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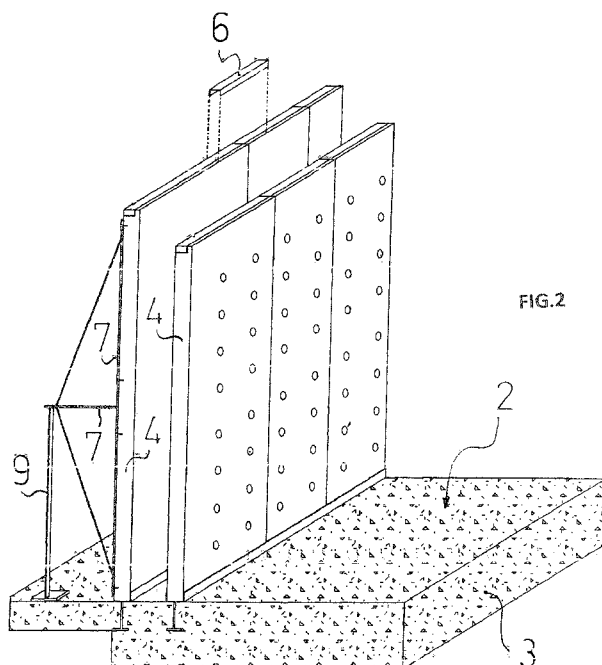
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(54) Title: FORMWORK CONSTRUCTION SYSTEM FOR ACOUSTIC AND THERMAL INSULATION



(57) Abstract: The formwork construction system for acoustic and thermal insulation consists of U-shaped or double U- shaped support means (1) placed into the flooring and into the slab (3) for interlocking of panels (4) of a formwork (5), with jig (6) to help the align of the walls during the concrete casting, with right angle bracket (7) for vertical fixing of the panels (4) of the formwork (5) and with the bracket (7) to be fixed with transversal connections means (8) of the formwork (5).



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Formwork construction system for acoustic and thermal insulation.

Field of the invention.

The invention refers to a formwork construction system mainly for acoustic and also thermal insulation of a building. It is also able to prevent the discharge of the material from the formworks in the construction of walls, floors and ceilings, to bond the iron into the concrete, to permit the blocking of a scaffold without boring the outside walls, to position by a jig the walls of an entire building, to simplify the position of the transversal irons by openings placed at an angle, to plumb the walls onto the outside permitting to arrange a sole jet, also robotized, of floors, walls and ceilings by a particular mixture of cement mortar.

State of the art.

Currently are known only formworks realized in plastic material, such as EPS (expanded polystyrene) with transversal connection means, this construction system, as described in the documents US 5,809,725 and WO2011/123526, has particular disadvantages. The material introduces inside the formworks tends to exit from the base and from the vertical joints and to push upward the structure, principally due to pushing of the used concrete, so it is necessary more jets at distance of hours making the resistance of the structure discontinuous.

Further, the use of concrete needs vibration worsening the exit of the material from the walls. Other disadvantage in the known arts consists of the unrestricted placement of the irons to have reinforced concrete. Further other disadvantage presents in the known art is given to the fact that they are not able to have an acoustic insulation of the walls against propagation in the air and against shock onto the surface of the building. Just another disadvantage presents in the know construction art is the total missing of guides or jigs for the positioning of the walls in comparison to the structural fixed points. Other disadvantage in the known realizations is given to the impossibility to have counterframes of the windows contemporary damage to the cast. Other disadvantage is given to the shoring to keep the walls plumb that, in the known arts, is placed inside the building. This make impossible a sole jet that can comprise walls and ceilings, always to the detriment of homogeneity of the jet. Other disadvantage of the known art is that all the parts that form the known formworks can not used in the conventional construction system. Other disadvantage of the known arts is that the plugs of the rods are placed in such a way as not to be protect against acoustic transmission for a shock, except in those cases wherein the formwork is decomposable, Other disadvantage of the known art consists in that it does not

provide the jet with special mortars and such as to permit a complete automation with robot.

Summary of the invention,

The invention permits to avoid the above cited disadvantages with bigger construction velocity, precision in the positioning of the walls and of the irons and simplicity of installation in a formwork construction system in EPS or coupled with plastic acoustic insulating such as the reused rubber or not plastic such as the cork or similar jointed each other by a spray binder that uses nanotechnology with the double aims to bond two different components, to resist at different thermal changes and to have the thermos reflective function. The construction system according the invention comprises essentially an U-shaped or double U-shaped support means working as jig, to be used for positioning without mistake the walls of the entire building, placed onto the flooring for the fixing of the panels and to have the estate of the walls against the exit of jet material from the lower. The U-shaped support means are in in metallic material or, in other embodiment, in plastic material, drowned in the flooring jet. The joint of the panels with U-shaped or double U-shaped support means, other to be a guide for the position of the walls of the building, permits an estate of the panels against the upraised of the formwork pushed toward to the concrete of the any other introduced material. The U-shaped support

means then can be thermally and acoustically insulated by a layer of reused rubber, cork or similar material with the same technical characteristics and placed in the hollow between the U-shaped support means. The construction system according to the invention provides joints between the walls able to avoid for vertical exits of jet material, to create suitable joints in the corners so to permit the easy positioning of the transversal irons and the creation of micro pillars suitable to bond the entire structure. The introduction of joints and staggered floors permits a reduction of pressures of the introduced material from the strips of the flanked floors of the formworks. Moreover, a particular mortar that, thanks to its characteristics, does not need vibration and it is able to quickly dried, determine continuous and homogeneous structures. The formwork construction system, having the staggered floors on the outside so to cover and insulate also the ceiling according to the invention, further provides prongs for positioning the irons forming the reinforced concrete into formworks. At the transversal connection means, i.e. at the spacers placed between the containment walls of the formwork, positioning prongs of the longitudinal and transversal irons are placed, so to determine their positioning without having possible movements determined to the concrete casting or other binder material. The collocation working of the irons is so faster and more precise in comparison with the known art

and permit the correct positioning of the irons of the reinforced concrete. Said spacers have the characteristic to permit their use also in the traditional construction systems such as the execution of a wall in reinforced concrete. The spacers according the invention have plastic parts and contemporary permit to distance the iron of the scaffolding from the wooden panels, and to keep the same panela at a correct distance and to avoid any acoustic propagation derived from the iron, as well as avoiding rust on the exterior. Other advantage given to the invention is the fact that the positioning of the irons for reinforce concrete in particular points, such as corners and central spine walls, with the precision of the positioning alley to brackets, together with the special mortar, permits to decrease the iron present in the building, both in vertical than in horizontal and so consequently the number of the spacers. The reduction of the scaffolding, thanks to the particular mixture of the mortar, however increases the anti seismic capacities due to the high compression and traction resistance. The formwork construction system according the invention, moreover, comprises, onto the outside of the building, covering tapes of the heads of the transversal spacers for the connection of the panels, so to prevent the same from acoustic transmission by shock. Said spacers, kept by opposite screws, not connected each other, realized in plastic material making the invented system

acoustically perfect also having the characteristic to be disassembled for the eventual passage of pipes and fecal. Further the invented system, using anchoring pre-assembled in the walls by external prisoner and inner washer, drowned in the jet, creates a bigger traction resistance, makes easy the mounting of the outside scaffold that will be arranged with tubular studs, internal screwing. Ferrous, aluminum or in similar material straight edges put onto the outside wall, screwing onto the heads of the spacer caps determine the easy plumbing of the walls, to make free the inside space so permitting a sole jet for walls and ceiling. This thanks to the special mortar permits a sole jet. The mortar is then distributed into the formworks with robotic device (such as in 3D stamp) with low pumping pressure. The used device is telescopic remote radio-controller or driven with PC with GPS or satellite detector able to detect the exact point of the jet. Said device provides an aluminum slide to avoid the waiting irons, with remote control by a camera placed onto the arm. The device can work also without concrete mixing plants in the near such as it provides a mixing hopper wherein the mixture can be got from possible silos or pre-packaged bags. These and other aims and advantages of the present invention will be better explained in the detailed description of a preferred embodiment but not exclusive with reference

to the enclosed drawings wherein the invention is illustrated in a merely and not limited view.

Brief description of the drawings.

Figure 1 is perspective view of a couple of U-shaped or double U-shaped support means for fixing of EPS panels with right angle bracket for the vertical plumb of the panels and of the wall to build. Figure 2 is perspective view of said U-shaped support means placed in the floor and with the panels according the vertical given to a bracket supported to a right angle part. Figure 3 is view of the disposition of the spacers and of the irons inside the panels. Figure 4 is section view of the containment walls with covering caps of the heads of the screws moved from their position. Figure 5 is section view of the connection of the walls in EPS material or coupled. Figure 6 is horizontal section view of the formworks with joint parts to prevent the exit of the material in the jet. Figure 7 is vertical section view of a wall with right angle bracket to have the perpendicularity between the walls and floors. Figure 8 is vertical section view with right angle bracket for scaffold fixed to the transversal parts to connect the panels. Figures 9 and 10 are views of the connection means of the right angle bracket for scaffold. Figures 11, 12, 13, 14, 15, 16 and 17 are lateral views of the spacers, i.e. of the connection parts of the panels forming the formworks with prongs for the positioning of the irons for the reinforced concrete. Figure

18, 19 and 20 are plant views of the components of connection of the wooden formworks. Figure 21 is perspective view of the upper part of a wall with alignment jig placed superiorly. Figure 22 is perspective view of an angled junction. Figure 23 and 24 are section views respectively of a flush and a centerline window closure, both integrated to the jet in the panels. Figure 25 is perspective view of a counterframe for a window inserted between the panels with support bracket to be reused for similar applications. Figure 26 is lateral view of a device with telescopic arm for inserting the jet between the formwork.

Detailed description.

The formwork construction system for acoustic and thermal insulation comprises U-shaped support means 1 paced into the floorings 2 and 3 for interlocking of panels 4 of a formwork 5. The U-shaped support means 1 in other embodiment have double U-shaped to adapt them at different thicknesses of the lateral panels of the formwork. The lower part of the support means 1 can be covered with insulating material, such as reused rubber, cork or similar to prevent thermic and acoustic transmissions. Said support means 1 are integrated in the jet of the flooring and in the upper parts of the formwork walls. To facilitate the correct positioning of the hollow of the jet to the flooring with the panels 4 of the formwork 5 a jig 6 is provided. The

upper jig 6 and the hollow obtained with the U-shaped support means 1, other to permit the connection to the EPS panels against the exit of concrete, have also the aim to facilitate the alignment of the walls during the concrete jet. The formwork construction system for acoustic and thermal insulation, further, comprises a right angle bracket 7 for the vertical plumb fixing of the panels 4 of the formwork 5. The right angle bracket 7 is fixed at the transversal connection means 8 of the formworks 5. Further, said right angle bracket 7 is vertical connects at least at an other right angle bracket 7 to assure the perpendicularity conditions for all the high of the building by other support bracket 9. The invented formwork construction system comprises joints 10 between the formworks 5 to prevent the exit of material long the side joints 11 or at joints at the corners 12 of the formworks 5. The pressure of the concrete or other binder element jets is so demolished to the broken ling joints 10, i.e. with zig-zag, step, L or similar shape, able to decrease the pressure of the concrete jet onto the side joints 11 and at the corners 12. The walls of the formworks 5 are formed to an outside plastic part, such as EPS, and to an inside non plastic part, such us cork 13 united together by a special glue based on heat-reflecting nanotechnology able to permit the consistency between materials with different thermic dilatations. The transversal connection means 8 are realized with screws 14 in plastic

material to be screwed onto pipes 15 in metallic material having the inside screwing 16 without contact with the stems 17 of the screws 14 to prevent the acoustic and thermal transmission inside the walls of the building. In this way come to be void the acoustic transmissions derived from shock and/or air owing to rumors generated outside or inside the building, as they are avoided thermal transmissions by the transversal connection means 8 that previous the present invention are thermal bridges and of rumor transmission. Said pipes 15 provide prongs 18 to place in vertical and in horizontal the irons 19 for the reinforced concrete. The prongs 18 ensure stable positioning of said irons 19 during the introduction of the concrete casting, of the mortar or of other binder element used into the formworks 5. The irons 19 can be placed between the flooring 2 and the formwork 5 to have elasticity between the wall and the flowing 2 in case of earthquake. The mortar used in the jets consists of limestone or siliceous sand for 71,4 % (seventy-one comma four percent), concrete for 21,7% (twenty-one comma seven percent), water for 6,67% (six comma sixty-seven percent) and an accelerating fluidizing additive for 0,3% (zero comma three percent). The accelerating fluidizing additive gives to the mortar a taking in short times and an homogenous diffusion of the material inside the formwork 5 such as to do not request more jets in different

times. The invented system is so able to have a bigger homogeneity of the material binding the irons without surfaces subject to drying in different times. Further, the invention system provides cover caps 20 onto the heads 21 of the screws 21. Said cover caps 20 are preferably made of cocks or similar acoustic insulating material and are removable to permit the placing of a scaffold directly fixed to the structure formed with the invented system. The invented system provides further fixing screws 22 for scaffolding with pipes 26 having inside screwing 27 26) placed in the concrete or in the mortar to support the scaffold. The transversal connection means 8 further can be provided with plastic material overhanging parts 23 so to prevent the creation of rust onto wooden formworks 5.f Further, the invented system the placement of fixtures both in line or inside the walls directly at the fixing of a counterframe for window of door-window during the concrete, mortar or other binder material jet into the framework s5 with the fixtures anchored to the building structure by protruding parts 25, such as dovetail joint, suitable to fix directly the fixtures to the obtained structure with the invented constructive system. The jet fluidity obtained with the mortar according the invention further permits the use of a robot 28 with mechanical arm 29 for the low pressure pumping of the mortar between the frameworks 5 with slide 30 placed at the top of the outside

panel 4 for the filling of framework 5 with the inside panel 4 having upper height in comparison to the outside panel 4 to have staggered floors so to cover and insulate the flooring 3 to be realized. The invention is possible of a lot of modifications and variations all part of the inventive object- All the particular can be changed with other technically equivalent without goes over the field of protection given to the claims.

CLAIMS.

- 1) Formwork construction system for acoustic and thermal insulation comprising U-shaped or double U-shaped support means (1) placed into the flooring (3) for interlocking of panels (4) of a formwork (5), with jig (6) to help the align of the walls during the concrete casting, characterized in that the pipes (15) provide prongs (18) to place in vertical and in horizontal the irons (19) for the reinforced concrete, with the prongs (18) that ensure stable positioning of the irons (19) during the introduction of the concrete casting, mortar or other binder element into the formwork (5).
- 2) Formwork construction system for acoustic and thermal insulation, according to claim 1, characterized in that the transversal connection means (8) are realized with screws (14) in plastic material to be screwed onto pipes (15) in metallic material having the inside screwing (16) without contact with the stems (17) of the screws (14) and provide cover caps (20) into the heads (21) of the screws (14) to avoid acoustic and thermal transmission inside and outside of the building walls.
- 3) Formwork construction system for acoustic and thermal insulation, according to claims 1 and 2, characterized in that the cover caps (20) in the

heads (21) of the screws (14) are to be moved to permit the positioning of a scaffold and of fixing screws (22) for scaffoldings with pipes (26) having inside screwing (27), with the pipes (26) placed in the concrete or in the mortar to support the scaffold.

- 4) Formwork construction system for acoustic and thermal insulation, according to claims 1, 2 and 3, characterized in that the transversal connection means (8) can provide an overhanging parts (23) in plastic material to avoid the formation of rust onto the frameworks (5) in wood.
- 5) Formwork construction system for acoustic and thermal insulation, according to claims 1, 2, 3 and 4, characterized in that the mortar used in the jets consists of limestone or siliceous sand for 71,4 % (seventy-one comma four percent), concrete for 21,7% (twenty-one comma seven percent), water for 6,67% (six comma sixty-seven percent) and an accelerating fluidizing additive for 0,3% (zero comma three percent).
- 6) Formwork construction system for acoustic and thermal insulation, according to claims 1, 2, 3, 4 and 5, characterized in that the mortar permits the use of a robot (28) with mechanical arm (29) for low pressure pumping of the mortar between the formworks (5), with slide (30) placed at the end of

the outside panel (4) for the filling of the formworks (5).

- 7) Formwork construction system for acoustic and thermal insulation, according to claims 1, 2, 3, 4, 5 and 6, characterized in that the counterframes of the windows and of the doors (24) are anchored in the jet of concrete or mortar with a joint (25) with dovetail, wherein the jet is kept by bracket anchored onto the heads (21) of the screws (14).

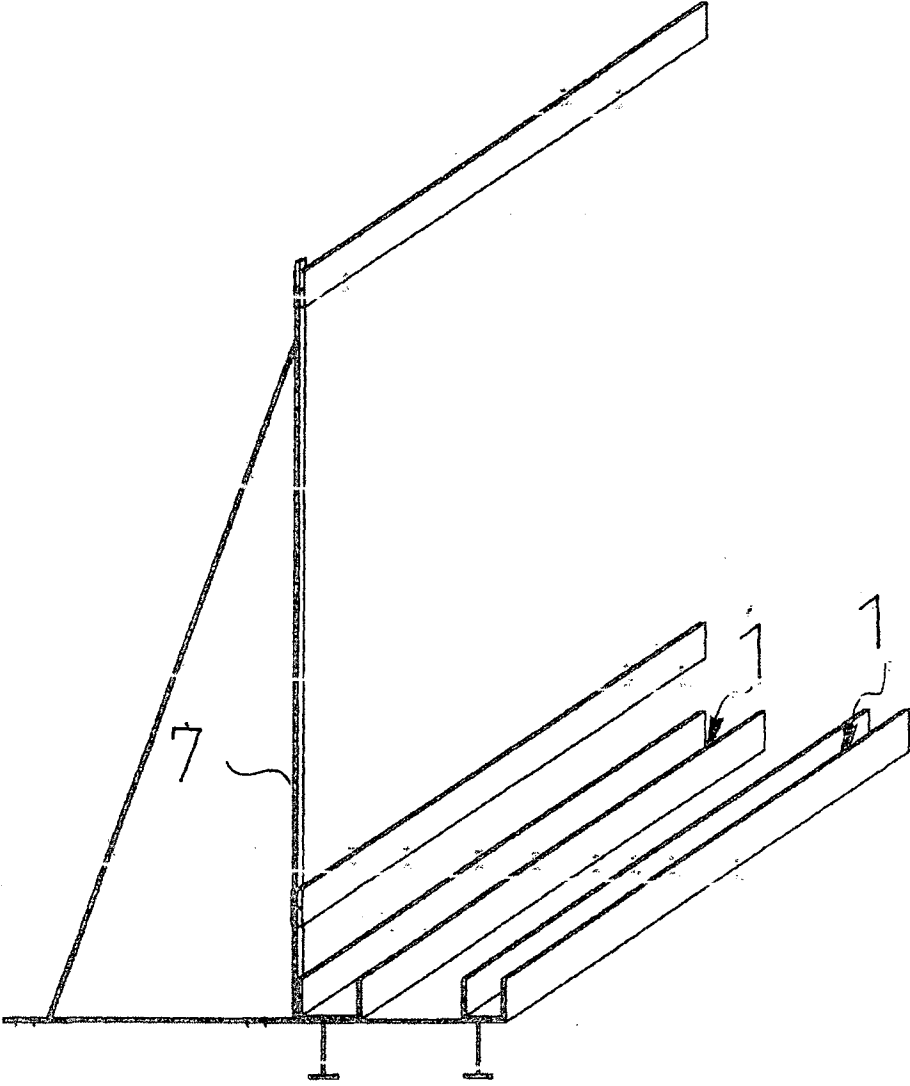
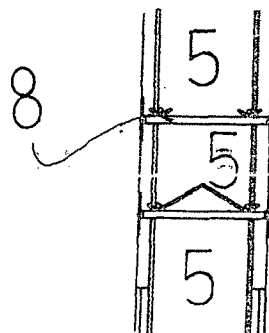
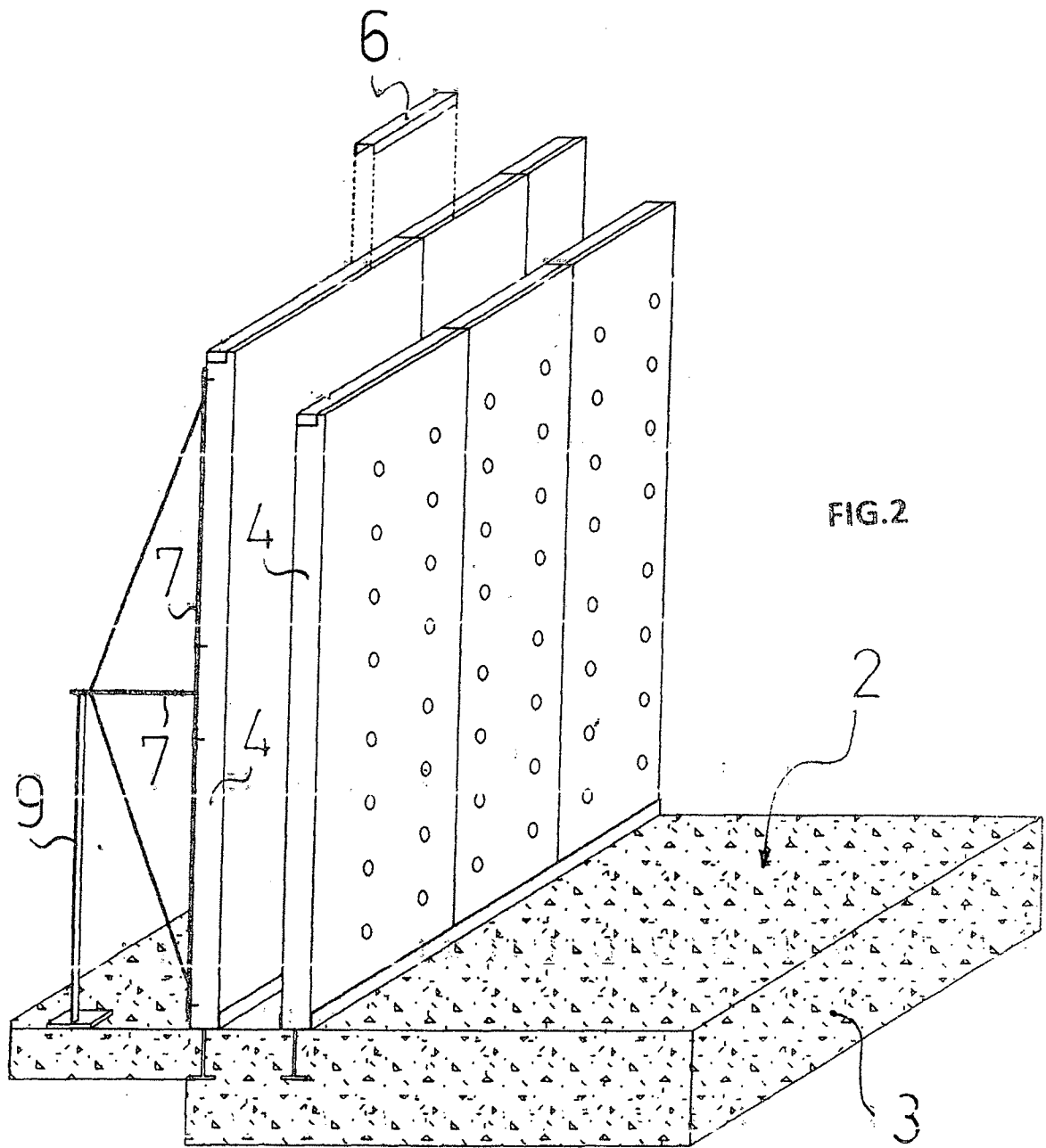
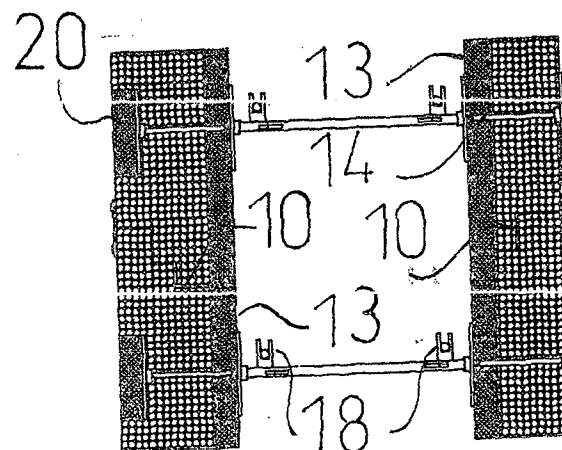
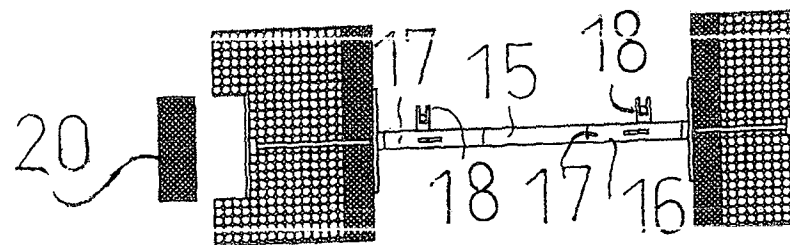
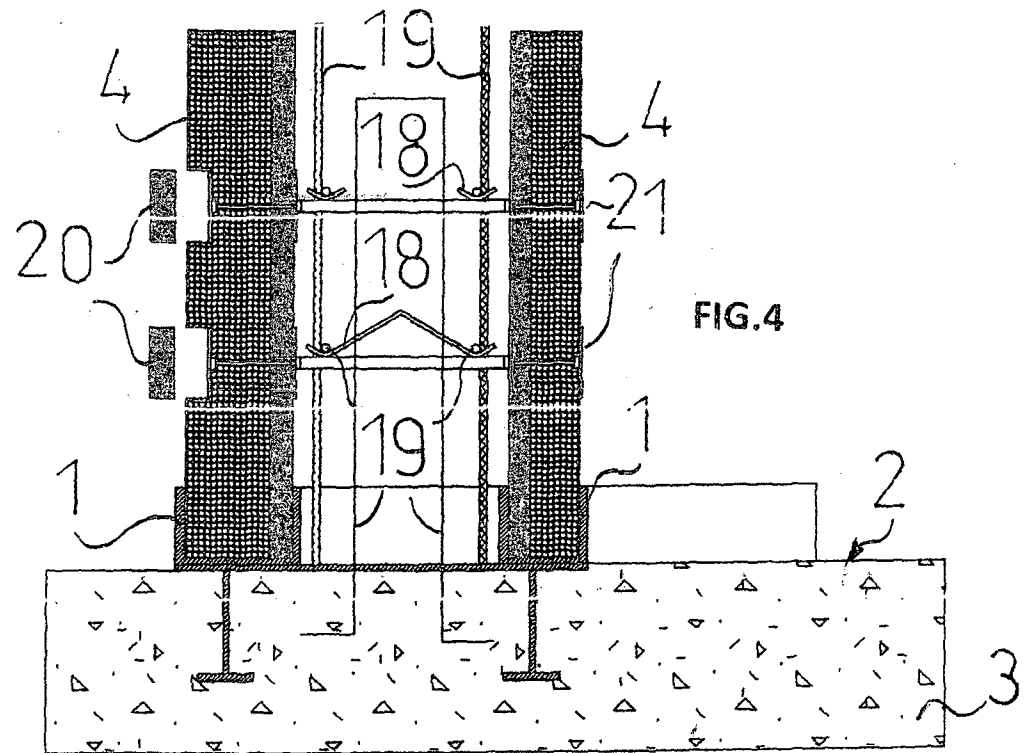
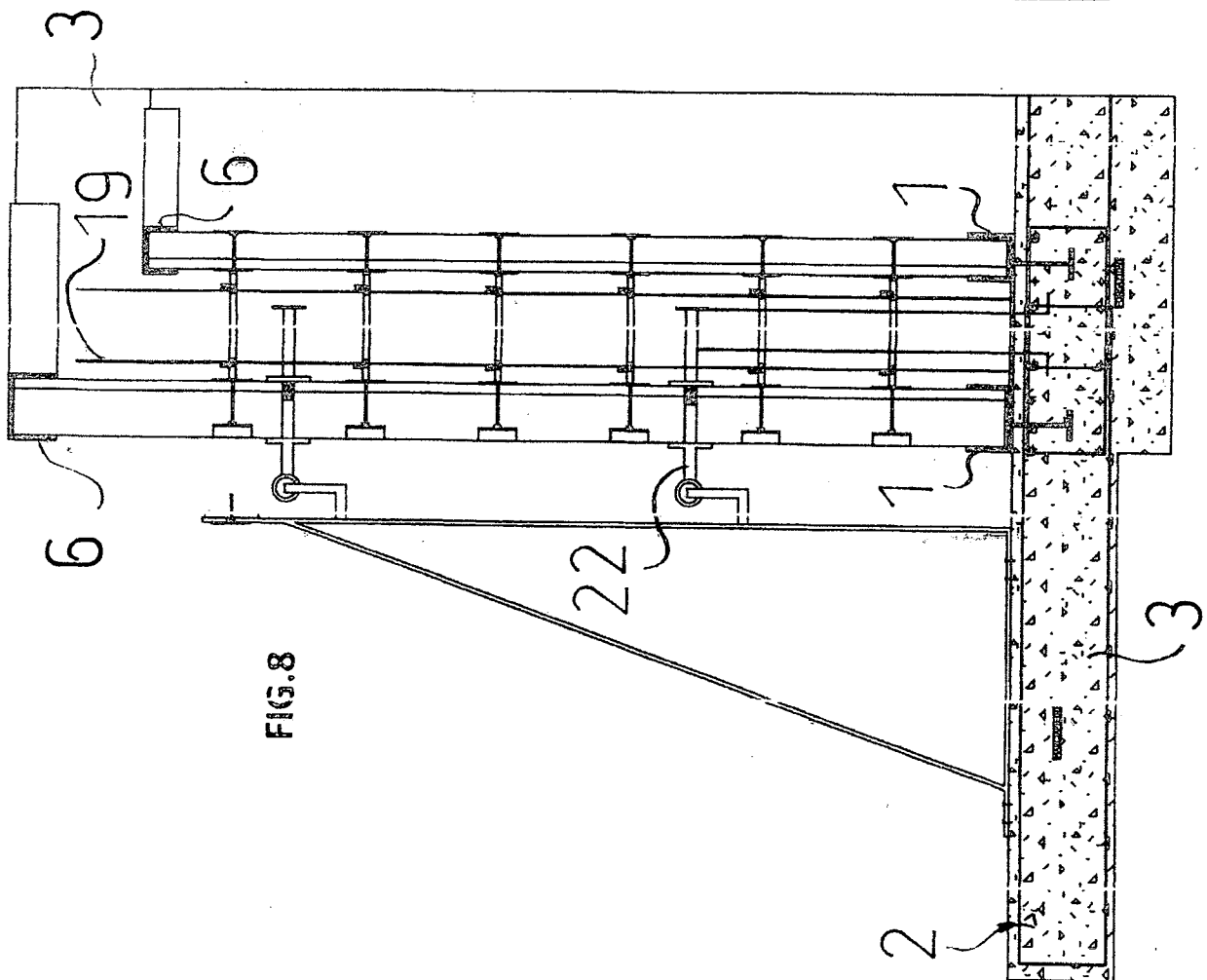
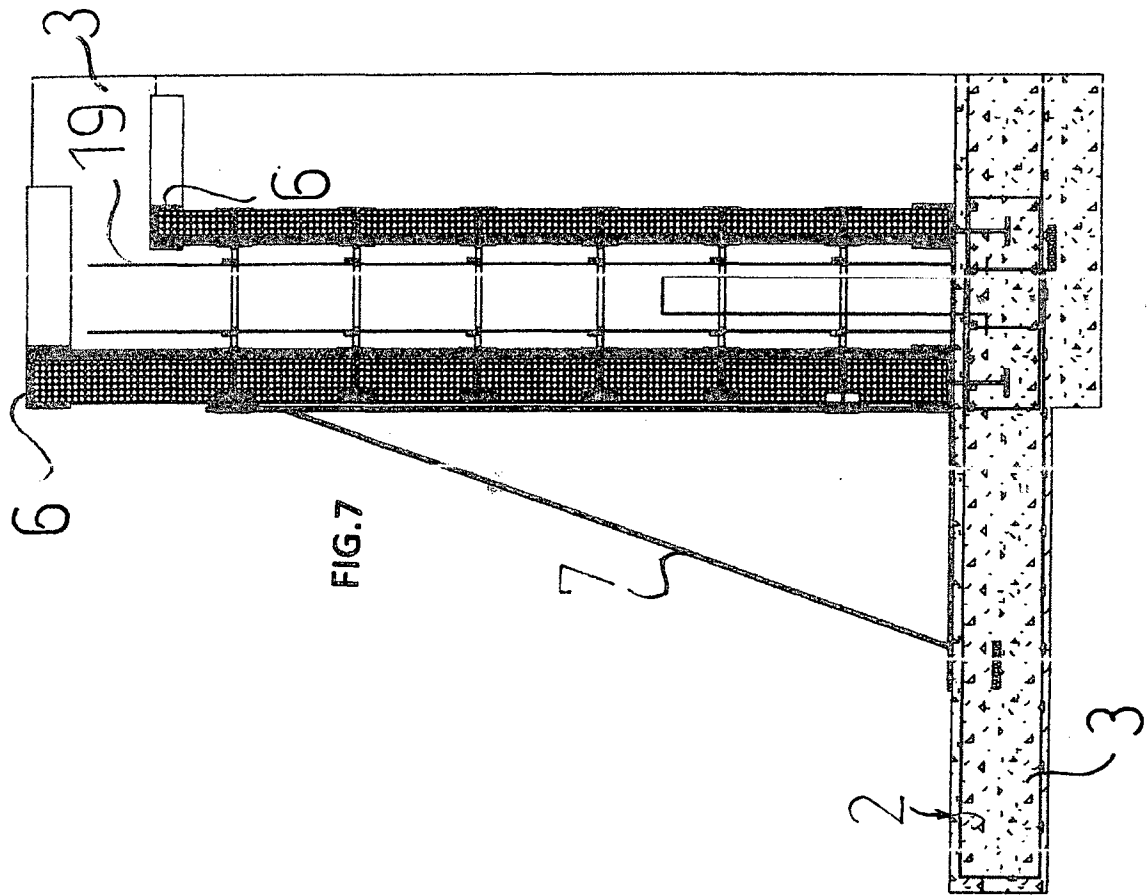
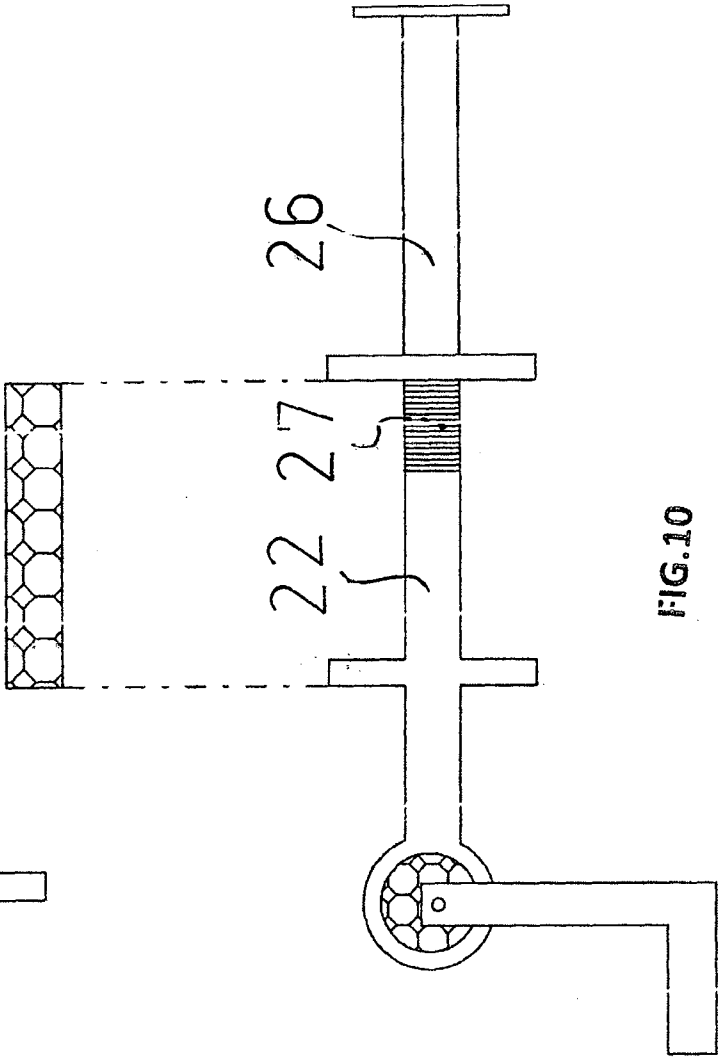
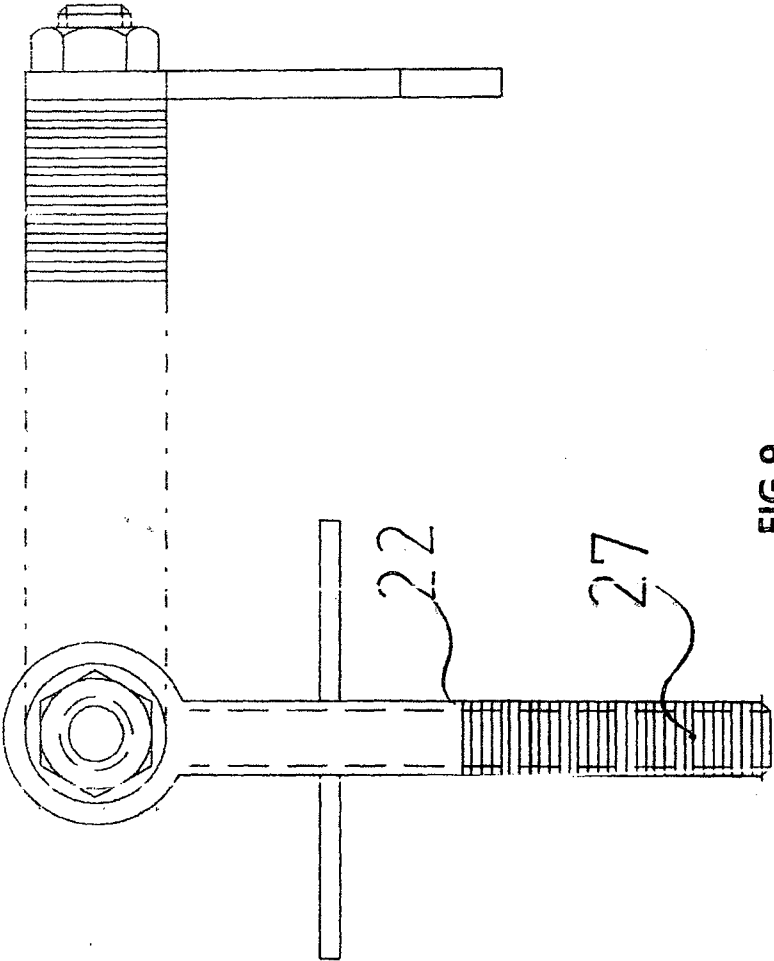


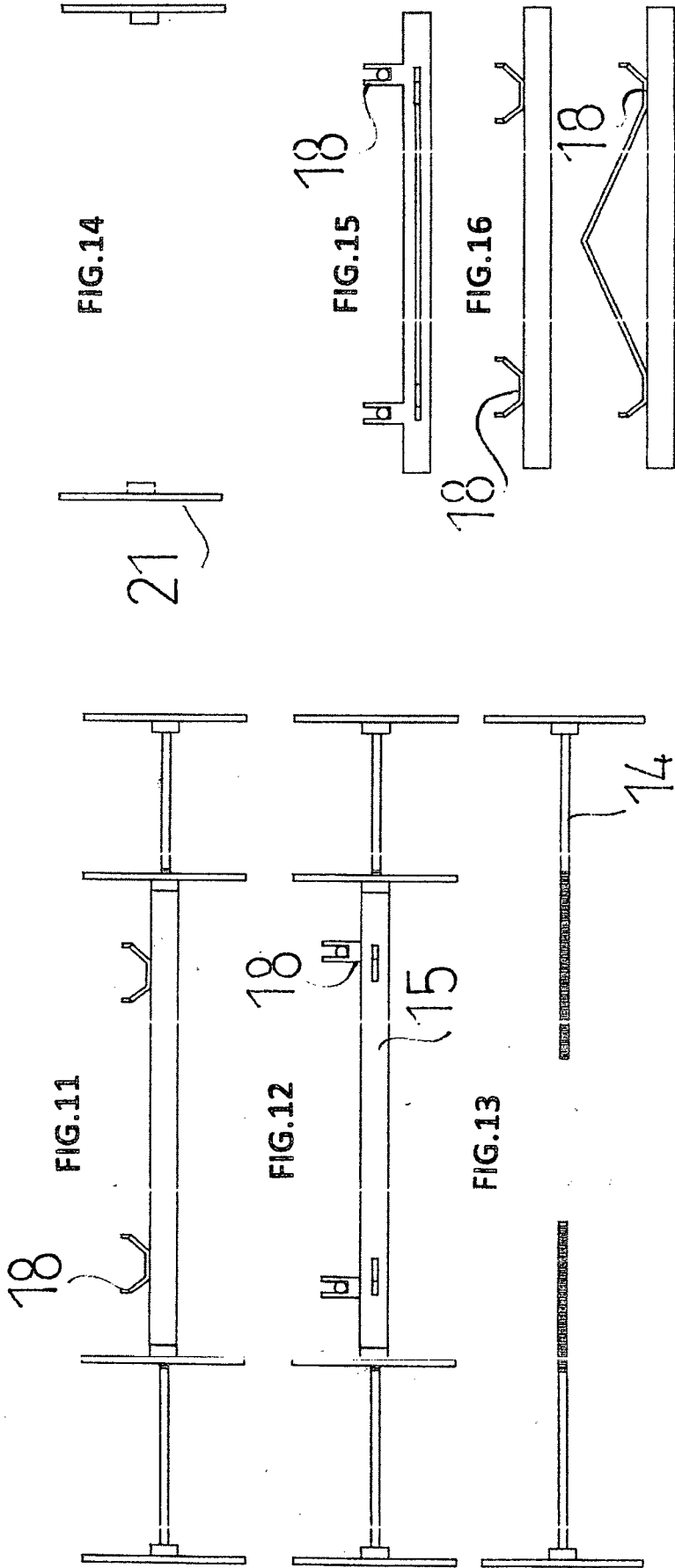
FIG.1

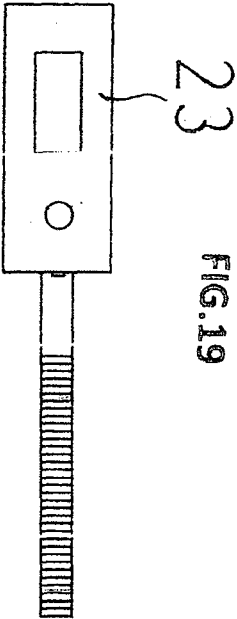
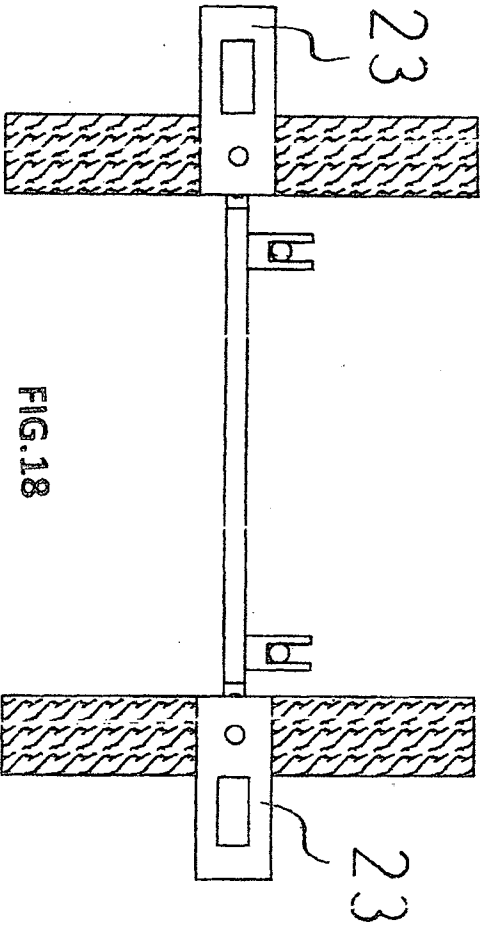












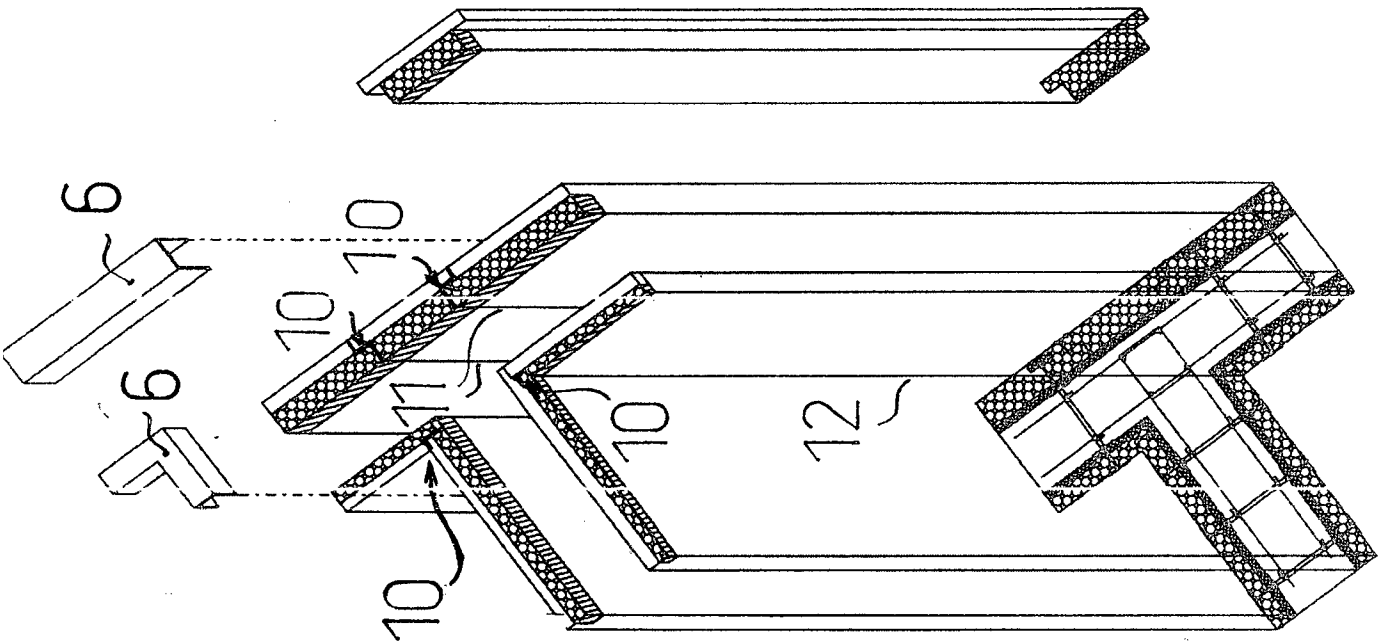


FIG. 22

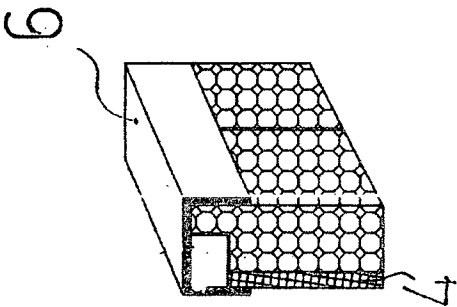


FIG. 21

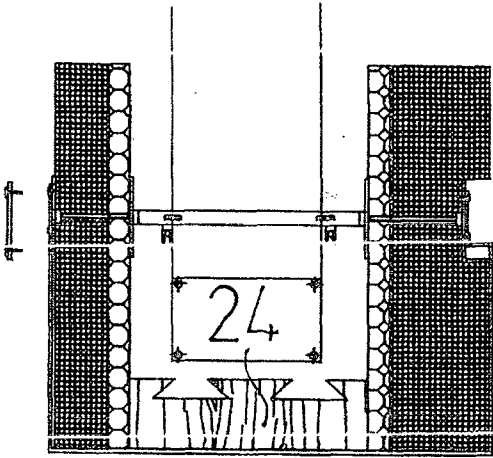


FIG. 23

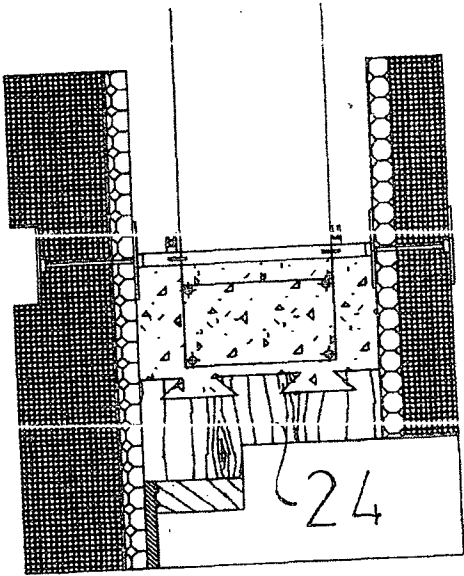


FIG. 24

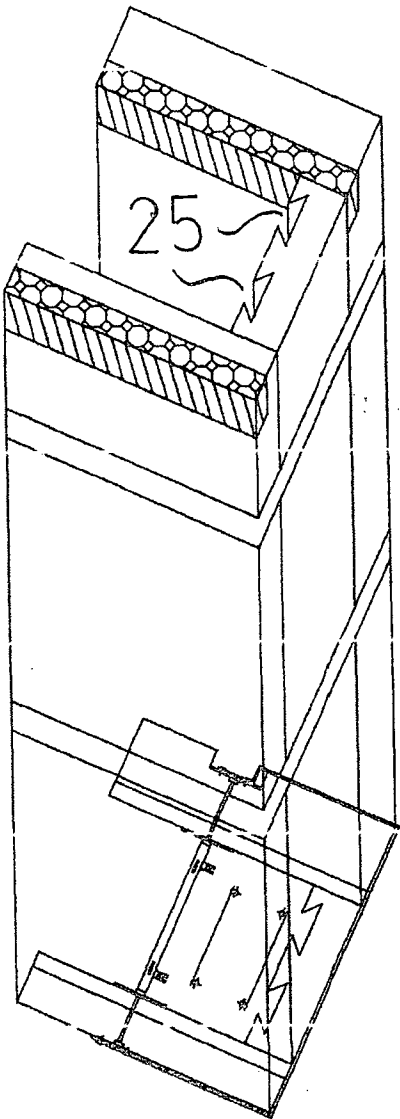


FIG. 25

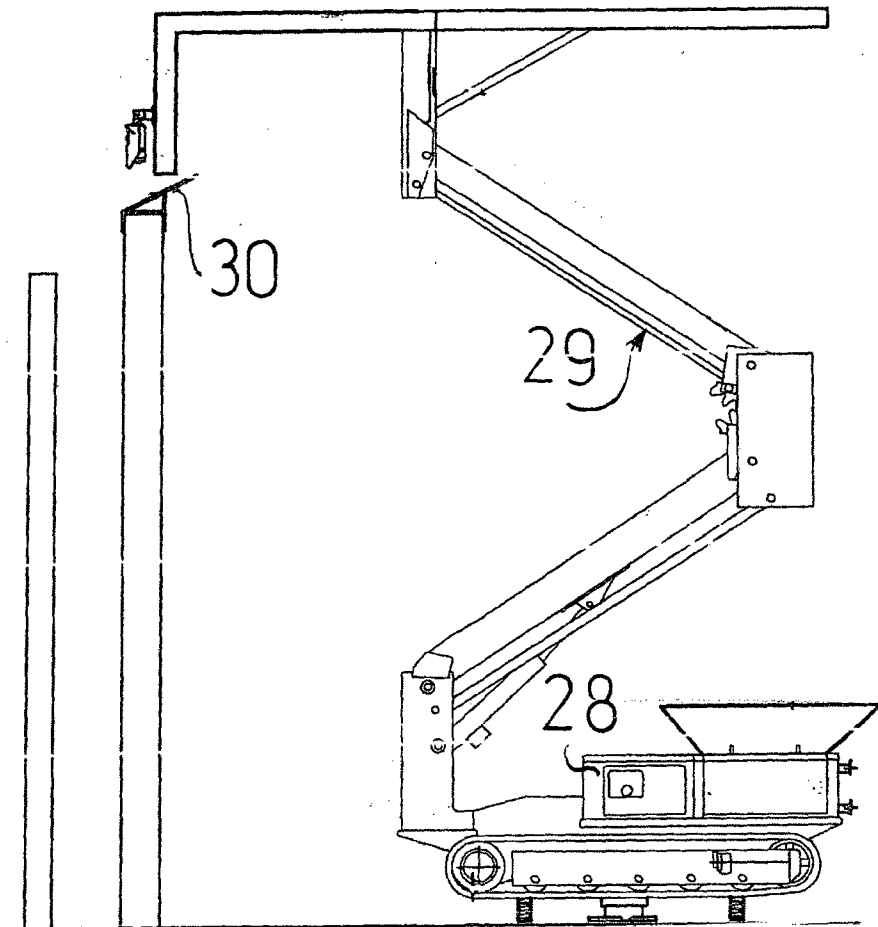


FIG. 26

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/000590

A. CLASSIFICATION OF SUBJECT MATTER INV. E04B2/86 E04G11/12 E04G17/065 E04G17/14 E04G21/04 ADD. E04G21/18		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) E04B E04G		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 832 456 B1 (BILOWOL PETER [AU]) 21 December 2004 (2004-12-21) column 6, line 8 - column 9, line 35; figures 4A-5, 11-13, 19, 23, 30 -----	1-7
X	US 2016/281355 A1 (MCDONAGH GREGORY M [US]) 29 September 2016 (2016-09-29) paragraph [0086] - paragraph [0123]; figures 1-16 -----	1-7
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search 18 September 2018	Date of mailing of the international search report 25/09/2018	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Melhem, Charbel	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6832456	B1	21-12-2004	NZ 505815 A 25-07-2003
			US 6832456 B1 21-12-2004
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