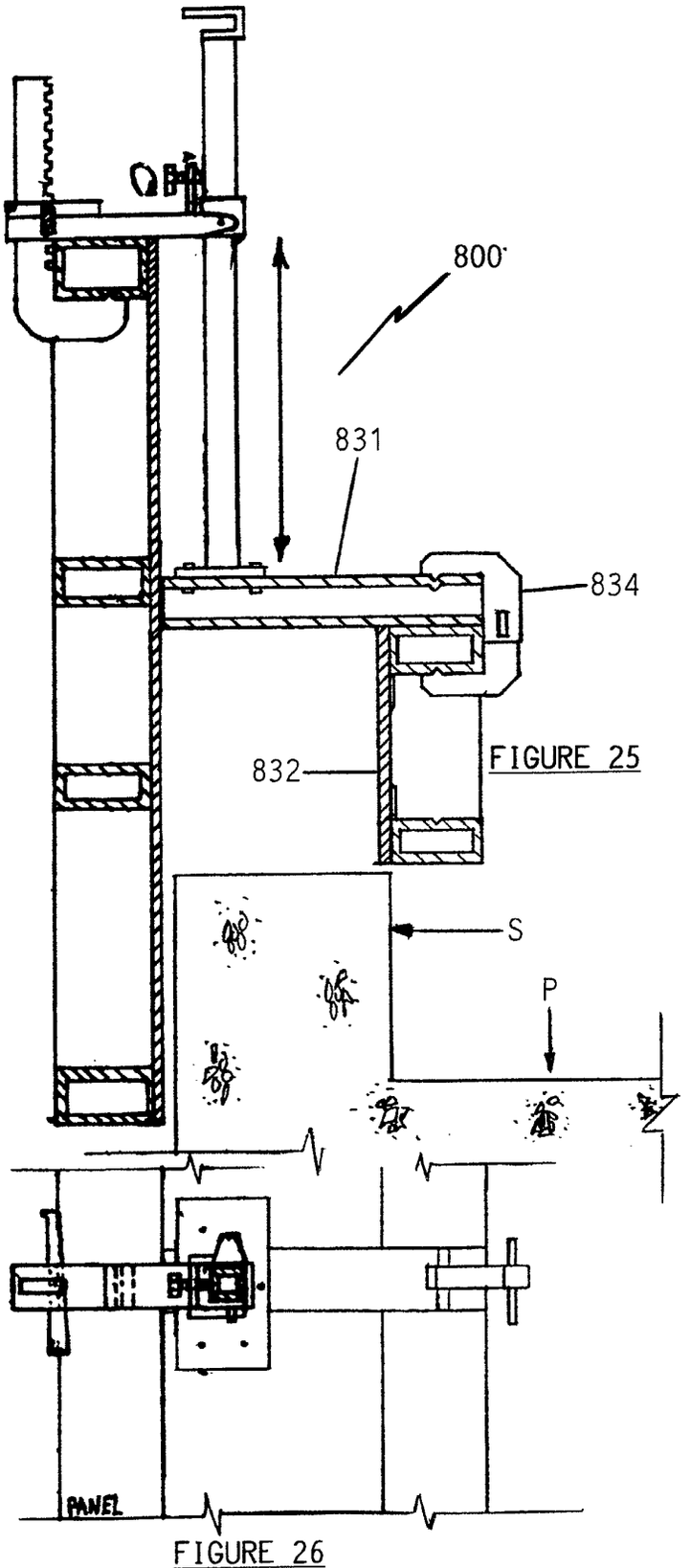

FIGURE 25

FIGURE 26

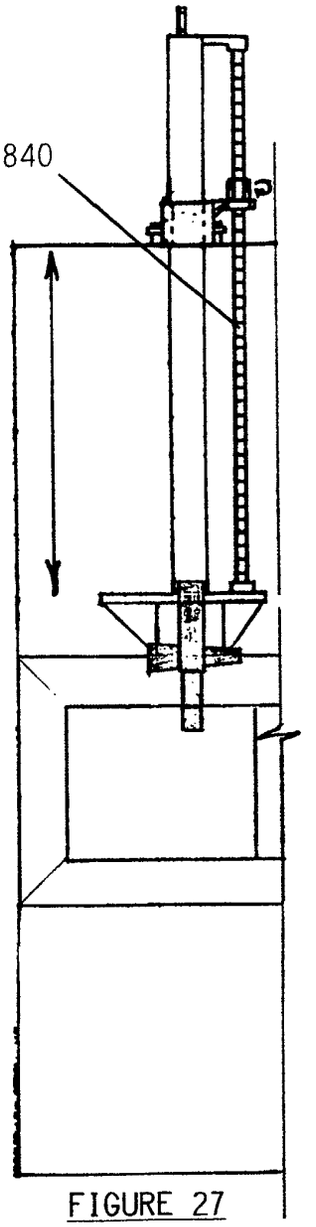

FIGURE 27

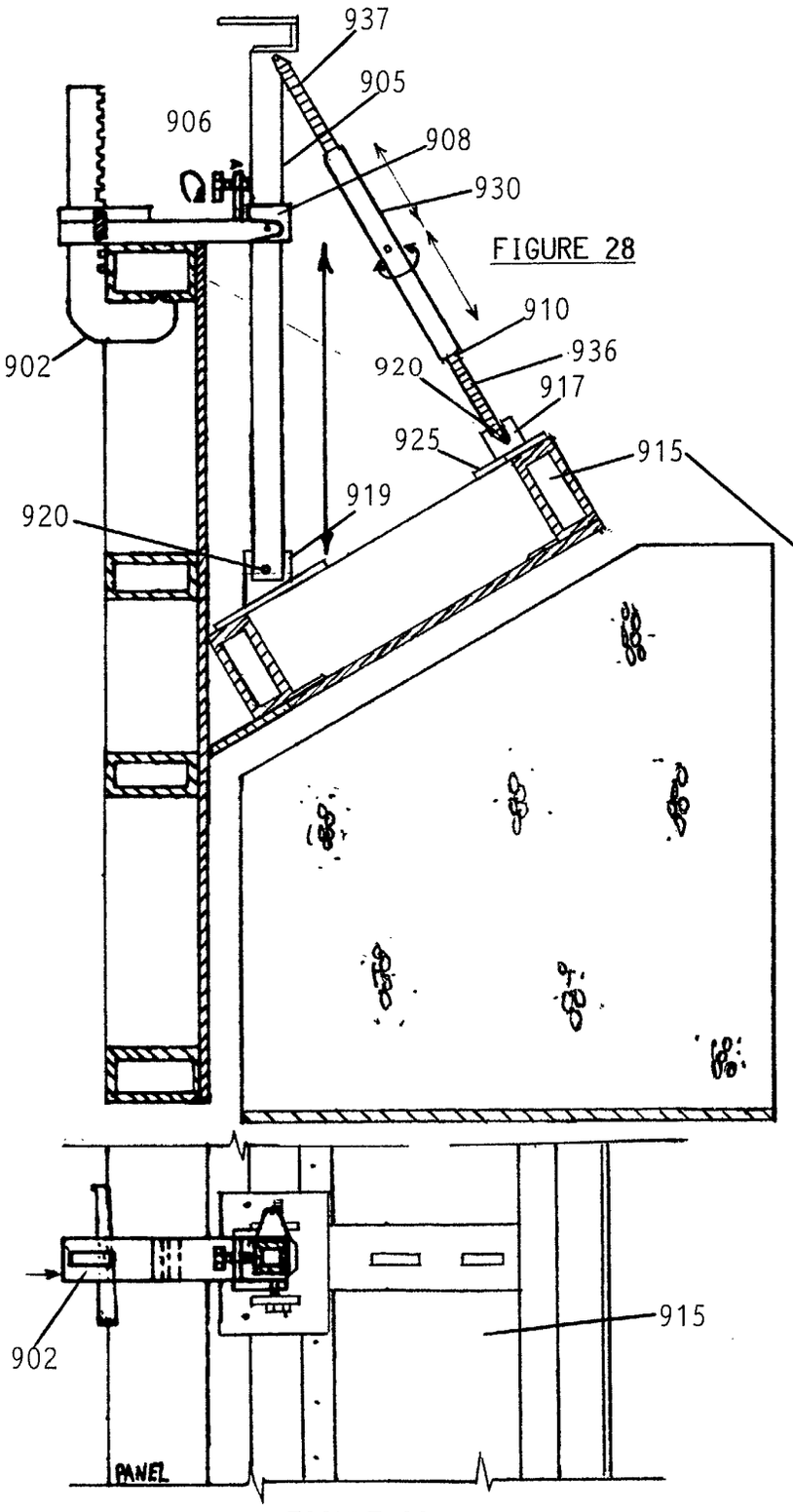

FIGURE 28

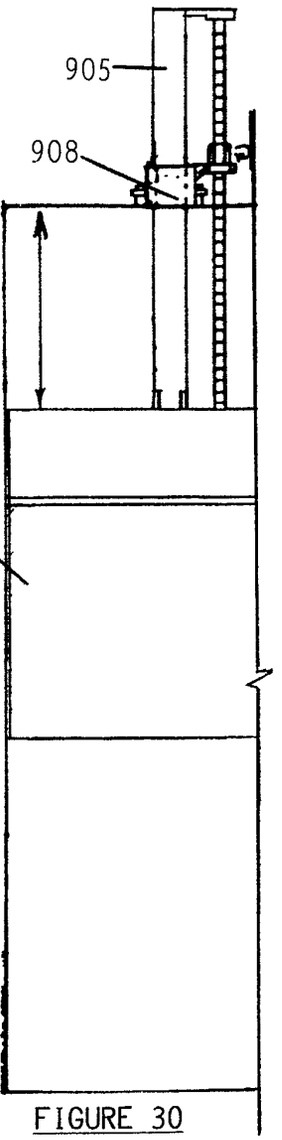

FIGURE 30

FIGURE 29

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 39 4012

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 843 324 A (SHIRLEY BRETT L) 1 December 1998 (1998-12-01) * column 2-6; figures 1-6 *	1-4,6,7	E04G15/06
X	US 2 776 463 A (LANKFORD ARMAN L) 8 January 1957 (1957-01-08) * the whole document *	1,2,4,6, 7	
X	FR 2 560 913 A (QUILLE ENTREPRISE) 13 September 1985 (1985-09-13) * page 4-9; figures 1-9 *	1,4,5,7	
X	US 805 883 A (RUSSELL, COLONEL ELLSWORTH) 28 November 1905 (1905-11-28) * the whole document *	1,4,7	
X A	FR 2 607 847 A (KLEIBER DENIS) 10 June 1988 (1988-06-10) * page 3-6; figures 1-4 *	1,4 5	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	19 July 2002	Festor, E

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19-07-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5843324 A	01-12-1998	NONE	
US 2776463 A	08-01-1957	NONE	
FR 2560913 A	13-09-1985	FR 2560913 A1	13-09-1985
US 805883 A		NONE	
FR 2607847 A	10-06-1988	FR 2607847 A1	10-06-1988

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