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(54) **A wall element**

(57) An exterior concrete wall element (11) comprising a first and a second vertical side surface (13, 14), a front and a back side (15, 16), an upper and a lower side (17, 18) each having a support surface (20) for supporting at least one elongated concrete floor component (5) at its transverse outer end (19). An elongated strength-

ening member (25) is provided adjacent to said support surface (20), parallel to the prolongation of said upper side (17), and which member (25) comprises connection means (26) for connecting said member (25) to a similar elongated strengthening member (25') provided at an adjoining wall element (11').

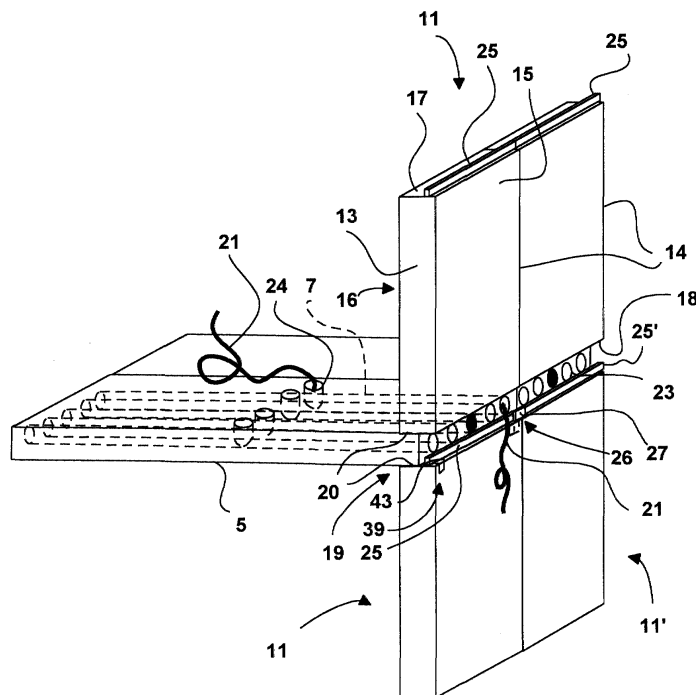


Fig. 2

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Description

[0001] The present invention relates to an exterior concrete wall element according to the preamble of claim 1.

[0002] A plurality of reinforcing band devices and constructions for junctions between wall elements of buildings are well known. Generally the constructions are used to secure building elements to each other. In areas where earthquakes frequently appears, buildings can be reinforced by means of, for example, strips.

[0003] Sometimes it is an advantage if the floor components, i.e. floor slabs, of a building can be uncovered at their ends, so that service and inspection work can be done in an efficient manner. That is, when the wall elements not cover the ends of the floor slabs, hollow cores and their outlet placed in the floor slabs, will be easy to reach.

[0004] A major problem today is that known reinforcing band devices cover the section of a building, that is the area where the ends of the floor slabs are placed between two on each other standing wall elements. This means that no service lines can be placed in the floor slabs being accessible from outside the building, since the band will cover the outlets. If there is a wish to place service lines in the floor slabs, accessible from the outside the building, the building worker must bore holes in the band for reaching the hollow cores. This will cause high costs and a complexity even during the service work and also a poorer strength of the building.

[0005] There is a need for wall elements comprising means for reinforcing and for holding a plurality of walls to each other. This wall elements can be load-bearing walls in a building with service lines, such as electric cables, water pipes, waste pipes an the like, extending into and out of rooms and enclosed areas in the building, which service lines further are placed in or adjacent exterior walls in a manner to be accessible from outside the building. The present invention is a result of a development work concerning the invention described in the EP 0 225 419 A1.

[0006] There is a need for a simple means for alignment of wall elements during the construction process.

[0007] There is also a need for a wall element with a reinforcing device, which is easy to mount and which is cost effective.

[0008] Further on, an intention of the inventor is to provide a wall element, which has an integrated multi-purpose reinforcing device. This will make the construction of a building more uncomplicated and therefore more flexible and cost effective.

SUMMARY OF THE INVENTION

[0009] This has been solved by an exterior concrete wall element as initially defined, which is characterized in that at least one elongated strengthening member is provided adjacent to said support surface, parallel to the

prolongation of said upper side, and which member comprises connection means for connecting said member to a similar elongated strengthening member provided at an adjoining wall element.

[0010] Hereby the wall elements can be reinforced within the area of the junction between the wall elements and the floor components. That is, the wall element can be fixed in a position in relation to an adjoining wall element, by that the member counteract eventual forces in the direction of the prolongation of the upper side. This will provide that a building with the wall elements according to the invention will resist the forces of an earthquake in a better way than common wall elements do.

[0011] Preferably, the elongated strengthening member extends with an essentially lesser height above the upper side than the height of at least one hollow core outlet discharging at the transverse outer end for making said outlet accessible from outside a building comprising said wall element, which hollow core, for accommodation of electric cables, water pipes, waste pipes and the like, is provided in the floor component. In this way, wherein hollow cores provided in the floor components according to known technique and wherein the wall elements not are covering the transverse outer ends of the floor components, the hollow cores can be accessible from outside the building, and the building is more resistant to earth quakes etc.

[0012] Suitably, the elongated strengthening member is mounted to said wall element, wherein the width and the length of the support surface are determined by respectively the member and the intersection line between the support surface and the plane of the back side. Hereby the floor component can be mounted to the upper side of the wall elements in an easy way, since the support surface is physical already before the floor component will be placed thereto. This will make the assembly work more cost effective. Furthermore, the strengthening member will prevent the wall elements and the floor components to move in a direction transverse to the prolongation of the member in a plane parallel to the floor components.

[0013] Suitably, a gusset plate respectively is mounted at each corner of the wall element each gusset plate having a first flange essentially in the same plane as the plane of the upper and lower side and a second flange recessed in the front side, wherein the elongated strengthening member is mountable to the first flanges. Hereby the elongated strengthening member can be mounted to the upper side of the wall element. The second flange is provided for a plate connectable to another wall element.

[0014] Preferably, the elongated strengthening member is made of a hollow square steel tube. In this way the area, on which weld joints and reinforcing bars etc. are placed, will be larger than what a homogeneous steel bar would provide with the same strength. Of course, the cross-section of the strengthening member can be rectangular as well.

[0015] Suitably, an elongated junction bar is mountable to the elongated strengthening member constituting its connection means. Hereby respectively each strengthening member of each wall element can be connected to each other and the members can together constitute a strip around a building.

[0016] Suitably, a reinforcing strip is connectable to said elongated junction bar, which strip extends to an other exterior concrete wall element placed at the opposite side of a building and between two elongated concrete floor components. Hereby the wall elements according to the invention are in a fixed position, standing in an opposite position of a building in a direction corresponding to the prolongation of the floor component.

[0017] Preferably, plates are mountable to the second flanges of the wall element for making a junction between the wall element and second flanges of adjoining wall elements. Hereby the storeys of a multi-storied building with hollow cores accommodating hollow cores, accessible from outside the building, can be reinforced. That is, the area within the lower side of a wall element can be fixed towards the strengthening member of the wall element standing adjoining below this element. At the same time, corners of other adjoining wall elements of the same type can be connected to the strengthening member. Also, the joint between the strengthening member and the first flange will according to the invention by means of the plate be additionally more rigid. The outer side of the plate will, since the second flange is recessed in the front side of the wall element, have the same plane as the front side. This will simplify the assembling work with panels covering the building sides.

[0018] Suitably, the wall elements constitute exterior walls in a multi-storied building, wherein the elongated strengthening members are mounted to the wall element. In such way a building owns a flexibility in mounting and a cost effective status concerning the assembly work. This multi-storied building has also an integrated reinforcing device, which makes a building according to the invention resistant to earth quakes etc.

[0019] Preferably, the elongated strengthening members is mounted to the gusset plates, the reinforcing bar and the elongated junction bar by means of welding. Hereby a strong junction is provided between the members, plates and bars and which art of connection provides a flexibility in the assembly work.

[0020] Preferably, at least one reinforcing bar is connectable to the elongated strengthening member and to the hollow core outlet for making a junction between said wall element and said floor component. This will prevent the wall element to move in a direction into the building comprising the wall elements according to the invention.

[0021] The exterior concrete wall element according to the invention, is adapted to be a building element in a multi-purpose system, wherein a continuous reinforcing strip is provided by means of the plurality of the elongated strengthening members connected to each other and placed in a building according to the invention.

DRAWING SUMMARY

[0022] The invention will now be described schematically with reference to the accompanying drawings, in which

Fig. 1a-1b schematically illustrates in perspective a building with wall elements according to prior art,

Fig. 2 schematically illustrates in perspective a section of a junction between a wall element according to the invention and a floor component,

Fig. 3 schematically illustrates a wall element according to the invention in a front view from outside, and

Fig. 4a-4b schematically illustrate respectively cross-sectional views taken along lines A-A and B-B in fig. 3.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Fig. 1a shows schematically a building 1. Wall components 3, known in prior art, and floor slabs, also in this application called elongated floor components 5, are according to known technique used for the building 1. The building 1 has hollow cores 7 accessible from the outside of the building 1. Of course, panel elements (not shown) can be mounted onto the wall components 3 of the building 1. The hollow cores 7 provide that each flat, office or the like can be supplied individually with electricity, cold water etc, which enables each flat to be responsible for its own heating, electricity and ventilation etc.

[0024] Fig. 1b shows the building 1 with strips 9 around it. This reinforcing device is common for buildings built in earthquake areas. But the strips 9 are covering the hollow cores 7 and there is a problem for service personal to carry out their service work. They have to bore holes (not shown) through the strips 9 to reach the hollow cores 7. This is expensive and weakens the reinforcement.

[0025] Fig. 2 shows schematically in perspective a section of a junction between four exterior concrete wall elements 11 according to the invention and two floor components 5. The exterior concrete wall element 11 comprises a first and a second vertical side 13, 14. It further comprises a front and a back side 15, 16 and an upper side 17 and a lower side 18. The upper and lower sides 17, 18 have each a support surface 20 for supporting the elongated concrete floor component 5 at its outer ends 19. The floor component 5 comprises hollow cores 7 according to known technique. The hollow cores 7 extend through the floor component 5.

[0026] The hollow cores 7 accommodate electric cables 21, water pipes, waste pipes and the like. Outlets 23 discharge at the outer end of the floor component 5

and inlets 24 are provided inside the building. The electric cable 21 is accessible from the outside of the building by means of the invention. Since an elongated strengthening member 25 is provided adjacent, to the support surface 20, parallel to the prolongation of the upper side 17, (that is on the upper side 17 of the wall element 11) and this member 25 is connected via a connection means 26 (such as an elongated junction bar 27, see also fig. 3) to a similar elongated strengthening member 25', the wall elements can not be moved from each other sideways. The fastening of the member 25 at the wall element 11 will be described more closely further on with reference to the fig. 3 and 4a-4b.

[0027] Fig. 3 illustrates the exterior concrete wall element 11 in a front view. The elongated strengthening member 25 extends with an essentially lesser height h above the upper side 17 than the height H of the hollow core outlet 23. The hollow cores 7 accommodate electrical cables 21. The member 25 is mounted to the wall element 11 in a way to define or determine a support surface 20 (see fig. 2) at the upper side 17. The length of this support surface 20 corresponds to the length of the wall element 11 and the width of the support surface 20 corresponds to the distance between the intersection line between the support surface 20 and a plane of said backside 16.

[0028] An L-formed reinforcing bar 29 is connected by means of welding to the strengthening member 25 and to one of the hollow cores 7 of the floor component 5. This hollow core 7 is plugged with a plug 31 (see fig. 4a) and refilled with concrete filler 33. A hair pin formed bar 35 connected to a holding loop 36 of the above placed wall is also moulded into this plugged hollow core 7 for reinforcement. Further on, extending from the upper side 17 of the wall element 11 is a lifting loop 37 moulded into the same plugged line 23. This provides a junction between the wall element 11 and the floor component 5. The lifting loop 37 is though provided for lifting the wall element and for reinforcing the junction between floor component 5 and the wall element 11.

[0029] A gusset plate 39 is mounted respectively at each corner of the wall element 11, each gusset plate 39 having a first flange 41 and a second flange 43. The first flange 41 is arranged in the same plane as the upper side 17. In this way the elongated strengthening member 25, made of a hollow square steel tube, bears on the upper side 17 when welded to the first flanges 41. The second flange is arranged in a recess 49 of the front side 15 (this is clearly shown in fig. 4b) so that a plate 45, which will be described further on with reference to fig. 4b, will have its outer side in line with the front side 15. To the left in fig. 3 the plate 45 is mounted. To the right in fig. 3 a further plate has not yet been mounted. The plate is mounted by means of welding to the second flanges 43 of the wall elements 11, 11'.

[0030] An elongated junction bar 27 is mounted by means of welding to the top side of the strengthening member 25 arranged at the upper side 17. The junction

bar 27 further is welded to the strengthening member 25' of the adjoining wall element 11'. In this way a connection means 26 between two wall elements 11, 11' is provided.

[0031] Between the lower side 18 of an above standing wall element 11 and the floor component 5 are neoprene plates 55 placed for making a distance between the wall element 11 and the floor component 5 and for decreasing the impact sound. Sealing compound 56 (see fig. 4) is filled in the space between the lower sides 18 of the wall elements 11 and the floor components 5. Joints between the wall elements 11 and 11' have the reference 47.

[0032] A reinforcing strip 29' is connectable to said elongated junction bar 27, which strip 29' extends to an other exterior concrete wall element (not shown) placed at the opposite side of a building (not shown) and between two elongated concrete floor components 5, 5'. The ends of the reinforcing strip 29' is welded to the junction bar 27 of respectively wall opposite wall element 11. This means that a fixture has been provided also in the direction of the floor components 5. As seen in the fig. 3 the strip 29' is placed between the floor components

[0033] In fig. 4a, which shows a cross-sectional view along line A-A in fig. 3, is illustrated how the strengthening member 25, in this embodiment a hollow square steel tube, is connected to the floor component 5 by means of the L-formed reinforcing bar 29 made of steel. One part of the bar 29 is projecting into the outlet 23 of one of the hollow cores 7. A plug 31 is mounted in the hollow core 7 and a section of an upper side of the floor component 5 is removed for moulding the filler 33 into the space formed by the outlet 23. The hair pin bar 35 and the lifting loop 37 is also projecting into the hollow core 7 surrounded by the filler 33. The holding loop 36 as well as the lifting loop 37 are moulded into the wall element 11 during the production of the wall element 11.

[0034] Fig. 4b illustrates a cross-section along line B-B in fig. 3. The gusset plates 39 are mounted in the recess 49 of the front side 15. The gusset plates 39 are fastened to the wall elements 11, 11' by means of into the wall element 11 extending pins 51 and the fastening can be done during the manufacturing of the wall element 11. Weld joints 52 are also illustrated in the figures 4a and 4b. The recess 49 permits the plate 45 (not shown in fig. 4b, but in fig. 3) to have its outer side in line with the front side 15 of the wall element 11. This will simplify the mounting of a panel (not shown) outside the building, since an even surface thus is achieved. The electric cable 21 or the like is supported by means of a support 53. The element gusset plate may in this application be called welding plate as well.

[0035] Vertical bars 100 are moulded in the wall element 11 and are connectable by means of welding to a similar wall element standing above the element 11 via the gusset plate 39. In this way a cross-like connection is provided near the corners of each wall element 11 and strengthening members are though provided in a build-

ing also in a vertical direction.

[0036] Other embodiments, such as wherein the elongated strengthening member 25 is mounted at the lower side 18 of the wall element 11 or at both sides are possible embodiments wherein the member 25 could be a strip or a homogenous band.

[0037] The outlet 23 will be accessible from outside the building by means of the invention, and a flexibility according to the purpose of the inventor of this invention is achieved. Since the wall elements 11 according to the invention may constitute exterior walls in a multi-storied building, which wall elements comprises the elongated strengthening members, the floor components according to known technique may be used. Of course may other floor components be used as well within the framework of the invention. Other ways of fastening the members, bars and elements than welding are also possible in the framework of this invention.

Claims

1. An exterior concrete wall element (11) comprising a first and a second vertical side surface (13, 14), a front and a back side (15, 16), an upper and a lower side (17, 18) each having a support surface (20) for supporting at least one elongated concrete floor component (5) at its transverse outer end (19), **characterized in that** at least one elongated strengthening member (25) is provided adjacent to said support surface (20), parallel to the prolongation of said upper side (17), and which member (25) comprises connection means (26) for connecting said member (25) to a similar elongated strengthening member (25') provided at an adjoining wall element (11').
2. A wall element (11) according to claim 1, **characterized in that** said elongated strengthening member (25) extends with an essentially lesser height (h) above said upper side (17) than the height (H) of at least one hollow core (7) with an outlet (23) discharging at said transverse outer end (19) for making said outlet (23) accessible from outside a building comprising said wall element (11), which hollow core (7), for accommodation of electric cables (21), water pipes, waste pipes and the like, is provided in said floor component (5).
3. A wall element (11) according to claim 1 or 2, **characterized in that** said elongated strengthening member (25) is mounted to said wall element (11), wherein the width and the length of said support surface (20) are determined by respectively said member (25) and the intersection line between said support surface (20) and the plane of said back side (16).
4. A wall element (11) according to any one of the preceding claims, **characterized in that** a gusset plate (39) respectively is mounted at each corner of said wall element (11), each gusset plate (39) having a first flange (41) essentially in the same plane as the plane of said upper and lower side (17, 18) and a second flange (43) recessed in said front side (15), wherein said elongated strengthening member (25) is mountable to said first flanges (41).
5. A wall element (11) according to any one of the preceding claims, **characterized in that** said elongated strengthening member (25) is made of a hollow square steel tube.
6. A wall element (11) according to any one of the preceding claims, **characterized in that** an elongated junction bar (27) is mountable to said elongated strengthening member (25) constituting its connections means (26).
7. A wall element (11) according to any one of the preceding claims, **characterized in that** a reinforcing strip (29') is connectable to said elongated junction bar (27), which strip (29') extends to an other exterior concrete wall element placed at the opposite side of a building and between two elongated concrete floor components (5).
8. A wall element (11) according to any one of the preceding claims, **characterized in that** plates (45) are mountable to said second flanges (43) of said wall element (11) for making a junction between said wall element (11) and second flanges (43) of adjoining wall elements (11').
9. A wall element (11) according to claims 1-3, **characterized in that** at least one reinforcing bar (29) is connectable to the elongated strengthening member (25) and to said hollow core outlet (23) for making a junction between said wall element (11) and said floor component (5).
10. A wall element (11) according to any one of the preceding claims, **characterized in that** said wall elements (11) constitute exterior walls in a multi-storied building, wherein said elongated strengthening members (25) are mounted to said wall element.
11. A wall element (11) according to any one of the preceding claims, **characterized in that** said elongated strengthening members (25) is mounted to said gusset plates (39), said reinforcing bar (29) and said elongated junction bar (27) by means of welding.

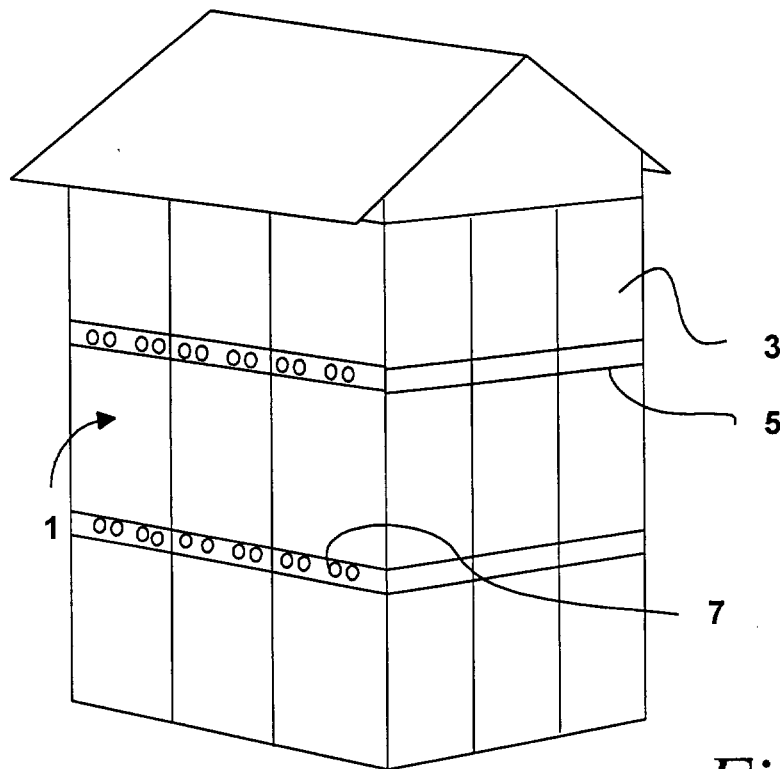


Fig. 1a

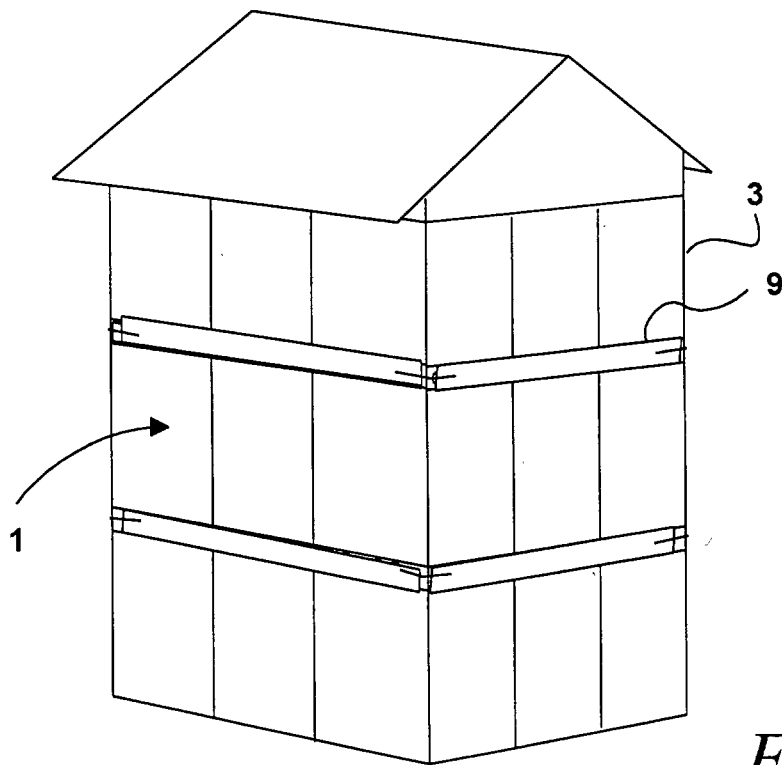


Fig. 1b

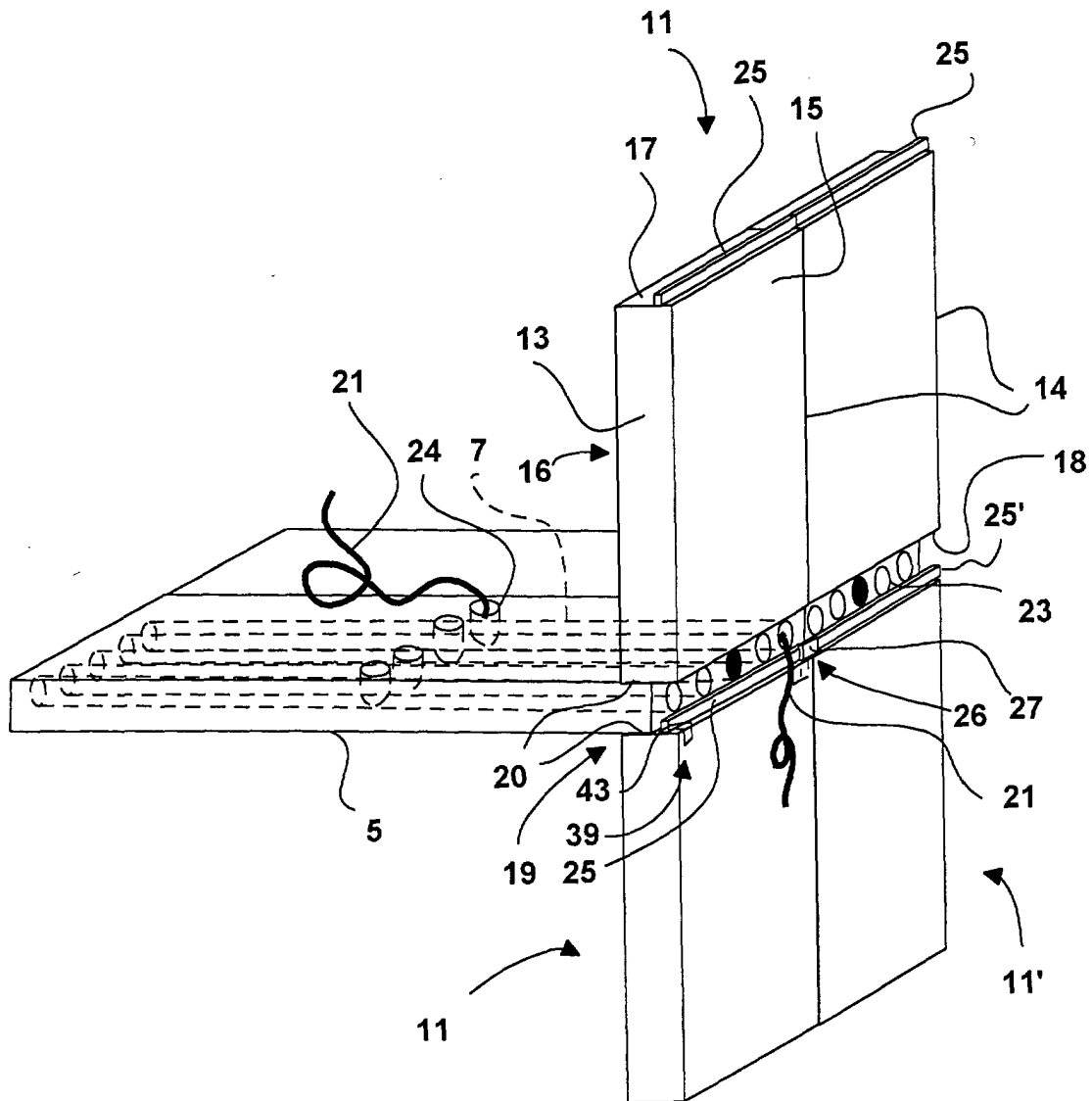
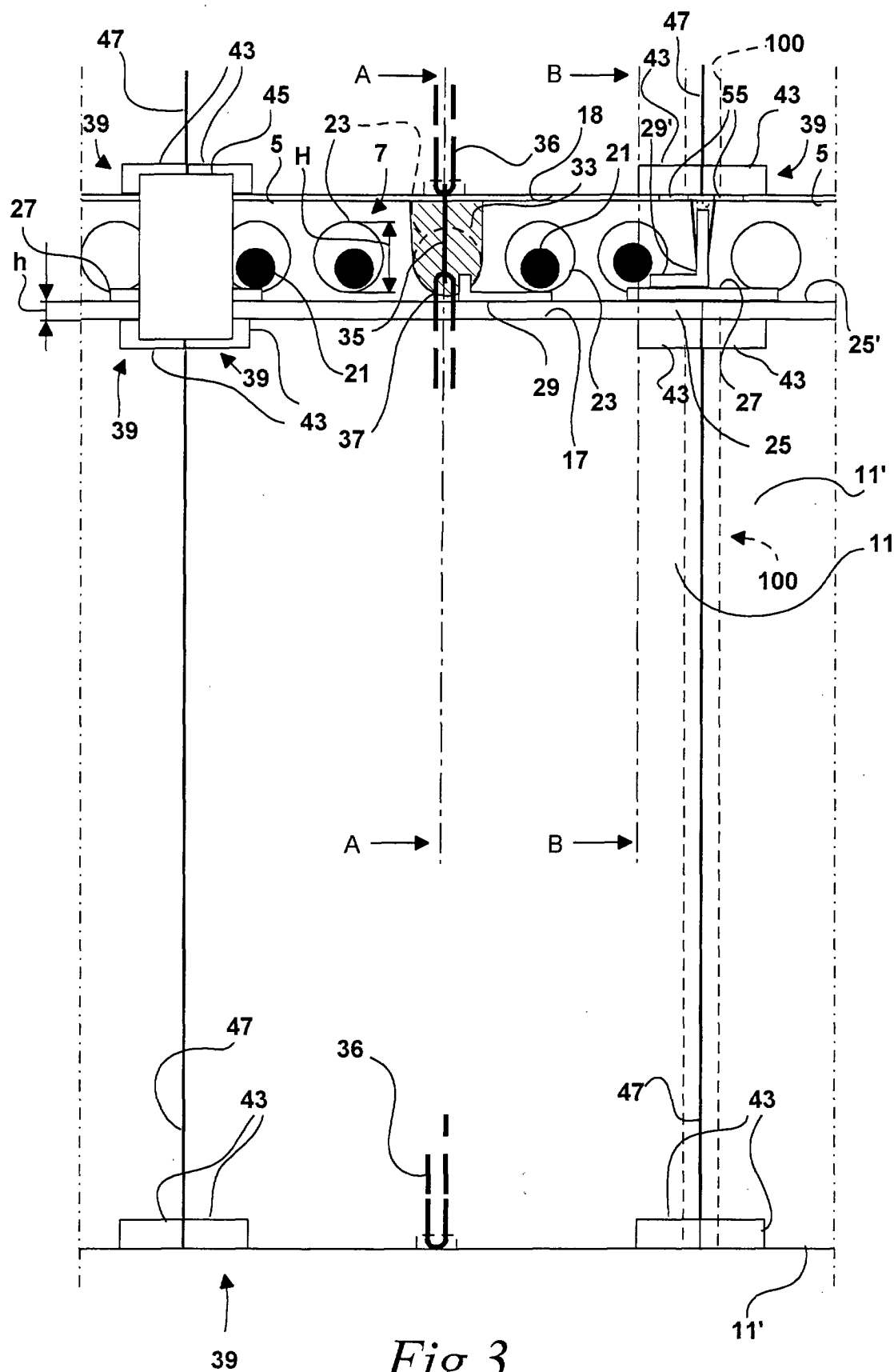


Fig. 2



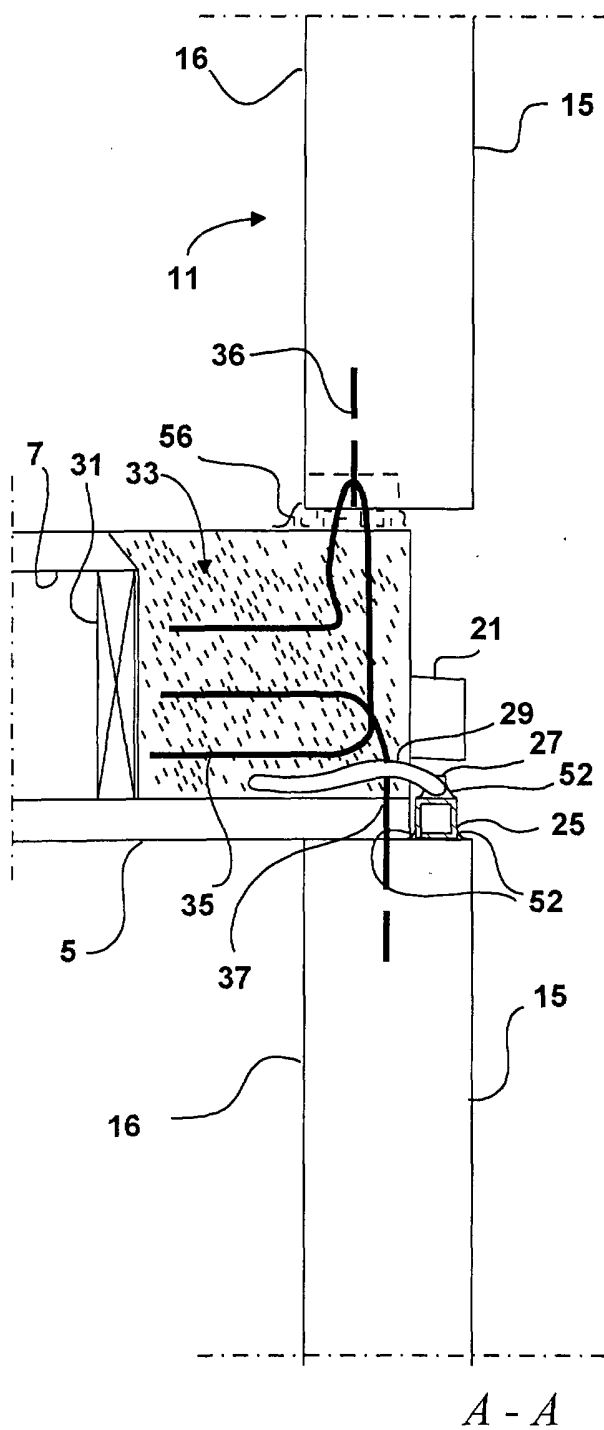


Fig. 4a

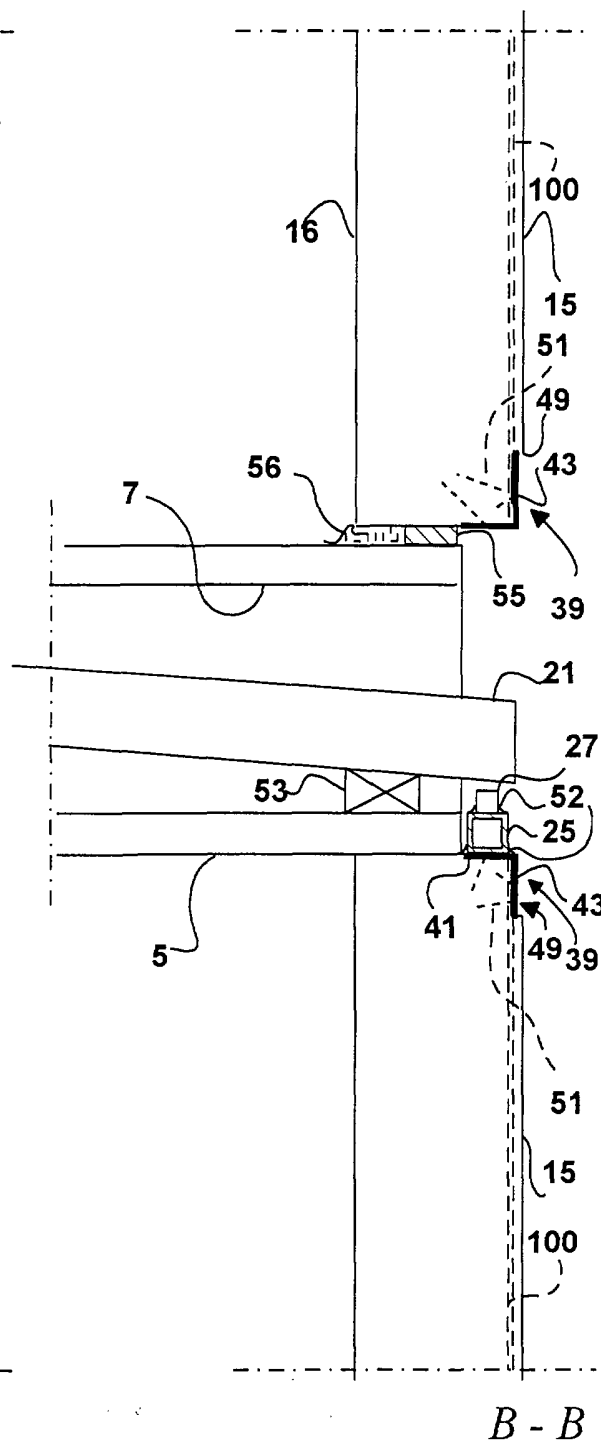


Fig. 4b



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EUROPEAN SEARCH REPORT

Application Number
EP 00 85 0128

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 3 330 084 A (G. RUSSELL) 11 July 1967 (1967-07-11) * column 3, line 22 - line 42 * * column 3, line 63 - column 4, line 27; figures 3,5 * ----	1	E04B1/04
A	US 3 736 709 A (KOCH C ET AL) 5 June 1973 (1973-06-05) * figures 2,5 * ----	1,2	
A	DE 21 58 475 A (STETTER BAUMASCHF GEORG) 30 May 1973 (1973-05-30) * page 17; figures 11-13,17-20 * ----	2	
A	US 2 883 852 A (H. MIDBY) 28 April 1959 (1959-04-28) * the whole document * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 7 December 2000	Examiner Kriekoukis, S
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 85 0128

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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US 3736709	A	05-06-1973	NONE	
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