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(71) Applicant: **Keegan Intellectual Property Limited Rathmoylon Meath (IE)**

(72) Inventor: **Keegan, John Co. Meath (IE)**

(74) Representative: **FRKelly 27 Clyde Road Dublin D04 F838 (IE)**

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(54) **A PRECAST MODULAR WALL SYSTEM**

(57) The present invention provides a precast modular wall system (10) comprising an inner leaf (12) and an outer leaf (14) secured in spaced relationship such as to define a cavity therebetween, and an exterior skin (18) secured to the outer leaf (14) by a plurality of brackets 20, 120 operable to permit limited planar displacement of the exterior skin relative to the outer leaf, and which are thus arranged to reduce on site construction time and complexity.

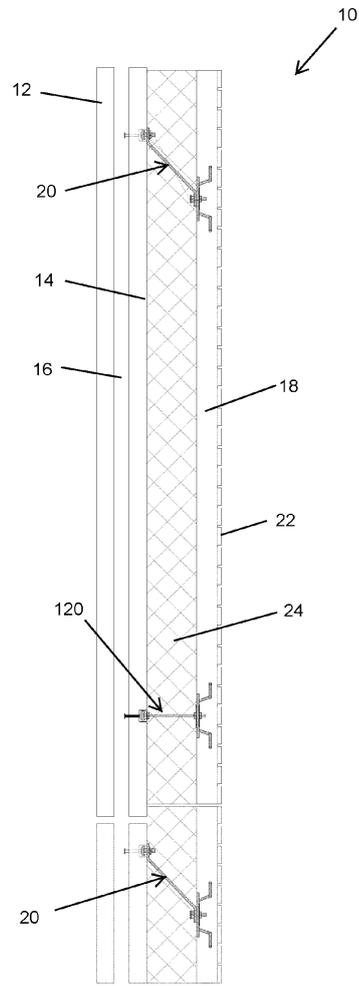


Fig. 1

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Description

Field of the invention

[0001] The present invention relates to a precast modular wall system and a building façade produced from an array of such wall systems and which are arranged to reduce on site construction time and complexity.

Background of the invention

[0002] In the construction industry, both in the commercial and residential space, there has been a steady move towards the use of precast concrete elements in order to reduce the time and therefore cost spent on site, in addition to improving the fit and finish of developments constructed with such concrete elements.

[0003] By manufacturing elements such as wall and floor panels off site a significant reduction in site time has been achieved, in addition to allowing greater dimensional accuracies/tolerances and quality of the finished components to be achieved, along with a corresponding improvement in the levels of quality control and increased overall U values for the finished building. Elements such as building facades can be factory produced with insulation preinstalled, along with the casting in situ of services such as electrical conduits and socket boxes, etc., while the improved surface finish achieved through factory production provides ready to paint surfaces on wall/ceiling panels, again greatly reducing the site time that would otherwise be required for first and second fixes. As a result of these improvements windows and doors can be pre-ordered from drawings due to the close dimensional tolerances the panels can be manufactured to.

[0004] In constructing building facades and outer walls using precast concrete elements, the conventional method involves the factory production of a so called concrete twin wall sections, each comprising an inner leaf and an outer leaf which are tied together by cast in site metal or fibre tie members such as steel lattice girders which fix the two leaves in spaced parallel relationship such as to define a cavity therebetween, on one or both inner faces of which may be provided a layer of suitable insulation. Once on site an array of the panels are fixed in edge to edge alignment to form the façade of the building, and concrete is poured into the cavity to fill same. The final wall is therefore effectively a solid concrete construction with a high quality paint ready finish on one or both sides.

[0005] This form of building may be used in various applications to produce elements such as push walls, beam walls, retaining walls, blast walls, basement walls, etc.

[0006] Depending on the design of building, an outer cosmetic layer of brickwork may then be constructed on site against the exterior face of the outer concrete leaf and extending across the multiple wall sections in order to cover the joint between adjacent sections and provide a seamless overall finish to the exterior of the building.

This is a relatively time consuming and skilled procedure which therefore adds time and cost to the overall build and most importantly to the time spend on site.

[0007] It is therefore an object of the present invention to provide a precast modular wall system which overcomes the above mentioned issue.

Summary of the invention

[0008] According to a first aspect of the present invention there is provided a precast modular wall system comprising an inner leaf and an outer leaf secured in spaced relationship such as to define a cavity therebetween; and an exterior skin secured to the outer leaf by a plurality of brackets operable to permit limited planar displacement of the exterior skin relative to the outer leaf.

[0009] Preferably, the bracket comprises a mounting plate secured to the outer leaf, a support plate secured to the exterior skin, and a coupling permitting the mounting plate and the support plate to be fixed to one another in a range of relative positions.

[0010] Preferably, the bracket comprises a bolt extending from the mounting plate through a circular opening in the support plate, and a circular filler washer captured in the circular opening and having an elongate slot therein through which the bolt passes.

[0011] Preferably, the support plate is at least partially precast into the exterior skin.

[0012] Preferably, the mounting plate comprises a channel precast into the outer leaf and a bolt having a head captured in the channel and a shaft projecting from the outer leaf.

[0013] Preferably, the mounting plate comprises an S shaped plate extending between the outer leaf and the exterior skin.

[0014] Preferably, the mounting plate is secured to the outer leaf via the bolt.

[0015] Preferably, the bolt extends directly into the bracket.

[0016] Preferably, the support plate is at least partially precast into the exterior skin.

[0017] Preferably, the support plate comprises a plurality of outwardly projecting retention members.

[0018] Preferably, the wall system comprises insulation provided between the outer leaf and the exterior skin.

[0019] Preferably, the exterior skin comprises a repeating geometric pattern on an exterior face.

[0020] Preferably, the repeating geometric pattern comprises a brick effect.

[0021] Preferably, the wall system comprises at least one door or window.

[0022] Preferably, the inner leaf and the outer leaf are formed from precast concrete.

[0023] Preferably, the wall system comprises a plurality of tie members securing the inner leaf to the outer leaf.

[0024] Preferably, the exterior skin comprising a plurality of openings through each of which a respective bracket is accessible.

[0025] Preferably, the wall system comprises a plug securable within each of the openings to occlude the respective bracket.

[0026] According to a second aspect of the present invention there is provided a building façade comprising a plurality of the precast modular wall systems according to any of the preceding claims arranged in a linear array and in which the exterior skins of adjacent wall systems are displaced relative to the respective outer leaf in order to be in alignment with one another.

[0027] Preferably, the cavity between the inner and outer leaf of each wall system is filled with concrete following the fixation of the wall systems on site.

Brief description of the drawings

[0028] The present invention will now be described with reference to the accompanying drawings, which include the following figures:

Figure 1 illustrates a sectioned side elevation of a precast modular wall system according to an embodiment of the present invention:

Figure 2 illustrates a perspective view of the wall system illustrated in Figure 1;

Figure 3 illustrates a front elevation of the wall system illustrated in Figures 1 and 2;

Figure 4 illustrates a perspective view of a first type of bracket forming part of the precast modular wall system of the invention;

Figure 5 illustrates a front elevation of the bracket illustrated in Figure 4;

Figure 6 illustrates an exploded side elevation of the bracket illustrated in Figures 4 and 5;

Figure 7 illustrates an exploded plan view of the bracket of Figures 4 to 6;

Figure 8 illustrates a perspective view of a second type of bracket forming part of the precast modular wall system of the invention;

Figure 9 illustrates a front elevation of the bracket illustrated in Figure 7;

Figure 10 illustrates an exploded side elevation of the bracket illustrated in Figures 8 and 9; and

Figure 11 illustrates an exploded plan view of the bracket of Figures 8 to 10;

Detailed description of the drawings

[0029] Referring now to the accompanying drawings there is illustrated a precast modular wall system, generally indicated as 10, for use in the construction of buildings such as residential or commercial properties, and which system 10 facilitates the exact alignment of adjacent sections or panels of a wall in order to allow the seamless continuity of an outer cosmetic layer or finish, for example a brick effect finish or other repeating geometric pattern, to be achieved onsite following the fixing of the wall system 10 in place.

[0030] The precast modular wall system 10 of the invention is designed to be factory produced off site and then transported to site for erection, allowing for consistent dimensional accuracy and finish to be achieved. The system 10 allows an outer wall of a building (not shown) to be produced by locating a plurality of the wall systems 10 in edge to edge alignment with one another, and securing each of the wall systems 10 in position by conventional means, for example tying above a precast floor slab (not shown) or the like, and utilising steel uprights or the like cast into the floor to secure each panel of wall system 10 in place. Any other suitable means may of course be used to secure the wall systems 10 in place.

[0031] While the above technique for locating and securing the wall systems 10 in place is relatively conventional, the wall system 10 of the invention differs from the art by providing an exterior skin 18 having a brick effect or the like on the outwardly facing surface thereof, the position of which exterior skin 18 may be adjusted in order to allow adjacent exterior skins to be aligned as hereinafter described, therefore allowing a significant reduction in site time to be achieved by avoiding the requirement to lay brickwork or apply a finishing skin to the erected precast twin wall.

[0032] The modular wall system 10 comprises a precast concrete inner leaf 12, a corresponding precast concrete outer leaf 14 secured in spaced relationship to the inner leaf 12 via an array of conventional tie members such as steel lattice girders (not shown) so as to define a cavity 16 between the leaves 12, 14. Once the wall system 10 is erected on site and secured in position concrete is then poured onsite in order to fill the cavity 16 such as to effectively provide a solid concrete wall.

[0033] The wall system 10 additionally comprises the exterior skin 18, which is preferably in the form of a relatively thin precast concrete panel whose exterior face 22 is cast or otherwise provided with a repeating geometric pattern, most preferably a brick effect finish as clearly visible in Figures 2 and 3, in order to replicate a conventional brick outer layer to the wall system 10 and therefore the finished building. The exterior skin 18 is secured to and spaced apart from the outer leaf 14 via an array of brackets 20, 120 the configuration and operation of which will be described in greater detail hereinafter. These brackets 20,120 permit relative displace-

ment between the exterior skin 18 and the outer leaf 14, in particular planar displacement of the exterior skin 18, in order to allow the geometric pattern of adjacent wall systems 10 to be aligned with one another subsequent to the wall systems 10 being secured in position onsite. This functionality facilitates the appearance of a continuous brickwork finish to the exterior of the building by allowing the rows of brick effect to be vertically aligned between adjacent wall systems 10 such that each horizontal row of brick on one exterior skin 18 runs seamlessly into the respective horizontal row on the adjacent exterior skin 18 of the wall systems 10.

[0034] The precast modular wall system 10 preferably comprises a layer of solid insulation 24 sandwiched between the exterior skin 18 and the outer leaf 14, and which may be of any suitable material and dimensions such as to provide a desired U value for the wall system 10.

[0035] Referring now to Figures 4 to 7 the bracket 20 is shown in greater detail and in isolation from the remainder of the modular wall system 10. The bracket 20 comprises a channel 26 which is cast into the outer leaf 14 adjacent the outer surface thereof. Captured within the channel 26 are a pair of bolts 28, a head 30 of each of the bolts 28 being contained within the channel 26 and dimensioned such that the head 30 can be captured within the channel 26. A shaft 32 of each of the bolts 28 projects substantially perpendicularly from the channel 26 and is dimensioned to extend externally of the outer leaf 14. It will thus be appreciated that the channel 26 serves as an anchor for the bolts 28 while permitting a limited range of displacement of the bolts 28 prior to casting the outer leaf 14, in order to allow the positions of the bolts 28 to be fine tuned. It will therefore also be understood that any other functional equivalent of the channel 26 may be employed to secure the pair of bolts 28 to the outer leaf 14.

[0036] The bracket 20 further comprises an elongate S-shaped mounting plate 34 secured to the outer leaf 14 via the pair of bolts 28 in conventional fashion, and which mounting plate 34 is dimensioned to extend to and abut against the opposing face of the exterior skin 18 for connection thereto as hereinafter described, in order to both support the exterior skin 18 while permitting limited relative displacement therefore prior to final fixing.

[0037] The bracket 20 additionally comprises a support plate 36 which in the embodiment illustrated is a square section of steel, the support plate 36 being secured to and preferably cast into the exterior skin 18 in order to facilitate connection to the mounting plate 34 as hereinafter described. In order to robustly anchor the support plate 36 into the precast concrete exterior skin 18 the support plate 36 is preferably provided with an array of outwardly projecting retention members 38 which it will be appreciated may be of any other suitable form once this anchoring functionality is achieved. The array of retention members 38 increase the anchoring between the support plate 36 and the exterior skin 18.

[0038] The support plate 36 is provided with a central circular opening 40 therein which facilitates the provision of a coupling 42 forming part of the bracket 20, and which permits the relative movement between the exterior skin 18 and the outer leaf 14 as hereinafter described.

[0039] The coupling 42 comprises a circular filler washer 44 captured for rotation within the circular opening 40, the filler washer 44 including an elongate slot 46 therein through which a bolt 48, forming part of the coupling 42, passes from the mounting plate 34 and is secured via a 1st nut 50 threaded onto the bolt 48. Once the position of the exterior skin 18 has been finalised, the 1st nut 50 is tightened against the filler washer 44 in order to secure the support plate 38 to the mounting plate 24 while also immobilising the coupling 42. A cover plate 52 is preferably located over the filler washer 44 and secured in position by a conventional washer 54 and 2nd nut 56.

[0040] During the initial installation of the wall systems 10, the 1st nut 50 is loosened to allow the coupling 42 to move freely, such that the filler washer 44 can be rotated so as to set the slot 46 in a particular orientation to enable requisite movement of the exterior skin 18 until the rows of brick effect can be aligned with the corresponding rows on the adjacent wall system 10. The provision of the slot 46 permits limited displacement of the exterior skin 18 relative to the outer leaf 14, and in particular by the overall length of the slot 46, which is therefore dimensioned to provide sufficient adjustment to allow alignment of the brick effect finish on the outer face of the exterior skin 18 between adjacent wall systems 10, regardless of the initial relative alignments when adjacent wall systems 10 are secured in position onsite. Once the exterior skins have been correctly positioned the 1st nut can be tightened to immobilise the coupling 42 and thus the exterior skin 18. The 2nd nut 56 may then be tightened to secure the cover plate 52 so as to occlude the filler washer 44.

[0041] Referring now to Figures 8 to 11 a second form of bracket 120 is disclosed, in which like components have been accorded like reference numerals and unless otherwise stated perform a like function.

[0042] The bracket 120 does not provide the same load bearing capability as the bracket 20 and may therefore be seen as a secondary or complimentary bracket 120 which may be located at various points about the wall system 10 in order to provide an increased number of support points at which adjustments to the relative position of the exterior skin 18 may be effected. The bracket 120 again comprises a cast in channel 126 but forgoes the mounting plate 34, instead including a single bolt 128 extending from the channel 126 directly into the coupling 142 captured within the support plate 136 opposite the channel 126.

[0043] In order to permit access to the coupling 142 (and coupling 42 of the first bracket 20), to allow a 1st nut 50, 150 to be loosened and tightened before and after relative adjustment of the position of the exterior skin 18, the exterior skin 18 is provided with an opening or access port 58 aligned with each of the support plates 36 and

136, as illustrated in Figure 3. Once the position of the exterior skin 18 has been adjusted and fixed a conventional or custom made brick (not shown) may be inserted into the opening 58 and secured in position using conventional grout or the like. This brick will then be indistinguishable from the surrounding brick effect, again ensuring a seamless finish to the exterior of the building.

[0044] Thus in use multiple units of the wall system 10 are secured in position side by side and fixed in place by conventional means, which may include gaskets between adjacent wall systems 10, between each wall system 10 and a precast or poured in situ floor slab, steel lattice reinforcing members, etc. Once secured in position the cavity 16 between the inner and outer leaf 12, 14 is filled with concrete and allowed to set. The exterior skin 18 of each wall system 10 may then be individually adjusted, primarily in a vertical direction/in plane horizontal direction via the action of the coupling 42, 142, in order to align the rows of brick effect or other geometric patterned finish between adjacent wall systems 10. Once aligned the exterior skins 18 are fixed in position by tightening the nuts 50, 56, 150, 156 in order to immobilise each of the couplings 42, 142, and a brick is then secured into each of the openings 58 in order to finish the exterior of the building. All windows and doors (not shown) are preferably installed in the individual wall systems 10 as required, and the interior of the inner leaf 12 is then ready to be painted and the remaining second fix procedures may then be immediately undertaken.

[0045] The precast modular wall system 10 of the invention thus permits a wall of a building to be effectively fully constructed offsite and thus to an extremely high standard and level of finish, before a final finished procedure is used to quickly and easily align the exterior skins 18 to provide a seamless brick effect finish to the exterior of the building.

Claims

1. A precast modular wall system comprising an inner leaf and an outer leaf secured in spaced relationship such as to define a cavity therebetween; and an exterior skin secured to the outer leaf by a plurality of brackets operable to permit limited planar displacement of the exterior skin relative to the outer leaf.
2. A precast modular wall system according to claim 1 in which the bracket comprises a mounting plate secured to the outer leaf, a support plate secured to the exterior skin, and a coupling permitting the mounting plate and the support plate to be fixed to one another in a range of relative positions.
3. A precast modular wall system according to claim 2 in which the bracket comprises a bolt extending from the mounting plate through a circular opening in the support plate, and a circular filler washer captured in the circular opening and having an elongate slot therein through which the bolt passes.
4. A precast modular wall system according to any preceding claim in which the support plate is at least partially precast into the exterior skin.
5. A precast modular wall system according to claim 4 in which the mounting plate comprises a channel precast into the outer leaf and a bolt having a head captured in the channel and a shaft projecting from the outer leaf.
6. A precast modular wall system according to claim 5 in which the mounting plate comprises an S shaped plate extending between the outer leaf and the exterior skin.
7. A precast modular wall system according to claim 6 in which the mounting plate is secured to the inner leaf via the bolt.
8. A precast modular wall system according to claim 5 in which the bolt extends directly into the bracket.
9. A precast modular wall system according to any preceding claim in which the support plate is at least partially precast into the exterior skin.
10. A precast modular wall system according to claim 6 in which the support plate comprises a plurality of outwardly projecting retention members.
11. A precast modular wall system according to any preceding claim comprising insulation provided between the outer leaf and the exterior skin.
12. A precast modular wall system according to any preceding claim in which the exterior skin comprises a repeating geometric pattern on an exterior face.
13. A precast modular wall system according to claim 9 in which the repeating geometric pattern comprises a brick effect.
14. A precast modular wall system according to any preceding claim in which the exterior skin comprising a plurality of openings through each of which a respective bracket is accessible.
15. A building façade comprising a plurality of the precast modular wall systems according to any of the preceding claims arranged in a linear array and in which the exterior skins of adjacent wall systems are displaced relative to the respective outer leaf in order to be in alignment with one another.

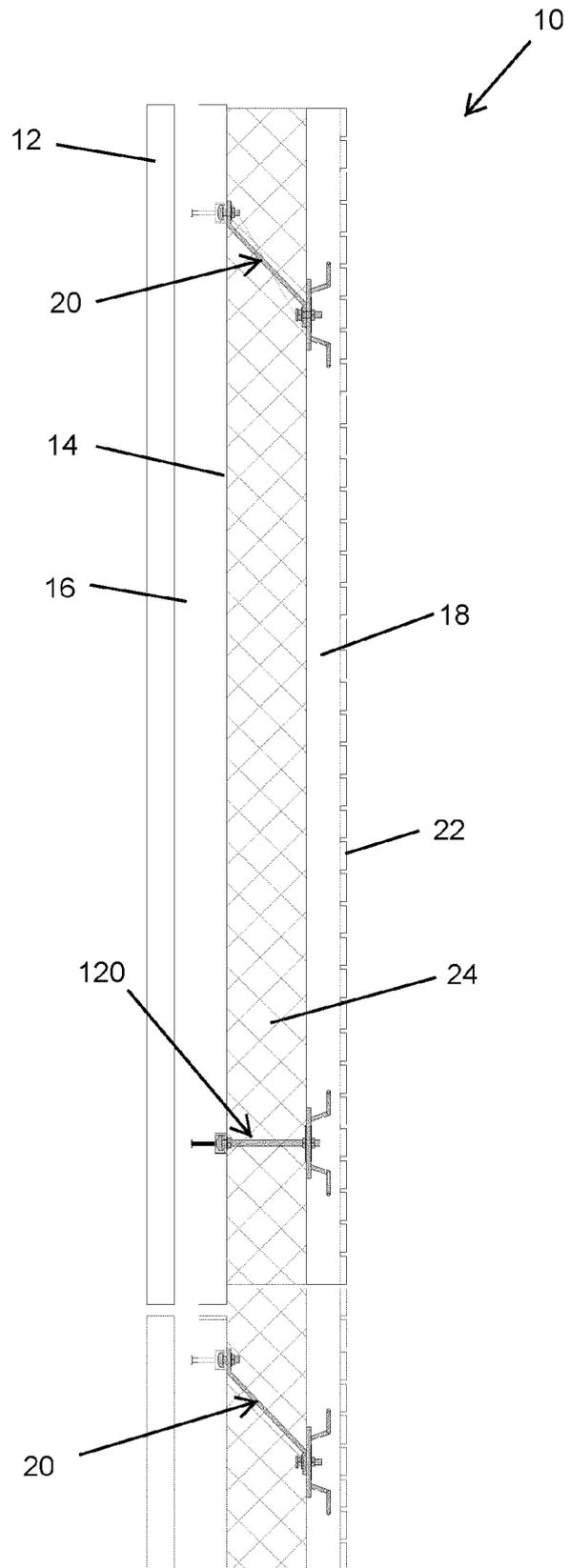


Fig. 1

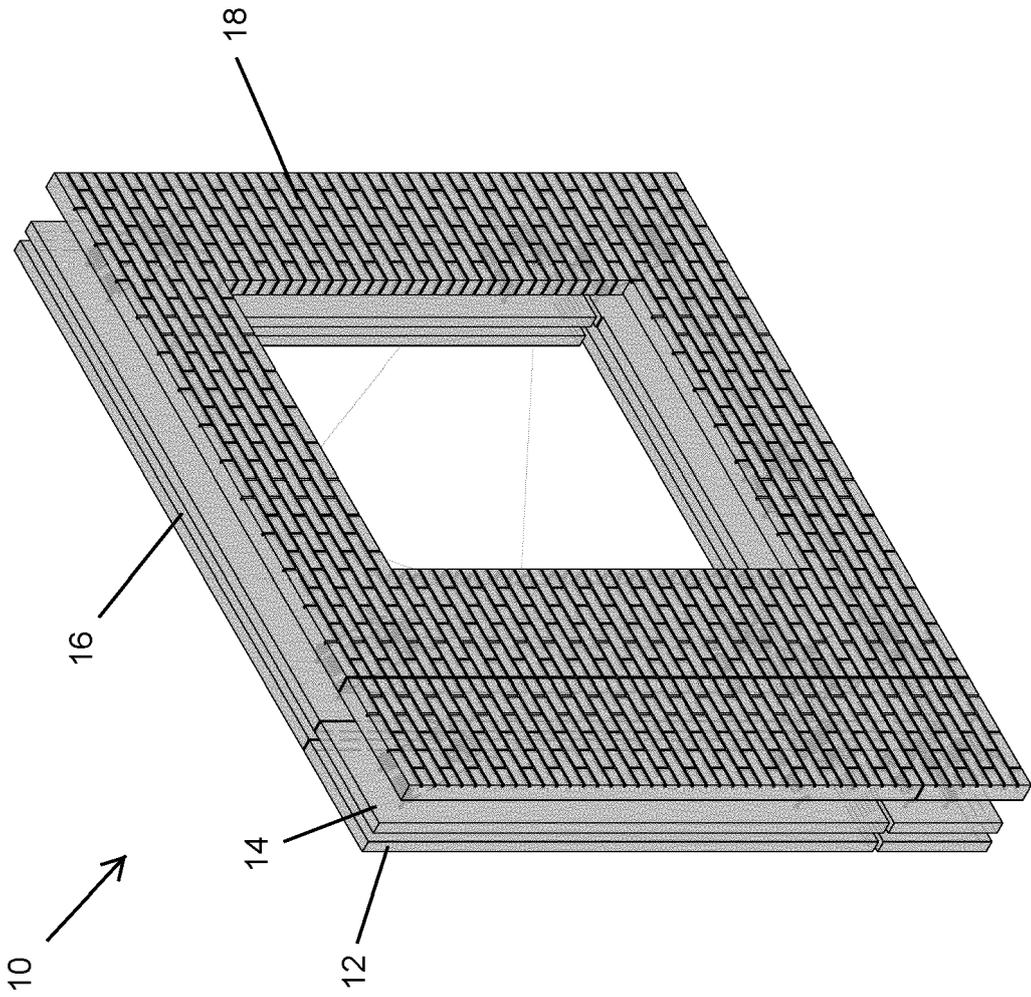


Fig. 2

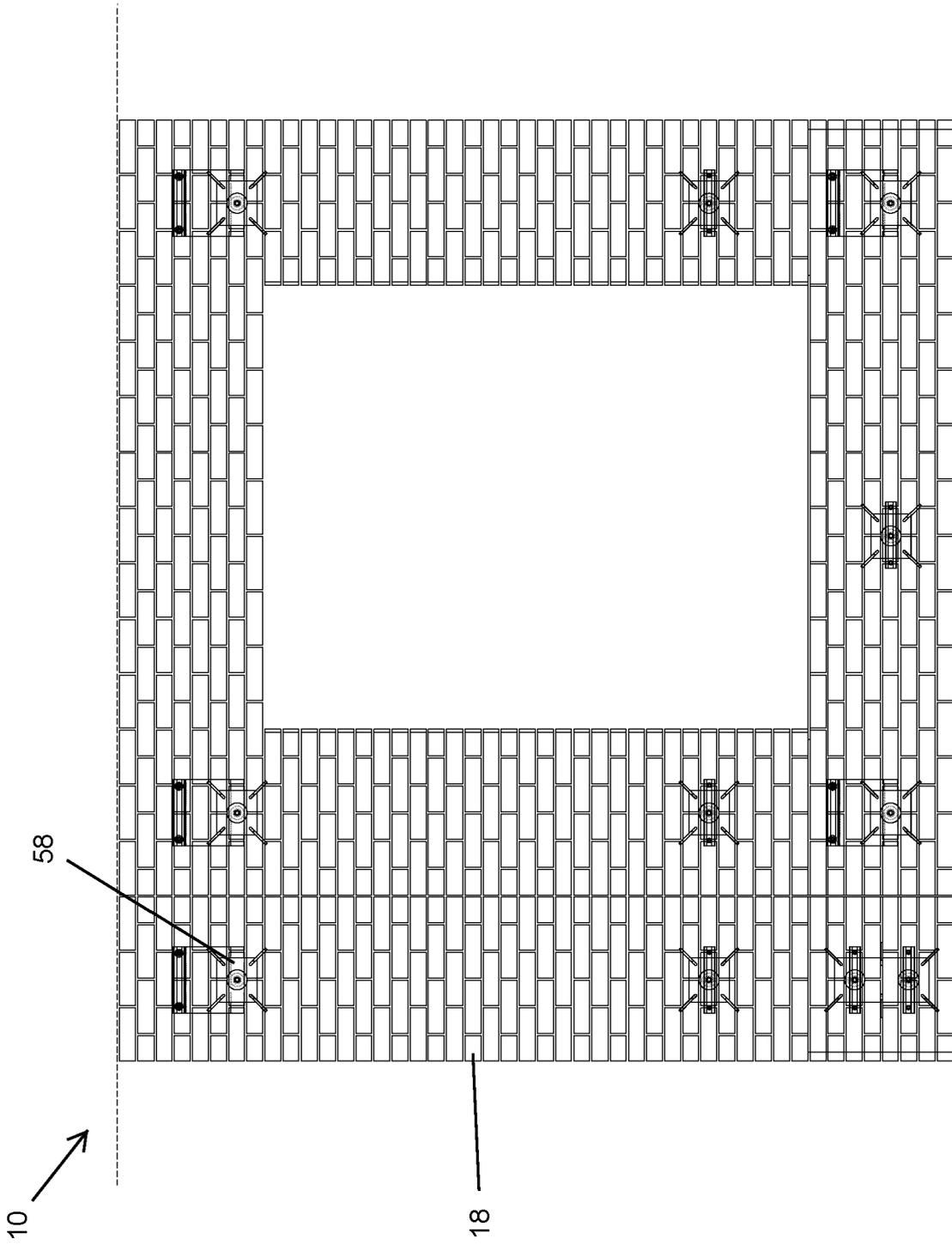
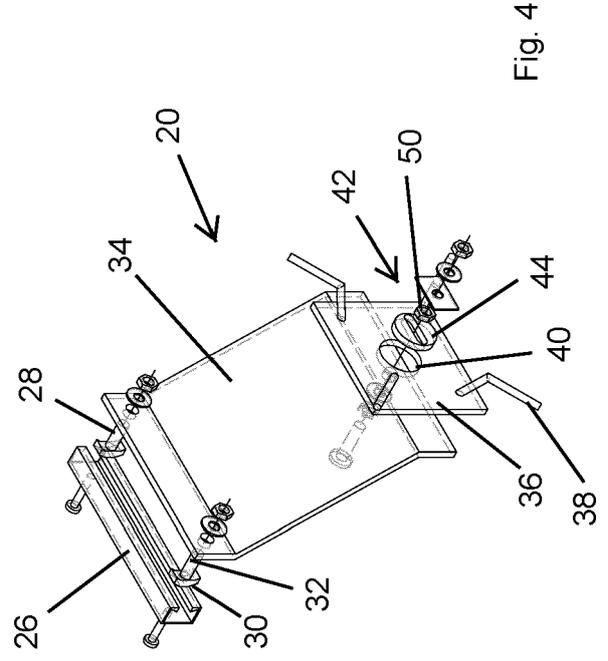
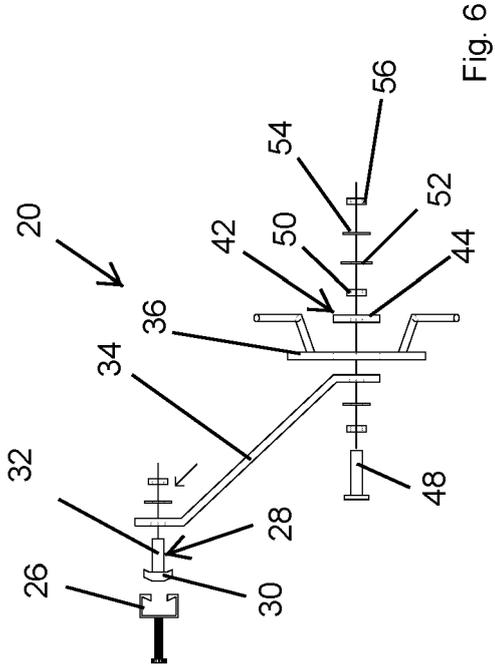
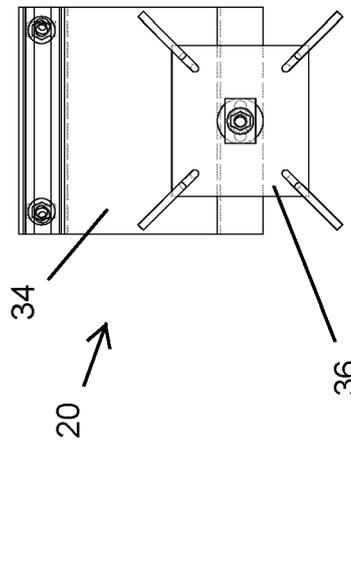
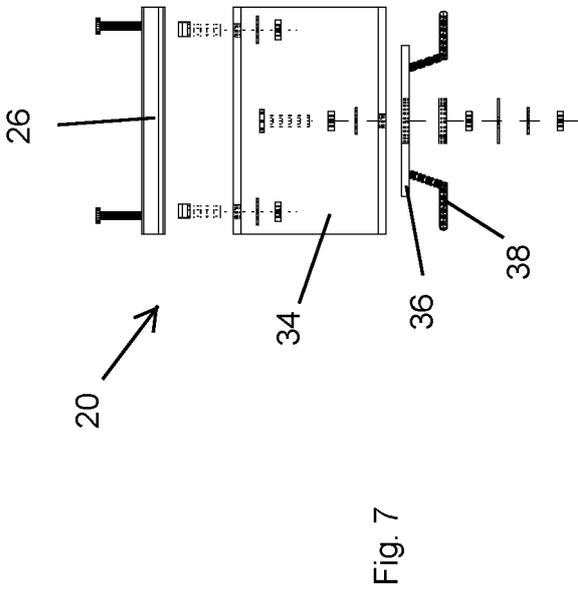


Fig. 3



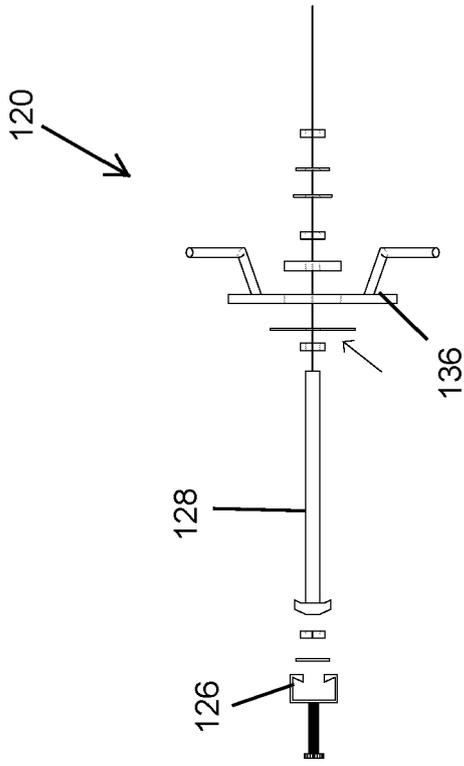


Fig. 10

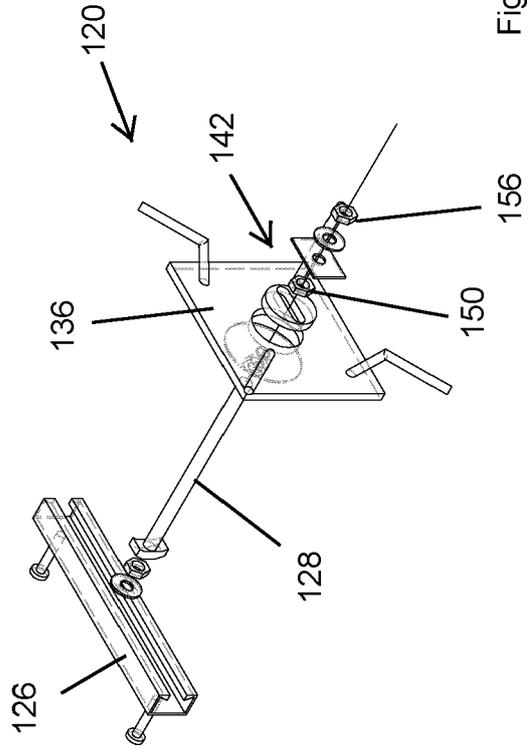


Fig. 8

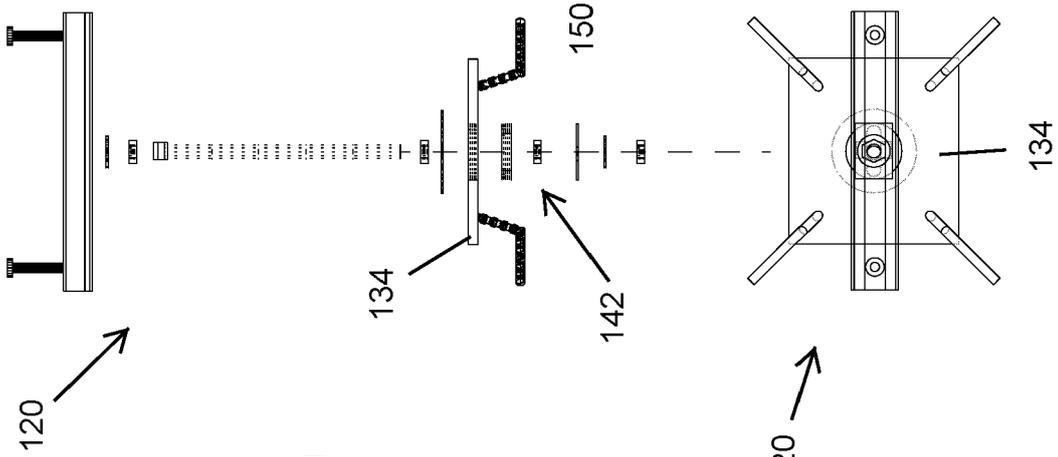


Fig. 11

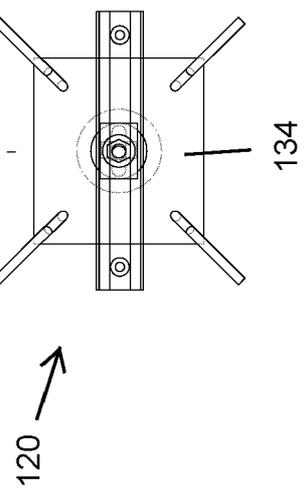


Fig. 9



EUROPEAN SEARCH REPORT

Application Number
EP 21 18 3287

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CA 2 888 404 A1 (HATZINIKOLAS MICHAEL [CA]) 16 October 2016 (2016-10-16) * page 5, line 8 - page 21, last line * * figures * -----	1-15	INV. E04B2/68 E04F13/08 E04B1/41 E04B2/86
X	EP 0 869 232 B1 (P2H DEV B V [NL]) 10 December 2003 (2003-12-10) * paragraphs [0020] - [0040] * * figures * -----	1-15	
X	DE 77 14 716 U1 (-) 15 September 1977 (1977-09-15) * the whole document * -----	1-15	
A	CN 108 867 943 A (SANY ZHUGONG TECH CO LTD) 23 November 2018 (2018-11-23) * abstract; figures * -----	1-15	
A	KR 101 890 860 B1 (CAMUS ENG & CONSTRUCTION INC [KR]; YUNWOO STRUCTRAL ENG CO LTD [KR]) 22 August 2018 (2018-08-22) * abstract; figures * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC) E04B E04F
A	CH 330 391 A (RUEESCH WILLY [CH]) 15 June 1958 (1958-06-15) * the whole document * -----	1-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 November 2021	Examiner Durrenberger, Xavier
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 21 18 3287

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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30-11-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CA 2888404	A1	16-10-2016	NONE
EP 0869232	B1	10-12-2003	AT 256231 T 15-12-2003 DE 69820322 T2 07-10-2004 EP 0869232 A1 07-10-1998
DE 7714716	U1	15-09-1977	NONE
CN 108867943	A	23-11-2018	NONE
KR 101890860	B1	22-08-2018	NONE
CH 330391	A	15-06-1958	NONE