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(54) Method for making a wall element including a conduit, a vertical mold and a wall element

(57) The object of the invention is a method for making a wall element including a conduit section (10) using a vertical mold, which consists of casting space limiting walls. Onto bottom part (5) of the space limited by a front wall (1), end walls (3,4) and the bottom part (5) are placed elements for positioning conduits (11) in the conduit section (10), and at least one conduit (11) in conduit section (10) is placed into position. At least one movable fill mold (6) is placed into the void between the casting area of the face of wall part (9) and at least one side wall of the conduit section (10). A movable back wall (2) is installed against the conduit section (10) and the mounted fill mold (6) or molds (6), and the front wall (1) and the back wall (2) are locked to each other. The upper parts of conduit section (10) conduits (11) are locked into place, and the casting of the wall element is carried out.

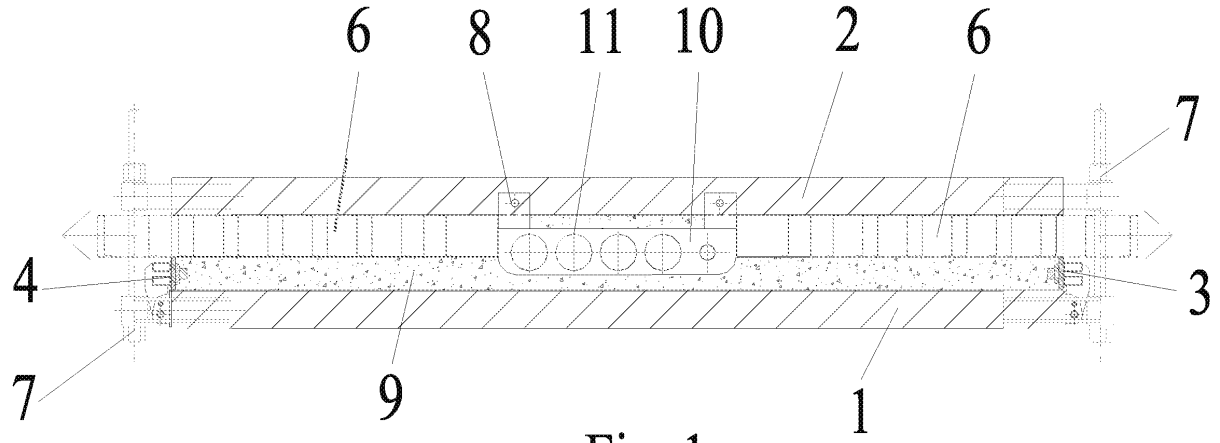

Fig. 1

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Description

[0001] The invention relates to the field of prefabricated concrete building elements. Particularly, the invention relates to a method of making a wall element including a conduit, to a vertical mold used in the fabrication process and to the wall element itself.

[0002] Conduits of contemporary apartment buildings are quite often made of concrete elements. In one solution this is done by casting large conduits with one hollow. Inside this hollow, required electric cables, water pipes, air condition ducts, sanitation pipes and other necessary plumbing and cables are installed. In this case, all of the pipes must be separately insulated against fire and noise. In addition, this kind of prior art conduit element requires fire insulation breaks to be cast at the distinct floor levels, whereby the space between pipes is sealed by concrete cast.

[0003] One example of element is the Elpo type conduit design made by Elpotek Oy, in which separate hollows have been provided for each pipe type, like water, heat and sanitation pipes, air condition ducts as well as for electric and telecommunication cables, according to the dimensions of the each pipe type. In addition, for each element, branching is provided at desired levels and locations.

[0004] The problem with these known conduit elements is the large amount of seaming and casting on site, which slows down construction work due to the various stages and drying periods. Distinct locations for conduit elements need to be reserved in the buildings, whereby a significant amount of building area and volume is consumed.

[0005] According to the present invention a conduit element is formed as part of a prefabricated, supporting concrete wall element. Such a wall element including a conduit is produced using a vertical mold. With the aid of laterally movable fill molds it is easy to change the position and the width of the conduit section within the wall element.

[0006] Using this method, it is possible to design a conduit section as advantageously as possible as part of the wall element, and it is possible to minimize the volume of the conduit element. The solution according to the invention at least partly eliminates seaming and other joints required for prior art conduit elements in building walls, which accelerates and facilitates the building process. Further, a load-carrying structure according to the invention makes it possible to use the wall element and especially its conduit section for supporting deck slabs.

[0007] According to the invention, the wall element including a conduit is made using a vertical mold, which vertical mold consists of walls limiting the casting space. Onto a bottom part of the space limited by a front wall, end walls and the bottom part are placed elements for positioning conduits in the conduit section, and at least one conduit in conduit section is placed into position. At least one movable fill mold is placed into the void between the casting area of the wall part face and at least one side wall of the conduit section. A movable back wall is installed against the conduit section and the mounted fill mold or molds. The front wall and the back wall are locked to each other. The upper parts of the conduit section conduits are locked into place and the casting of the wall element is carried out.

[0008] The invention also comprises a vertical mold for producing a wall element including a conduit, which vertical mold comprises walls limiting a casting space. The vertical mold includes at least one fill mold, which is laterally movable.

[0009] In addition, the invention is directed to a wall element, which is a prefabricated concrete element and which wall element comprises a supporting wall part. The wall element comprises a fixed conduit section, inside which at least one conduit is formed, the thickness of said conduit section being larger than the thickness of the wall part of the wall element.

[0010] More specifically, the method according to the invention is characterized by what is stated in the characterizing part of claim 1, the vertical mold according to the invention is characterized by what is stated in the characterizing part of claim 7 and the wall element according to the invention is characterized by what is stated in the characterizing part of claim 11.

[0011] The invention and its details will be described in more detail in the following, with reference to the enclosed drawings, wherein

Fig. 1 shows one vertical mold and wall element according to the invention seen from above,
Fig. 2 shows one vertical mold and wall element according to the invention seen from the side,
Fig. 3 shows one vertical mold and wall element according to the invention seen from the end side,
Fig. 4A and 4B show a schematic view of a wall element according to the invention,
and
Fig. 5 is a schematic view of another wall element according to the invention in cross section view.

[0012] In Figure 1 is shown a vertical mold and inside it a wall element provided with a conduit. The vertical mold comprises front wall 1, back wall 2, end walls 3 and 4, bottom part 5 (Figure 2) and laterally movable fill mold 6. In addition, figure 1 shows locking element 7 and fastening members 8. The wall element comprises wall part 9 and conduit section 10, which includes at least one conduit 11. Conduit section 10 of the wall element can be formed as a supporting or a non-supporting structure, but wall part 9 is always formed as a supporting structure. According to the invention, the height of the wall element is substantially equivalent to the storey height of the building.

[0013] Figure 4A shows one wall element according to the invention in side view and figure 4B presents the same wall element in cross section view. The prefabri-

cated concrete wall element shown in figure 4A and 4B comprises supporting wall part 9, as well as conduit section 10 which is an integral part of the wall element.

[0014] Before front wall 1 is cast, end walls 3, 4 and bottom part 5 are positioned in the vertical mold. Into the space limited by these, in bottom part 5, are placed members determining the position of conduit section 10 conduits 11. These members prevent the lower ends of conduits 11 from shifting inside the vertical mold during casting. Preferably, the members are cores, which are mounted with the aid of a template panel to bottom part 5 by screwing, welding, magnetic attachment or any other method. At least one conduit section 10 conduit 11 is placed into position engaging the cores attached to bottom part 5 by threading through the template panel. Cores 11 are, for example, metal and/or plastic pipes and preferably they remain as part of the final wall element.

[0015] The thickness of the wall element conduit section 10 is larger than that of wall part 9, which is due to regulations applying to conduits 11 formed into conduit section 10, such as minimum diameters of air conditioning ducts and sanitation pipes, fire and noise insulation requirements for wall surfaces formed on conduits 11, as well as provisions relating to the carrying capacity of the wall. The thickness of conduit section 10 is preferably 350 mm and the thickness of wall part 9 is preferably 200 mm. In this case, conduit section 10 is 150 mm thicker than wall part 9, and consequently movable fill mold 6 is placed into the void between the casting area of the wall part face and at least one side wall of conduit section 10. Fill mold 6 acts as a counter mold to the casting area of the wall part face and the other edge of conduit section 10.

[0016] Movable back wall 2 is installed against the conduit section 10 and the mounted fill mold 6 or molds 6, acting as a counter mold for the cast of the conduit section 10 wall. Front wall 1 and back wall 2 are locked to each other using locking elements 7 at the corners. Locking element 7 is preferably designed as shown in figures 1-3, where perforated fasteners are attached to the corners of front wall 1 and back wall 2. A steel bolt is inserted through the aligning holes of the front wall 1 and back wall 2 fastening parts, and at the other end of the fastening part is screwed a nut that tightens and closes the mold interspace, defining its final position. Also other suitable locking methods may be used. The upper part of the conduit section 10 conduits 11 are locked into place to front wall 1 or back wall 2 of the vertical mold using fastening member 8. Preferably, fastening member 8 is a template panel.

[0017] It is possible to reduce the casting pressure of conduit 11 before casting by mounting a support inside or outside conduit 11, using for example a metal bar or pipe. The wall element is preferably cast by using self-compacting concrete. The extension of self-compacting concrete is for example 400-800 mm. The wall element can also be cast by using conventional, vibration-compacted concrete.

[0018] With the help of laterally movable fill molds 6, the width and the location of conduit section 10 can be changed according to the desired shape, size and number of wall element conduits 11. Conduit section 10 can be located abutting wall element end wall 3 or 4, whereby only one fill mold 6 is required. Alternatively, the thick part of wall element conduit section 10 can be formed to extend outside the level determined by both the wall surfaces of wall part 9, as shown in figure 5. Conduit section 10 can be freely formed to facilitate the effective design of the building interior.

[0019] During the production phase it is possible to form the required lead-throughs 12 and 13 to conduits 11 of wall element conduit section 10, through which the space limited by conduit 11 can be reached from the wall surface of wall element conduit section 10. These lead-throughs 12 and 13 can advantageously be made throughout the entire height of wall element conduit section 10, and because of the load-carrying structure of the wall element, for example toilet seats etc. can be mounted directly to the surface of wall element conduit section 10. In addition, when required it is possible to add control hatches as desired into conduit section 10 at the conduits 11, for example for checking pressurized water pipes.

[0020] As in the example of figure 4A, at the lower edge of a wall element conduit section 10 according to the invention, lead-throughs 13 are preferably formed at the bottom region of conduits 11, through which lead-throughs 13 it is convenient to carry out the necessary connections to attach stacked conduit section 10 conduits 11 to each other. With the aid of these lead-throughs 13, installation of the wall elements according to the invention is essentially faster and easier comparing to conventional solutions, and tight seals between stacked wall element conduits 11 can be ensured.

[0021] In the method according to the invention is used a laterally movable fill mold for making a wall element including a conduit, which mold allows variability of the location and the width of a conduit section. This speeds up production of different wall elements at the factory and reduces costs.

[0022] By the solution according to the invention, a wall element is provided which comprises a load-bearing wall part and a conduit section as one entity, and as a result there is no need for seaming at the construction site as with conventional wall elements. This enhances and facilitates construction and makes the wall structure tighter. Using the wall elements according to the invention, it is possible to select the distribution of seams as sparse as possible, increasing construction efficiency and the tightness of the wall structure. The wall elements according to the invention can be used in all building walls, like in partition walls or as an inner core of the outer wall.

[0023] In addition, the following advantages are achieved using the wall element according to the invention:

- In the solution according to the invention, a conduit puts no load on the intermediate floors of the building,

thus reducing the burden on these. Thus the intermediate floors can be made more economically.

- The number of items to be installed on site is reduced in comparison to the earlier conduit solutions, which will facilitate the building process.
- It is easier to locate HVAC in the building.

Claims

1. A method for making a wall element including a conduit section (10) using a vertical mold, which vertical mold consists of casting space limiting walls, **characterized in that**

- onto bottom part (5) of the space limited by a front wall (1), end walls (3,4) and the bottom part (5) are placed elements for positioning conduits (11) in the conduit section (10),
- at least one conduit (11) in the conduit section (10) is placed into position,
- at least one movable fill mold (6) is placed into the void between the casting area of the face of wall part (9) and at least one side wall of the conduit section (10) ,
- a movable back wall (2) is installed against the conduit section (10) and the mounted fill mold (6) or molds (6),
- the front wall (1) and the back wall (2) are locked to each other,
- the upper parts of conduit section (10) conduits (11) are locked into place, and
- the casting of the wall element is carried out.

2. A method according to claim 1, **characterized in that** the position and the width of conduit section (10) is variable with the aid of laterally movable fill molds (6).

3. A method according to claim 1 or 2, **characterized in that** the lower ends of conduits (11) in the conduit section (10) are locked into position to the bottom part (5) with the aid of cores.

4. A method according to any of the preceding claims, **characterized in that** the locking of front wall (1) and back wall (2) is carried out using locking members (7) at the corners.

5. A method according to any of the preceding claims, **characterized in, that** the upper ends of the conduits (11) in the conduit section (10) are locked into position to the vertical mold with the aid of a template panel.

6. A method according to any of the preceding claims, **characterized in, that** the wall element is cast using self-compacting concrete.

7. A vertical mold for making a wall element including a conduit section (10), which vertical mold comprises walls (1, 2, 3, 4) limiting the casting space, **characterized in that** the vertical mold comprises at least one fill mold (6) which is laterally movable.

8. A vertical mold according to claim 7, **characterized in** the provision, in the lower part of the vertical mold, for the mounting of elements determining the position of the lower ends of conduits (11) within conduit section (10).

9. A vertical mold according to claim 7 or 8, **characterized in that** a fastening member (8) determining the position of the upper ends of the conduits (11) within conduit section (10) is attached to the vertical mold.

10. A vertical mold according to any of the claims 7-9, **characterized in that** front wall (1) and back wall (2) locking members (7) are provided at the corners of the front wall (1) and the back wall (2).

11. A wall element, which wall element is a prefabricated concrete element and which wall element comprises a supporting wall part (9), **characterized in that** the wall element comprises an integrated conduit section (10), within which conduit section (10) at least one conduit (11) is formed, and the thickness of which conduit section (10) is larger than the thickness of the wall part (9) of the wall element.

12. A wall element according to claim 11, **characterized in that** also wall element conduit section (10) is a load-bearing structure.

13. A wall element according to claim 11 or 12, **characterized in that** at least one lead-through (12) has been formed into the wall element conduit section (10) from the wall surface to the space limited by the conduit (11).

14. A wall element according to any of the claims 11-13, **characterized in that** lead-throughs (13) have been formed in the wall element conduit section (10) at the bottom part of each conduit (11) from the wall surface to the area of the lower ends of the conduits (11).

15. A wall element according to any of the claims 11-14, **characterized in that** the wall element has been produced by casting into a vertical mold.

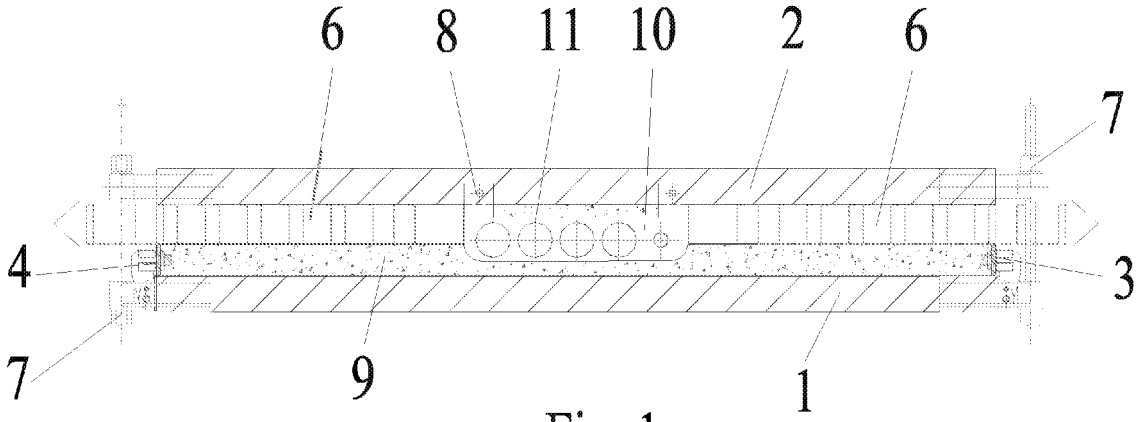

Fig. 1

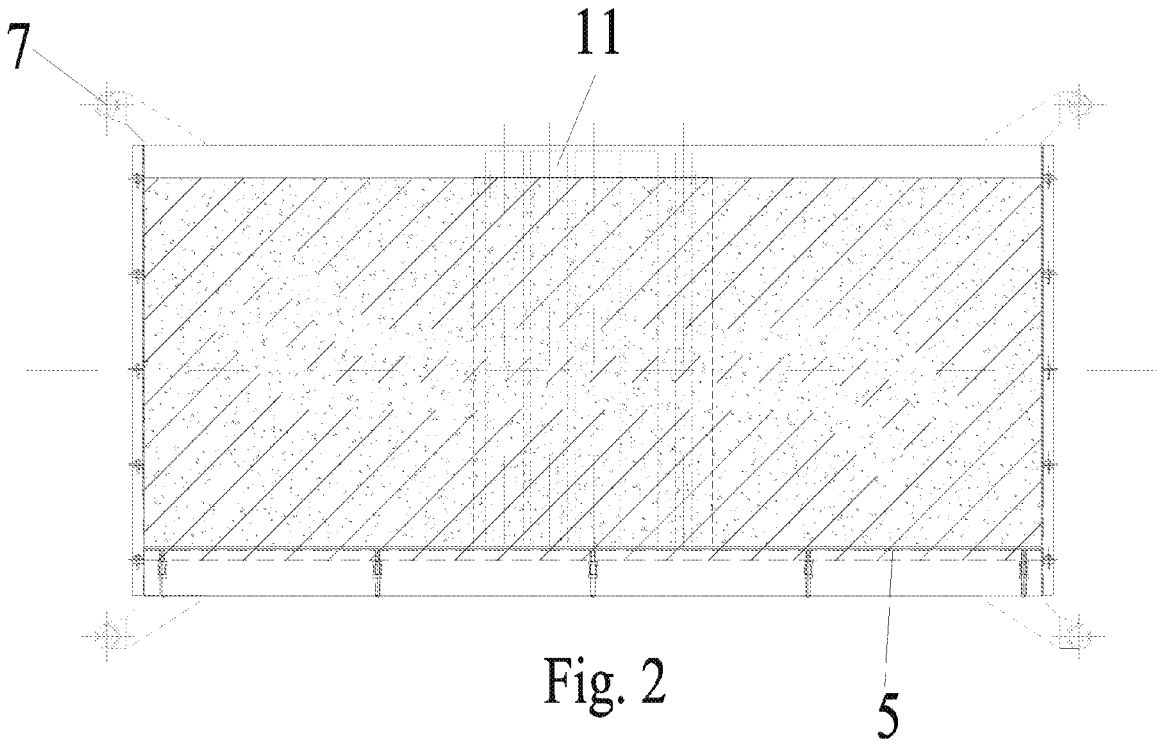

Fig. 2

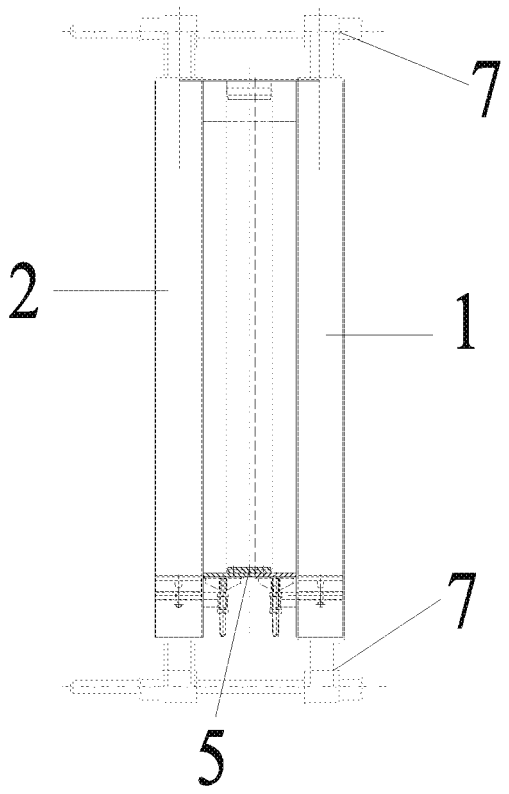

Fig. 3

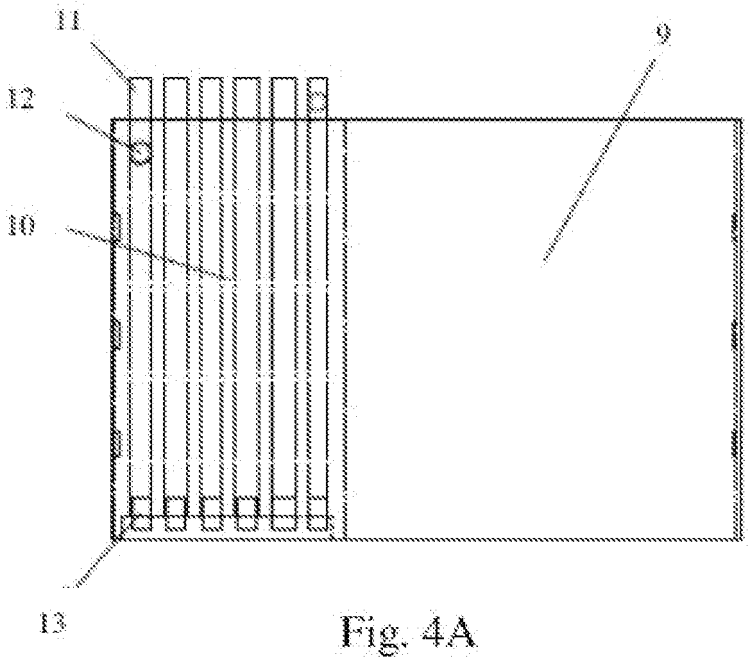

Fig. 4A

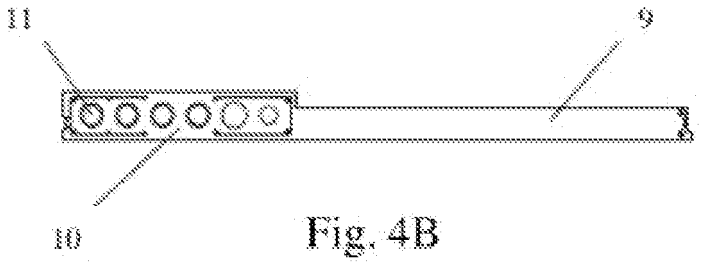

Fig. 4B

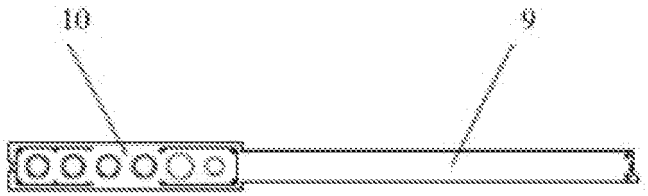

Fig. 5