(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 January 2016 (21.01.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/010488 A1

(51) **International Patent Classification**:
E04G 11/06 (2006.01) ***E04B 2/84*** (2006.01)
E04G 9/10 (2006.01)

(21) **International Application Number**:
PCT/TH2015/000044

(22) **International Filing Date**:
16 July 2015 (16.07.2015)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
1401004091 16 July 2014 (16.07.2014) TH

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) **Title**: A METHOD FOR CONSTRUCTING CAST-IN-PLACE WALLS WITH BINDER

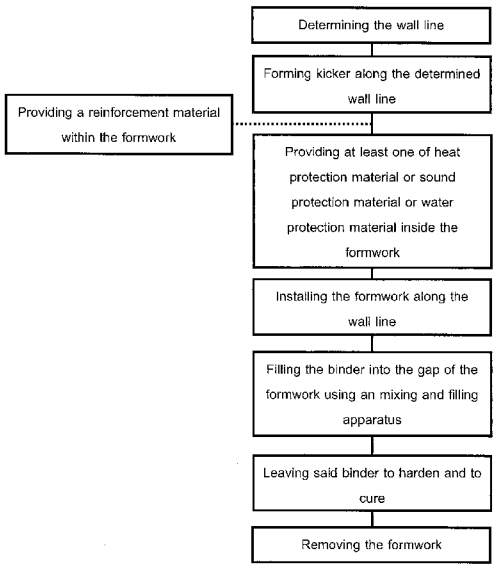

Fig. 1

(57) **Abstract**: The present invention relates to a cast-in-place wall construction method comprising the steps of: determining the wall line; forming kicker along the determined wall line; providing at least one of heat protection material or sound protection material or water protection material inside the formwork; installing the formwork along the wall line such that there is a gap between the two panels of the formwork or a gap between one panel of the formwork and a rigid body located on the opposite side of said panel; filling the binder into the gap of the formwork; leaving said binder to harden and to cure within the formwork; and removing the formwork. According to the invention, the filling of binder into the gap of the formwork is carried out by positioning an end of at least one binder filling tube above the slurry surface level at which the binder is to be filled, with at least one binder filling tube being moved vertically or horizontally or with at least one binder filling tube being moved both vertically and horizontally in a relative manner.

WO 2016/010488 A1

Published:

— *with international search report (Art. 21(3))*

A METHOD FOR CONSTRUCTING CAST-IN-PLACE WALLS WITH BINDER

Field of the Invention

The present invention is in the field of engineering related to a method for constructing cast-in-place walls with binder.

Background of the Invention

In the conventional wall construction method such as brick laying and plastering for building wall consists of several steps including preparing cement and sand, transporting cement and sand, mixing cement and sand in a tray, plastering and disposing of cement bags. The conventional method obviously involves too many steps, thus requires considerable time. The cement also causes dust pollution and extra space is required for storing the cement and sand. In case of high-rise building construction, cranes and elevators must be used for conveying building materials which complicates the construction process, leading to spending a larger amount of cost. Another wall construction method using precast wall panels also involves steps, such as, transporting the precast wall panels to the intended site and installing the precast walls. Similarly, in case of high-rise building construction, cranes and elevators must also be used for conveying the wall panels and other materials involved. This can be dangerous and thus requires experts to supervise the installation. The cast-in-place construction method is therefore invented to improve the efficiency of the construction work.

Following our research on the prior cast-in-place wall constructions, we found several prior arts disclosing both conventional wall construction methods and cast-in-place wall construction methods as follow.

A TH petty patent no. 5218 discloses a method for building wall panels by injecting lightweight concrete composition into the forms at the construction site. Said method comprises the steps of; installing the formwork with an opening for filling the composition and a hole for venting air; mixing; and injecting the composition through the opening for filling the composition; sealing the opening; leaving the composition to cure for 12 hours; and removing the formwork.

A published JP patent application no. JP 10-068226 discloses a cementitious material injection device and dispensing the cementitious material with the cementitious material injection device consisting of the following main components such as, a raw material storage tank, a material feeding tank, a material transferring device, mixing apparatus and injector. The cementitious material is transferred from the storage tank to the feeding tank and to the mixing apparatus by the transferring device. The cementitious material is mixed with water by the mixing apparatus and then injected via the injector. The cementitious material is automatically transferred to the mixing apparatus and the cementitious material is continuously injected. This publication describes various uses of the invention such as in ground reinforcement in tunnel excavation structure, in land adjustment in a residential construction project, in street surface adjustment, etc.

US patent no. US 5,882,540 discloses a wall construction method consisting of the steps of preparing a footing form to outline a horizontal dimension for the wall; pouring wall forming material between opposing sides of said footing form; allowing said poured wall forming material to set to provide a wall footing; attaching the first formwork to a side of the footing form to define the vertical dimension of the wall to be built; attaching the wall component structure to the inner surface of a first formwork at the desired location for said wall component on the wall; attaching a second formwork to an opposite side of the footing form at a predetermined distance from the first wall form according to a desired width of the wall; pouring wall forming material between the first and second wall forms to form a wall, said wall forming material being poured around said wall component structure; and allowing said wall forming material to set between the wall forms and around said wall component structure.

A published PCT application no. WO 2012/075071 A1 discloses a wall construction method involving the steps of; placing a concrete form having a cavity; placing a steel reinforcement within the cavity; pouring a mix of aggregate, sand, cement, fly ash, and mineral fibers into the cavity; and allowing the mix to cure.

Summary of the Invention

The present invention relates to a cast-in-place wall construction method comprising the steps of: determining the wall line; forming kicker along the determined wall line; providing at

least one of heat protection material or sound protection material or water protection material inside the formwork 1; installing the formwork 1 along the wall line such that there is a gap between the two panels of the formwork 1 or a gap between one panel of the formwork and a rigid body located on the opposite side of said panel; filling the mortar into the gap of the formwork 1; leaving said mortar to harden and to cure within the formwork; and removing the formwork 1 (as shown in Fig. 1). According to the invention, the filling of mortar into the gap of the formwork 1 is carried out by positioning an end of at least one mortar filling tube 2 above the slurry surface level at which the mortar is to be filled, with at least one mortar filling tube 2 being moved vertically or horizontally or with at least one mortar filling tube 2 being moved both vertically and horizontally in a relative manner.

The object of the present invention is to provide a method for constructing cast-in-place walls comprising the aforementioned steps which has the following advantages:

- This method reduces the steps involved in the construction of cast-in-place walls for low-rise and high-rise building.
- The resulting wall has a homogenous and seamless surface with no limitation in terms of area and dimension.
- The resulting wall has minimal porosity or air bubbles in the texture, resulting in a wall having the desired strength.
- This method allows the construction of walls having a complicated shape.
- The wall casting can be carried out without limitations in terms of length, height, and thickness of the wall to be built.
- This method saves costs in cement transporting because it does not require the step of transporting gravels and sand required in the conventional construction system.
- This method minimizes the risks of accidents during the construction.

Brief Description of the Drawings

Fig. 1 shows the block diagram of the steps of wall construction method according to the present invention.

Fig. 2 shows the filling of binder into the gap of the formwork by inserting an end of one binder filling tube from the top of the formwork such that the tube is vertically movable.

Fig. 3 shows the vertical movement by interval of a binder filling tube.

Fig. 4 shows the filling of binder into the gap of the formwork by inserting an end of at least two binder filling tubes from the top of the formwork such that the tube is vertically movable.

Fig. 5 shows the vertical movement by interval of at least two binder filling tubes.

Fig. 6 shows the filling of binder into the gap of the formwork by inserting an end of at least one binder filling tube from the top of the formwork such that the tube is vertically movable and said at least one binder filling tube provided at one lateral side or both lateral sides of the formwork.

Fig. 7 shows the vertical movement by interval of at least one binder filling tube and said at least one binder filling tube provided at one lateral side or both lateral sides of the formwork.

Fig. 8 shows the filling of binder into the gap of the formwork by positioning an end of the binder filling tubes above the slurry surface level at which the binder is to be filled with the binder filling tubes being moved both vertically and horizontally by interval, in a relative manner according to the present invention.

Fig. 9 shows the relative vertical and horizontal movement of the binder filling tube from one side of the formwork to the other side of the formwork in a continuous manner, by interval.

Fig. 10 shows the relative vertical and horizontal movement of the binder filling tube in a continuous manner, by interval, in alternation with the continuous horizontal movement.

Fig. 11 shows the horizontal movement by interval of binder filling tube from one side of the formwork to the other side of the formwork in alternation with the continuous vertical movement.

Fig. 12 shows at least one binder filling tube provided at the top of the formwork.

Fig. 13 shows at least one binder filling tube provided at one lateral side or both lateral sides of the formwork.

Fig. 14 shows at least one binder filling tube provided at the bottom of the formwork.

Fig. 15 shows at least one binder filling tube provided at the front of the formwork.

Fig. 16 shows at least one binder filling tube provided at the top of the formwork and at least one binder filling tube being provided at the front of the formwork.

Fig. 17 shows at least one binder filling tube provided at the top of the formwork and at least one binder filling tube provided at one lateral side or both lateral sides of the formwork.

Fig. 18 shows at least one binder filling tube provided at the bottom of the formwork and at least one binder filling tube being provided at one lateral side or both lateral sides of the formwork.

Fig. 19 shows at least one binder filling tube provided at the bottom of the formwork and at least one binder filling tube provided at the front of the formwork.

Fig. 20 shows at least one binder filling tube provided at the front of the formwork and at least one binder filling tube provided at one lateral side or both lateral sides of the formwork.

Detailed Description of the Invention

The present invention will now be described further in detail with reference to the attached drawings.

As shown in Fig. 1 showing a method for constructing cast-in-place walls according to the present invention, a method for constructing cast-in-place walls according to the present invention comprises the steps of: determining the wall line; forming kicker along the determined wall line; providing at least one of heat protection material or sound protection material or water protection material inside the formwork; installing the formwork 1 along the wall line such that there is a gap between the two panels of the formwork 1 or a gap between one panel of the formwork and a rigid body located on the opposite side of said panel; filling the binder into the gap of the formwork 1; leaving said binder to harden and to cure within the formwork 1; and removing the formwork 1, wherein the filling the binder into the gap of the formwork 1 is carried out be positioning an end of at least one binder filling tube 2 above the slurry surface level at which the binder is to be filled, with at least one binder filling tube 2 being moved vertically or horizontally or with at least one binder filling tube 2 being moved both vertically and horizontally in a relative manner.

According to the present invention, said rigid body located on the opposite side of said panel may be, for example, a wall of a building.

As shown in Fig. 2 - 7 filling the binder into the gap of the formwork 1 is carried out by inserting an end of one binder filling tube 2 from the top of the formwork 1 such that the tube is vertically movable; by inserting an end of at least two binder filling tubes 2 from the top of the formwork 1 such that the tube is vertically movable; or by inserting an end of at least one binder filling tube 2 from the top of the formwork 1 such that the tube is vertically movable and providing at least one binder filling tube 2 at one lateral side or both lateral sides of the formwork.

According to the present invention, the relative movement of at least one binder filling tube 2 in the vertical and horizontal directions (as shown in Fig. 8) may start from one side or one position of the formwork 1 to the other side or position of the formwork 1 in a continuous manner, by interval (as shown in Fig. 9), or the relative movement in the vertical and horizontal directions in alternation with the continuous horizontal movement starts from one side or one position of the formwork 1 to the other side or position of the formwork 1 (as shown in Fig. 10).

Furthermore, the movement of at least one binder filling tube 2 also includes the movement in the horizontal direction from one side or one position of the formwork 1 to the other side or position of the formwork 1, in a continuous manner, by interval, in alternation with the continuous movement in the vertical direction (as shown in Fig. 11).

According to the present invention, the filling of binder into the gap of the formwork 1 is carried out by positioning an end of the binder filling tube 2 above the slurry surface level at which the binder is to be filled, with at least one binder filling tube 2 being moved vertically or horizontally or with at least one binder filling tube 2 being moved both vertically and horizontally in a relative manner, by intervals, each being 30-300 cm, preferably, 30-120 cm, more preferably 30-50 cm in length.

Furthermore, a method for constructing cast-in-place walls further comprises horizontally arranging the binder filling tube 2 at 30-2000 cm apart, preferably at 30-1000 cm apart, more preferably at 30-200 cm apart.

This method is advantageous in that the resulting walls have a homogenous and seamless surface with minimal porosity in the texture, resulting in a wall having the desired strength.

As shown in Fig. 12 to 20, the filling of binder into the gap of the formwork 1 is carried out by filling the binder from at least one binder filling tube 2 provided at at least one of the sides of the formwork 1 (at the top, the lateral side, the bottom and/or the front).

Furthermore, filling the binder into the gap of the formwork 1 is also carried out by filling the binder from at least one binder filling tube 2 provided at the top of the formwork 1 by inserting the filling tube through the upper floor, which is advantageous in that the gap between the top edge of the wall and the upper floor is minimal.

According to the present invention, the inner surface of the formwork 1 is smooth or textured, which is advantageous in that the steps of finishing the wall surface can be excluded. The texture on the wall will be more durable than ones resulting from other conventional methods as it is integrated into the wall.

According to the present invention, the formwork 1 is of a flat shape, curved shape or geometric shape, which is advantageous in that it is possible to build walls of different shapes as a single piece, giving the walls higher strength than those of the same appearance which are built by other methods.

According to the present invention, the formwork 1 can be made from at least one material selected from metal, wood, plastic, cement fiber board, foam board or gypsum board, as appropriate.

According to the present invention, the heat protection material includes foam, sand, wood, asphalt, cement fiber board, or gypsum board. The sound protection material includes foam, sand, wood, corrugated paper, asphalt, water protection plastic sheet, cement fiber board or gypsum board. The water protection material includes foam, wood, fiber, asphalt, water protection plastic sheet, cement fiber board, natural rubber or foil. Said heat protection material or the sound protection material or the water protection material is provided at a position of the formwork 1 such as the heat protection material or the sound protection material or the water protection material is provided in the middle of the gap between the form work panels or closer to one of the panels of the formwork 1.

According to the present invention, a method for constructing cast-in-place walls further comprises a step of providing a reinforcement material within the formwork 1, wherein said

reinforcement material includes at least one of the following: wire mesh, plastic mesh, deformed bars or wooden reinforcement mesh.

According to the present invention, a method for constructing cast-in-place walls further comprises a step of managing the sanitation system, electricity system and cooling system before or during the step of installing the formwork 1.

According to the present invention, the step of forming kicker along the predetermined wall line is carried out simultaneously with the installation of sanitation system, electricity system and cooling system.

According to the present invention, the installation of the formwork 1 along the wall line further comprises a step of providing openings for windows, doors and/or skylights.

According to the present invention, the walls cast from said binder is seamless and thus does not require application of binder to seal the adjoining edges of the boards as in conventional systems.

According to the present invention, said binder is a cement-based material which includes concrete.

According to the present invention, said binder includes gypsum.

It should be appreciated that the practice of the method for constructing cast-in-place walls according to the present invention is not limited to the above-mentioned steps, apparatus and devices. Modifications and changes can be made to the method for constructing cast-in-place walls according to the present invention without departing from the scope and the spirit of the present invention.

Claims

1. A method for constructing cast-in-place walls comprising the steps of:

determining the wall line;

forming kicker along the determined wall line;

providing at least one of heat protection material or sound protection material or water protection material inside the formwork (1);

installing the formwork (1) along the wall line such that there is a gap between the two panels of the formwork (1) or a gap between one panel of the formwork and a rigid body located on the opposite side of said panel;

filling the binder into the gap of the formwork (1);

leaving said binder to harden and to cure within the formwork (1); and

removing the formwork (1),

characterized in that:

the filling of binder into the gap of the formwork (1) is carried out by positioning an end of at least one binder filling tube (2) above the slurry surface level at which the binder is to be filled, with at least one binder filling tube (2) being moved vertically or horizontally or with at least one binder filling tube (2) being moved both vertically and horizontally in a relative manner.

2. The method for constructing cast-in-place walls according to claim 1 wherein the filling of binder into the gap of the formwork (1) is carried out by inserting an end of one binder filling tube (2) from the top of the formwork (1) such that the tube is vertically movable.

3. The method for constructing cast-in-place walls according to claim 1 wherein the filling of binder into the gap of the formwork (1) is carried out by inserting an end of at least two binder filling tubes (2) from the top of the formwork (1) such that the tubes are vertically movable.

4. The method for constructing cast-in-place walls according to claim 1 wherein the filling of binder into the gap of the formwork (1) is carried out by inserting an end of at least one binder filling tube (2) from the top of the formwork (1) such that the tube is vertically movable and

providing at least one binder filling tube (2) at one of the lateral sides or both lateral sides of the formwork (1).

5. The method for constructing cast-in-place walls according to claim 1 wherein the filling of binder into the gap of the formwork (1) is carried out by inserting an end of at least one binder filling tube (2) from the top of the formwork (1) such that the tube is vertically and horizontally movable in a relative manner.

6. The method for constructing cast-in-place walls according to claim 1 or 5 wherein the relative vertical and horizontal movement of at least one binder filling tube (2) starts from one side of the formwork (1) to the other side of the formwork (1) by interval in a continuous manner.

7. The method for constructing cast-in-place walls according to claim 1 or 5 wherein the relative vertical and horizontal movement of at least one binder filling tube (2) starts from one position of the formwork (1) to the other position of the formwork (1) by interval in a continuous manner.

8. The method for constructing cast-in-place walls according to claim 1 or 5 wherein the relative vertical and horizontal movement of at least one binder filling tube (2) in alternation with the continuous horizontal movement starts from one side of the formwork (1) to the other side of the formwork (1).

9. The method for constructing cast-in-place walls according to claim 1 or 5 wherein the relative vertical and horizontal movement of at least one binder filling tube (2) in alternation with the continuous horizontal movement starts from one position of the formwork (1) to the other position of the formwork (1).

10. The method for constructing cast-in-place walls according to claim 1 or 5 wherein the movement of at least one binder filling tube (2) further includes the continuous horizontal movement by interval from one side of the formwork (1) to the other side of the formwork (1) in alternation with the continuous vertical movement.

11. The method for constructing cast-in-place walls according to claim 1 or 5 wherein the movement of at least one binder filling tube (2) further includes the continuous horizontal movement by interval from one position of the formwork (1) to the other position of the formwork (1) in alternation with the continuous vertical movement.

12. The method for constructing cast-in-place walls according to any one of claims 1 to 11 wherein the filling of binder into the gap of the formwork (1) is carried out by positioning an end of the binder filling tube (2) above the slurry surface level at which the binder is to be filled, with at least one binder filling tube (2) being moved vertically or horizontally or with at least one binder filling tube (2) being moved both vertically and horizontally in a relative manner, by interval, each being 30-300 cm.

13. The method for constructing cast-in-place walls according to claim 12 wherein the filling of binder into the gap of the formwork (1) is carried out by positioning the end of the binder filling tube (2) above the slurry surface level at which the binder is to be filled, with at least one binder filling tube (2) being moved vertically or horizontally or with at least one binder filling tube (2) being moved both vertically and horizontally in a relative manner, by interval, each preferably being 30-120 cm.

14. The method for constructing cast-in-place walls according to claim 13 wherein the filling of binder into the gap of the formwork (1) is carried out by positioning the end of the binder filling tube (2) above the slurry surface level at which the binder is to be filled, with at least one binder filling tube (2) being moved vertically or horizontally or with at least one binder filling tube (2) being moved both vertically and horizontally in a relative manner, by interval, each more preferably being 30-50 cm.

15. The method for constructing cast-in-place walls according to any one of claims 1 to 11 further comprising arranging the binder filling tubes (2), in the horizontal direction, at 30-2000 cm apart.

16. The method for constructing cast-in-place walls according to claim 15 wherein the arrangement of the binder filling tubes (2), in the horizontal direction, is preferably at 30-1000 cm apart.

17. The method for constructing cast-in-place walls according to claim 16 wherein arrangement of the binder filling tube (2), in the horizontal direction, is more preferably at 30-200 cm apart.

18. The method for constructing cast-in-place walls comprising the steps of:

determining the wall line;

forming kickers along the determined wall line;

providing at least one of heat protection material or sound protection material or water protection material inside the formwork (1);

installing the formwork (1) along the wall line such that there is a gap between the two panels of the formwork (1) or a gap between one panel of the formwork and a rigid body located on the opposite side of said panel;

filling the binder into the gap of the formwork (1);

leaving said binder to harden and to cure within the formwork (1); and

removing the formwork (1),

characterized in that:

the filling of binder into the gap of the formwork (1) is carried out by filling binder from at least one binder filling tube (2) stationarily provided at at least one side of the formwork (1).

19. The method for constructing cast-in-place walls according to claim 18 wherein the filling of binder into the gap of the formwork (1) is carried out by filling binder from at least one binder filling tube (2) provided at the top of the formwork (1).

20. The method for constructing cast-in-place walls according to claim 18 wherein the filling of binder into the gap of the formwork (1) is carried out by filling binder from at least one binder filling tube (2) provided at one of the lateral sides or both lateral sides of the formwork (1).

21. The method for constructing cast-in-place walls according to claim 18 wherein the filling of binder into the gap of the formwork (1) is carried out by filling binder from at least one binder filling tube (2) provided at the bottom of the formwork (1) .

22. The method for constructing cast-in-place walls according to claim 18 wherein the filling of binder into the gap of the formwork (1) is carried out by filling binder from at least one binder filling tube (2) provided at the front of the formwork (1).

23. The method for constructing cast-in-place walls according to claim 19 wherein the filling of binder into the gap of the formwork (1) is further carried out by filling binder from at least one binder filling tube (2) provided at the front of the formwork (1).

24. The method for constructing cast-in-place walls according to claim 19 wherein the filling of binder into the gap of the formwork (1) is further carried out by filling binder from at least one

binder filling tube (2) provided at one of the lateral sides or both lateral sides of the formwork (1).

25. The method for constructing cast-in-place walls according to claim 20 wherein the filling of binder into the gap of the formwork (1) is further carried out by filling binder from at least one binder filling tube (2) provided at the bottom of the formwork (1).

26. The method for constructing cast-in-place walls according to claim 21 wherein the filling of binder into the gap of the formwork (1) is further carried out by filling binder from at least one binder filling tube (2) provided at the front of the formwork (1).

27. The method for constructing cast-in-place walls according to claim 20 wherein the filling of binder into the gap of the formwork (1) is further carried out by filling binder from at least one binder filling tube (2) provided at the front of the formwork (1).

28. The method for constructing cast-in-place walls according to claim 18 wherein the filling of binder into the gap of the formwork (1) is carried out by filling binder from at least one binder filling tube (2) provided at the top of the formwork (1) by inserting the filling tube through the upper floor.

29. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the inner surface of the formwork (1) is smooth.

30. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the inner surface of the formwork (1) is textured.

31. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the formwork (1) has a flat shape.

32. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the formwork (1) has a curve shape.

33. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the formwork (1) has a geometric shape.

34. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the formwork (1) is made from at least one material selected from metal, wood, plastic, cement fiber board, foam board or gypsum board.

35. The method for constructing cast-in-place walls according to claim 1 or 18, wherein the heat protection material includes foam, sand, wood, asphalt, cement fiber board or gypsum board.

36. The method for constructing cast-in-place walls according to claim 1 or 18 wherein the sound protection material includes foam, sand, wood, corrugated paper, asphalt, water protection plastic sheet, cement fiber board or gypsum board.

37. The method for constructing cast-in-place walls according to claim 1 or 18 wherein the water protection material includes foam, wood, fiber, asphalt, water protection plastic sheet, cement fiber board, natural rubber or foil.

38. The method for constructing cast-in-place walls according to any one of claims 35 to 37 wherein at least one of the heat protection material or the sound protection material or the water protection material is provided at any position on the panel of the formwork (1).

39. The method for constructing cast-in-place walls according to claim 38 wherein at least one of the heat protection material or the sound protection material or the water protection material is provided in the middle of the gap between the form work panels or closer to any of the panels of the formwork (1).

40. The method for constructing cast-in-place walls according to claim 1 or 18 further comprising a step of providing a reinforcement material within the formwork (1).

41. The method for constructing cast-in-place walls according to claim 40 wherein the reinforcement material includes at least one of the following: wire mesh, plastic mesh, deformed bars or wooden reinforcement mesh.

42. The method for constructing cast-in-place walls according to claim 1 or 18 further comprising a step of providing the sanitation system, electricity system and cooling system before the step of installing the formwork (1).

43. The method for constructing cast-in-place walls according to claim 1 or 18 further comprising a step of providing the sanitation system, electricity system and cooling system during the step of installing the formwork (1).

44. The method for constructing cast-in-place walls according to claim 1 or 18 wherein the step of forming kicker along the determined wall line is carried out simultaneously with the provision of sanitation system, electricity system and cooling system.

45. The method for constructing cast-in-place walls according to claim 1 or 18 wherein the step of forming kicker along the determined wall line is carried out after the provision of sanitation system, electricity system and cooling system.

46. The method for constructing cast-in-place walls according to claim 1 or 18 wherein the installation of the formwork (1) along the wall line further comprises a step of providing openings for windows, doors and/or skylights.

47. The method for constructing cast-in-place walls according to one of the preceding claims, wherein the binder is a cement-based material or gypsum.

48. The method for constructing cast-in-place walls according to claim 47 wherein the cement-based material includes concrete.

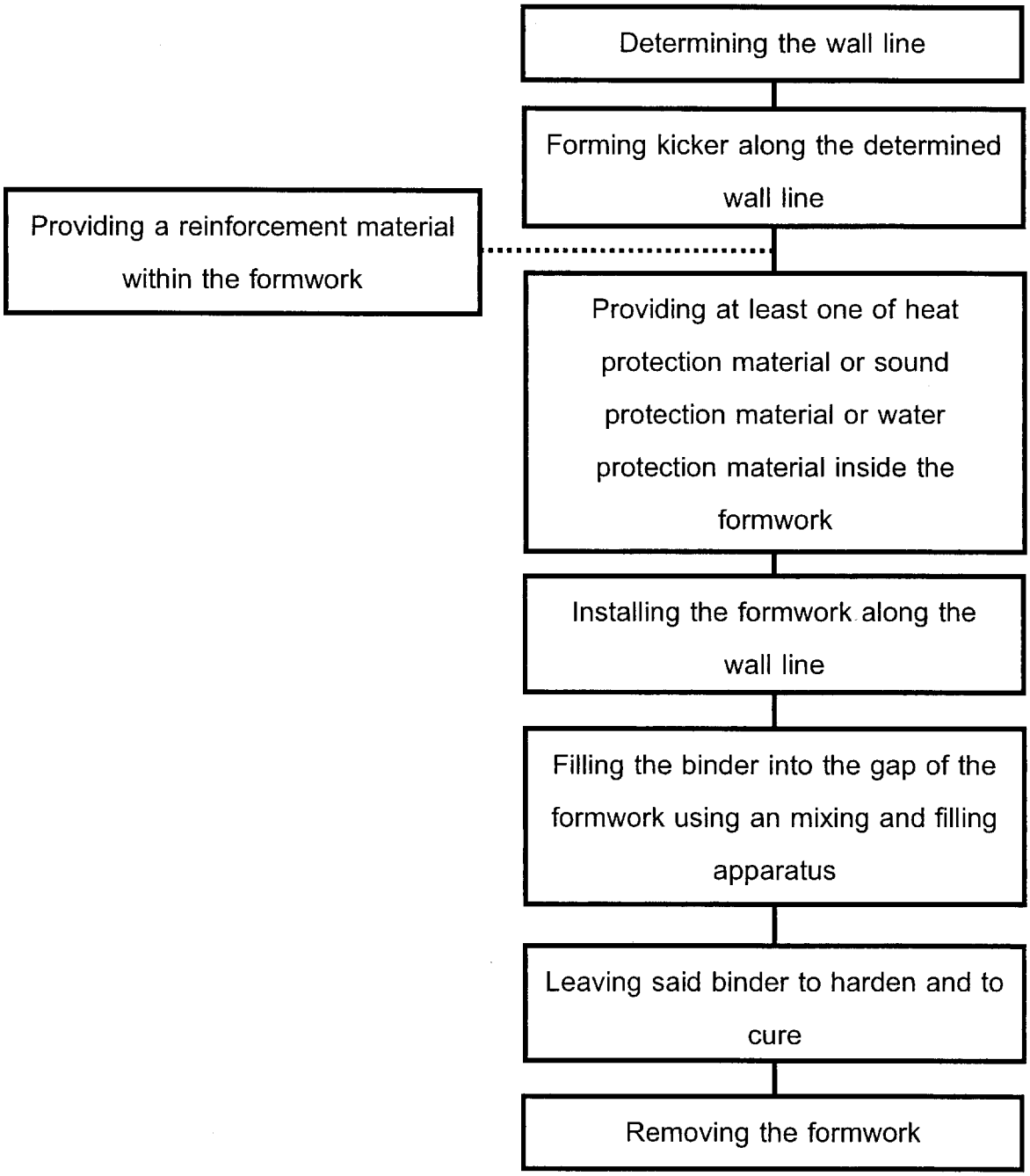
Determining the wall line
Forming kicker along the determined wall line
Providing a reinforcement material within the formwork
Providing at least one of heat protection material or sound protection material or water protection material inside the formwork
Installing the formwork along the wall line
Filling the binder into the gap of the formwork using an mixing and filling apparatus
Leaving said binder to harden and to cure
Removing the formwork

Fig. 1

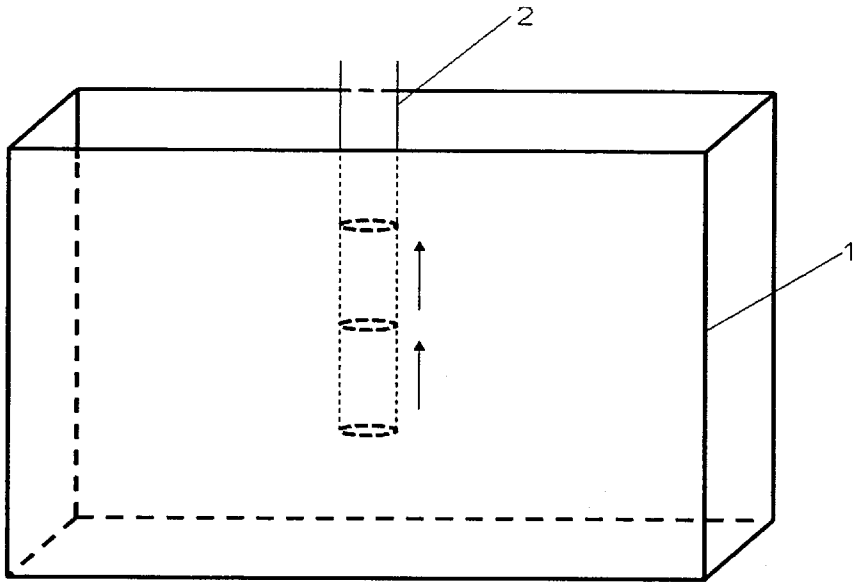

Fig. 2

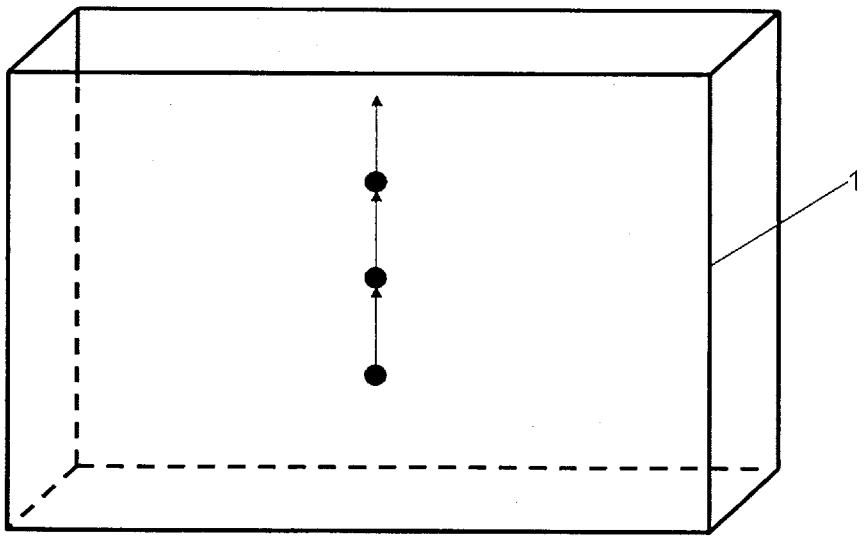

Fig. 3

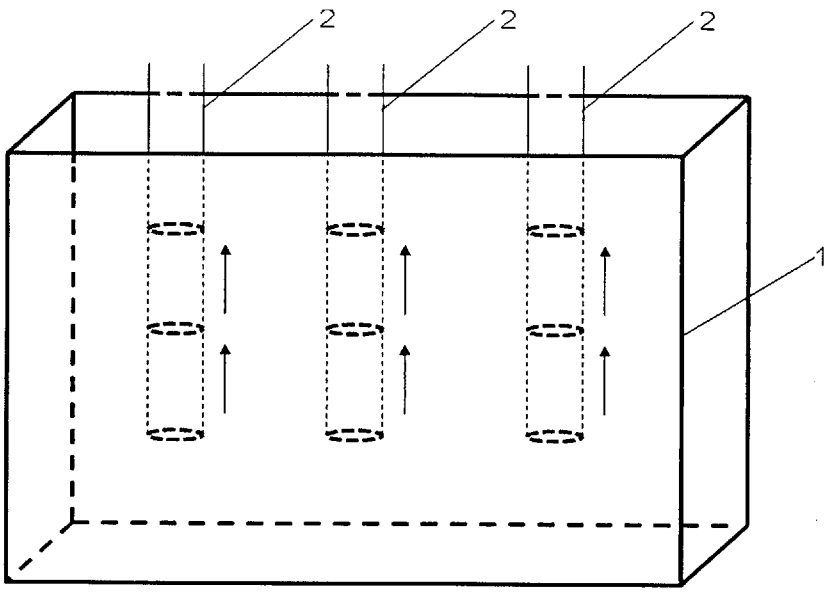

Fig. 4

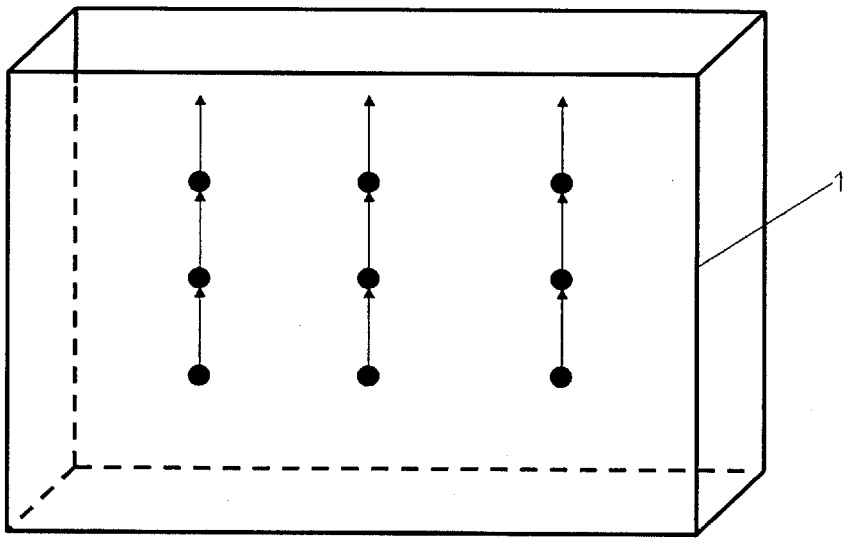

Fig. 5

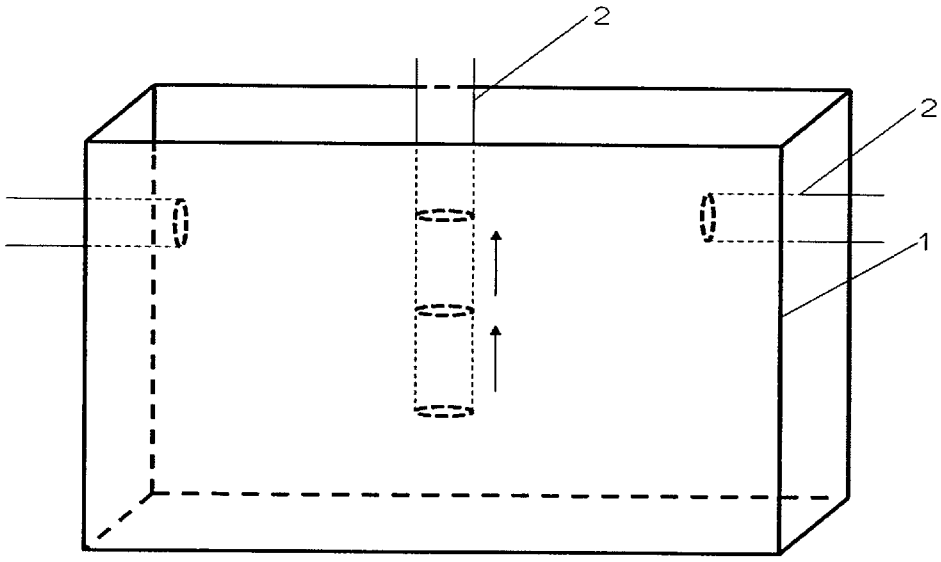

Fig. 6

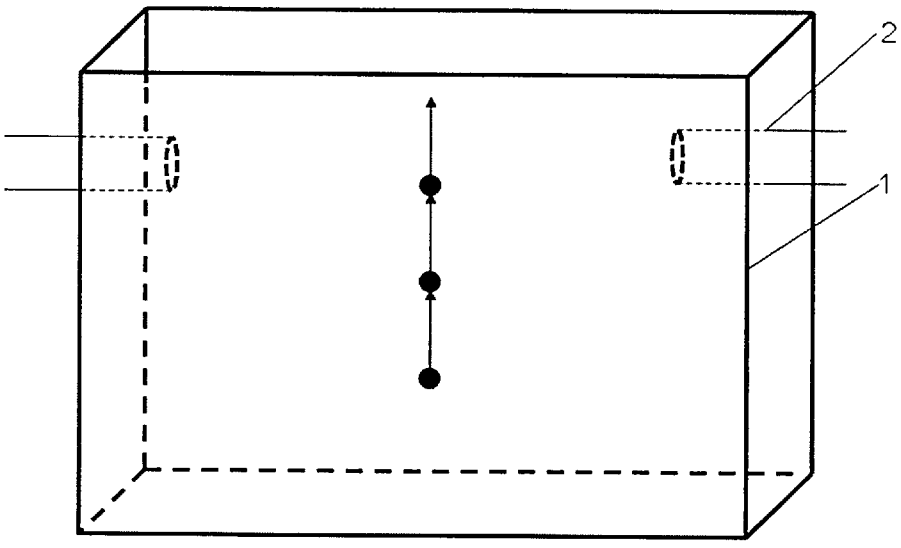

Fig. 7

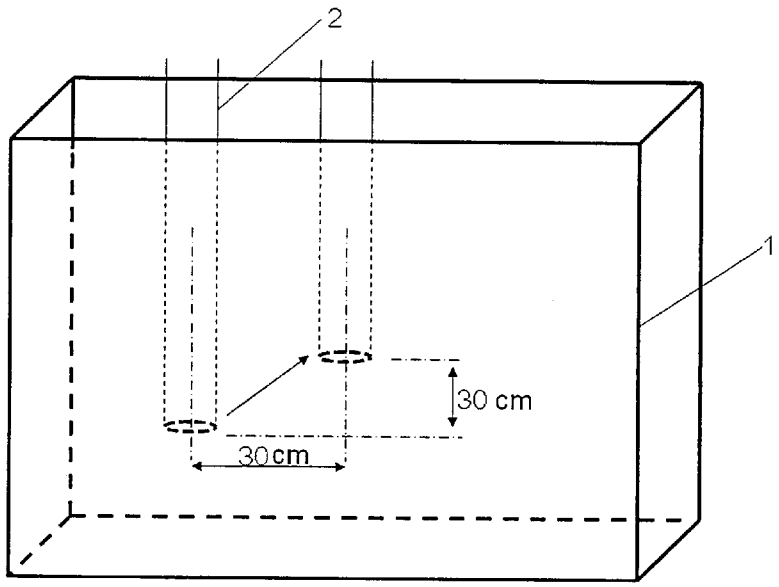

Fig. 8

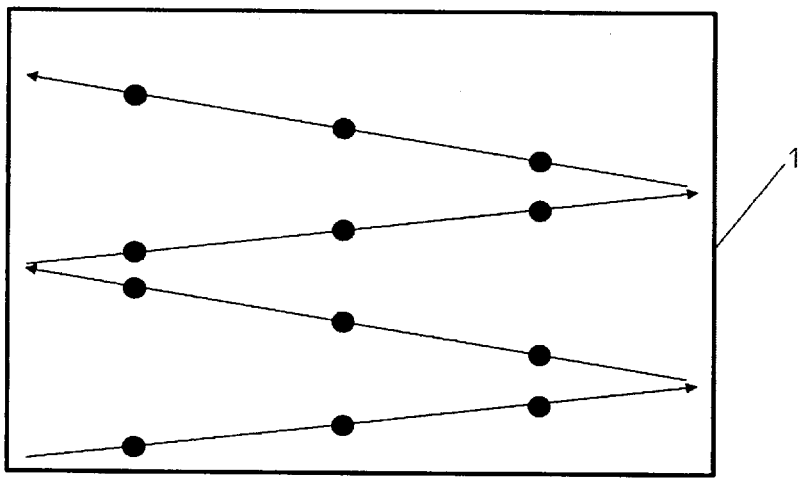

Fig. 9

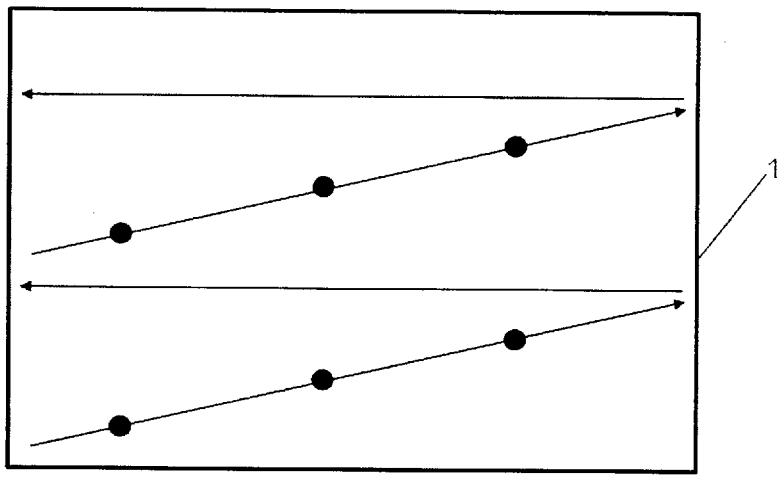

Fig. 10

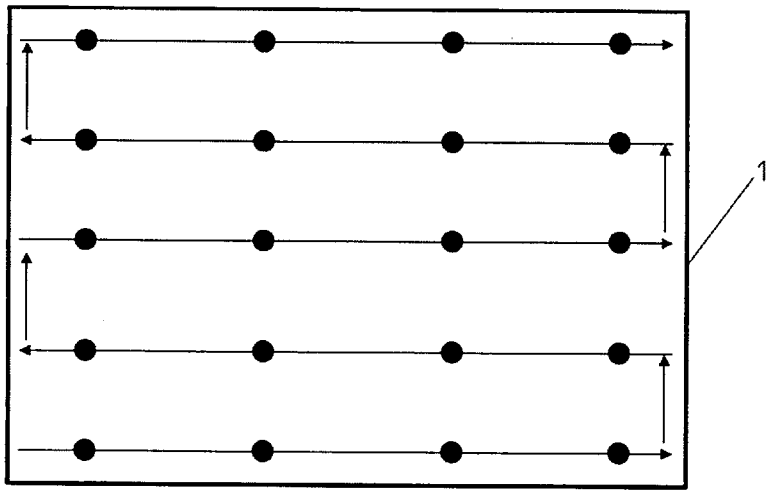

Fig. 11

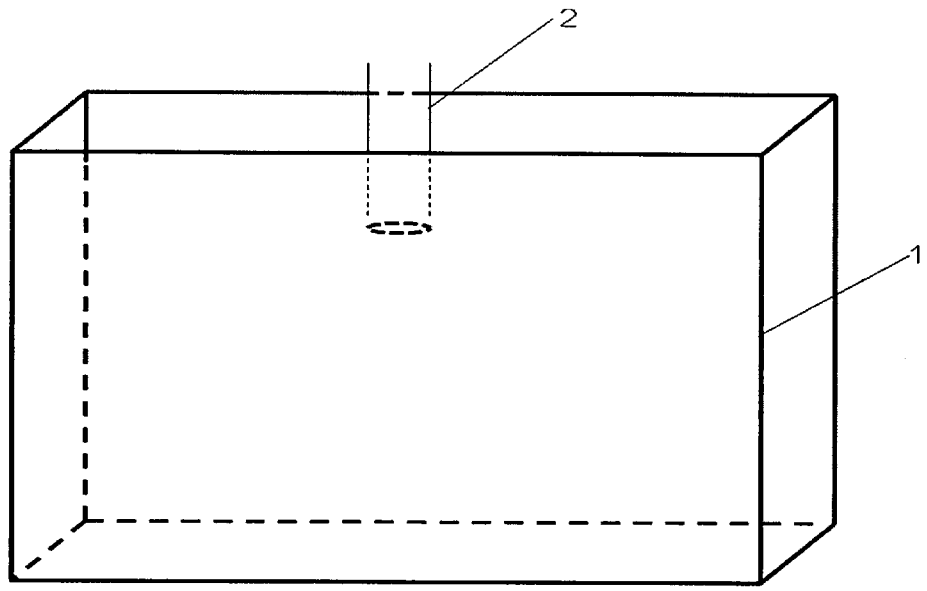

Fig. 12

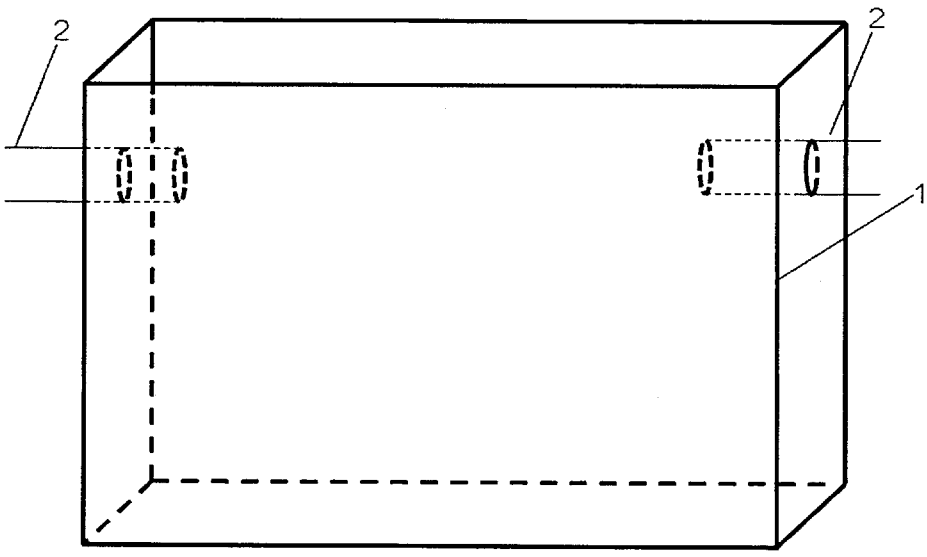

Fig. 13

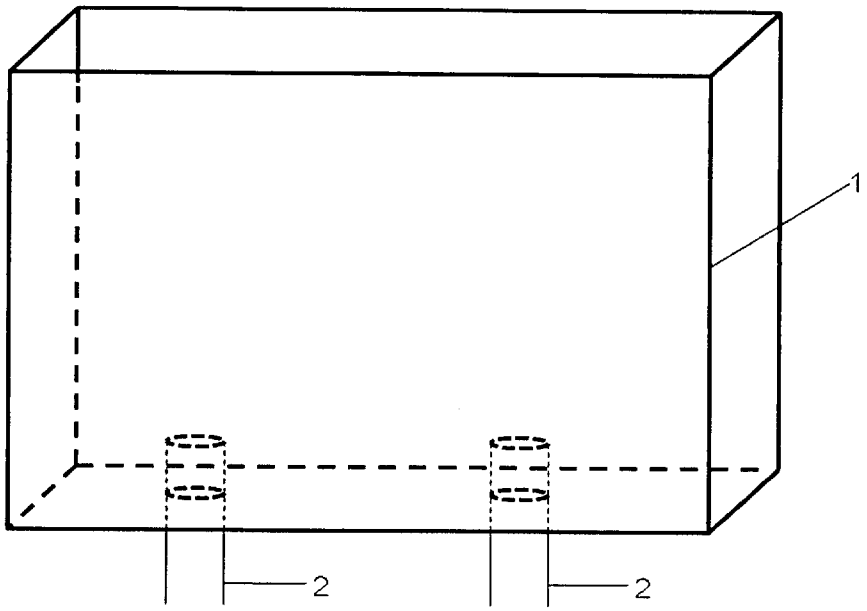

Fig. 14

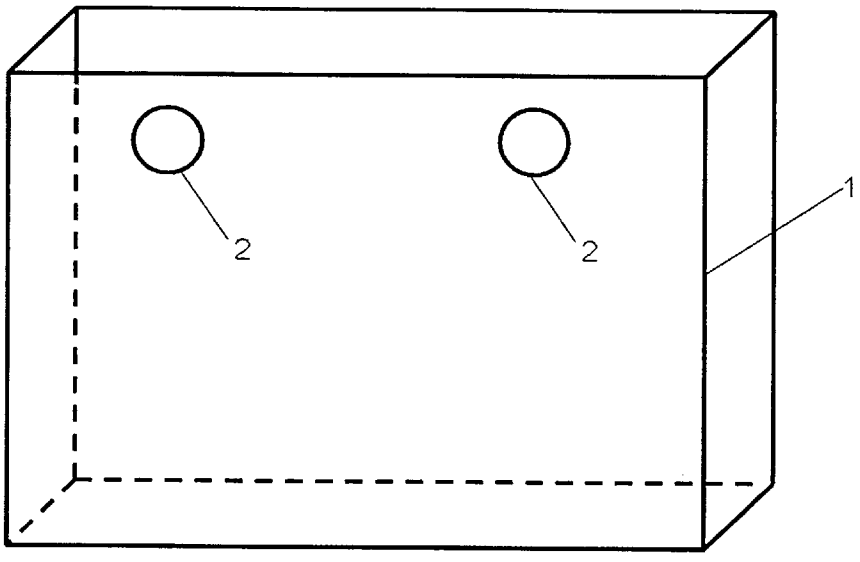

Fig. 15

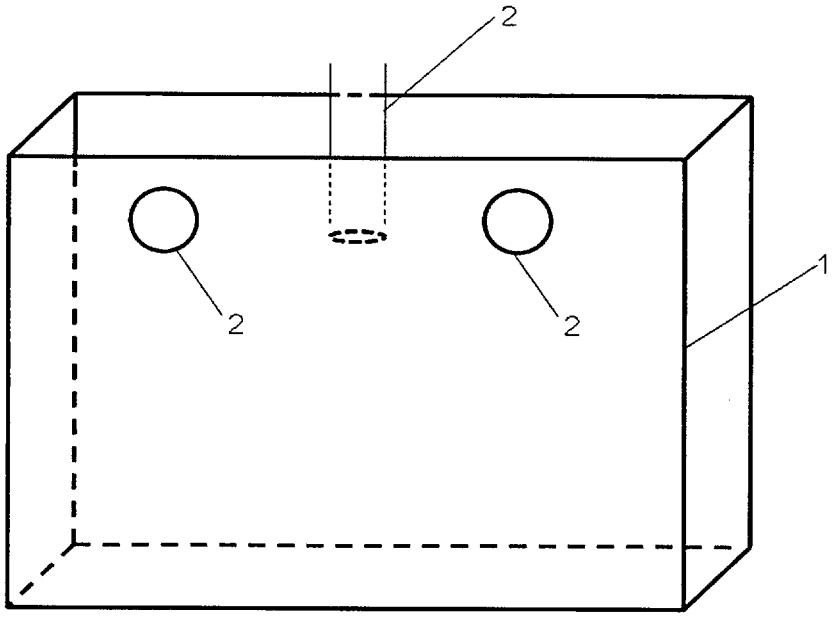

Fig. 16

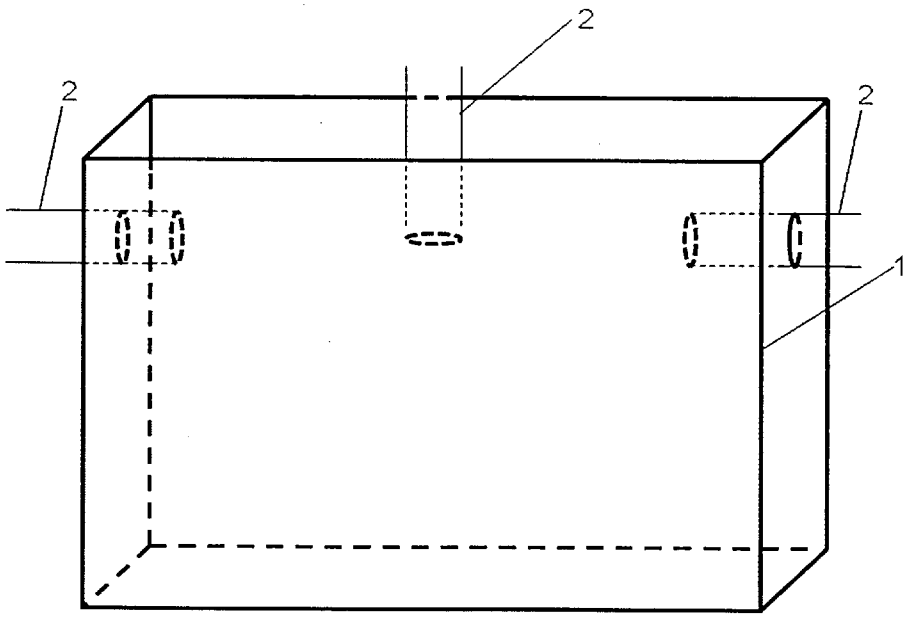

Fig. 17

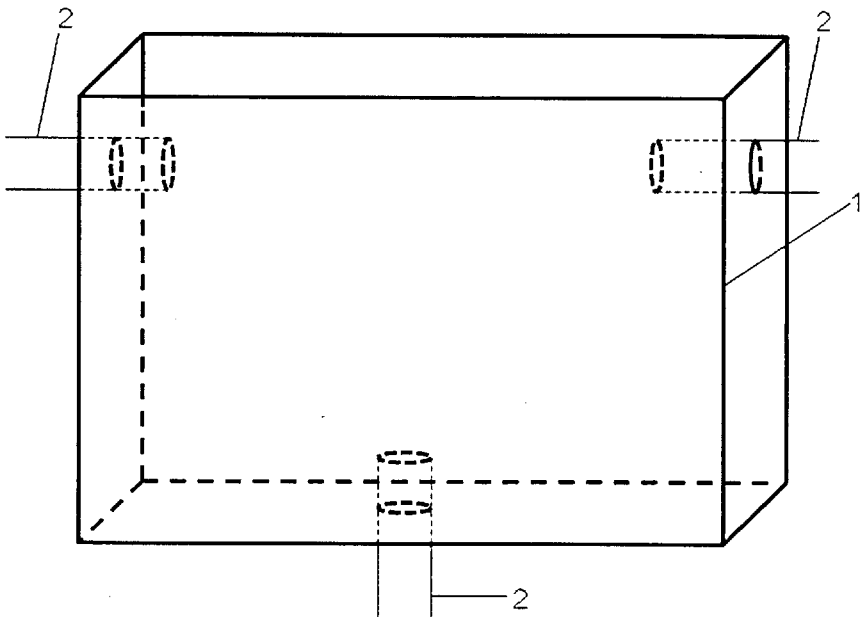

Fig. 18

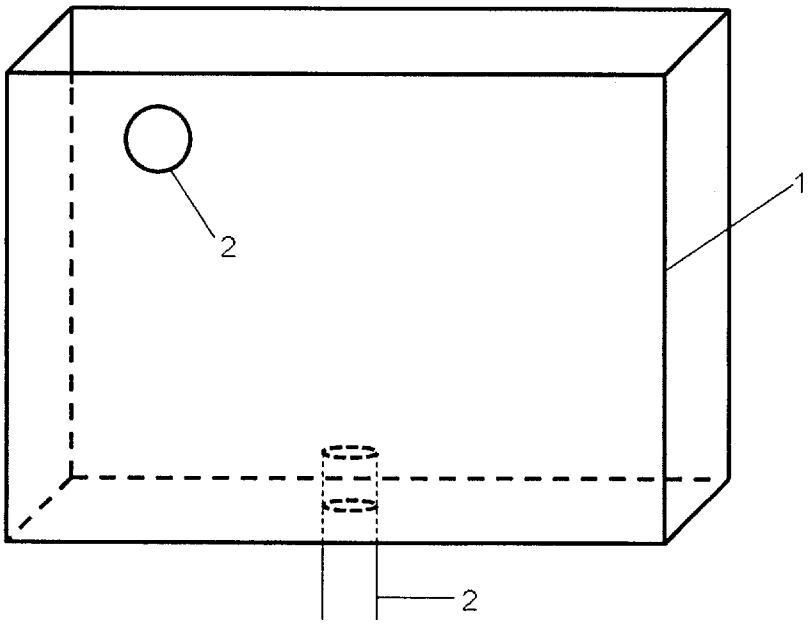

Fig. 19

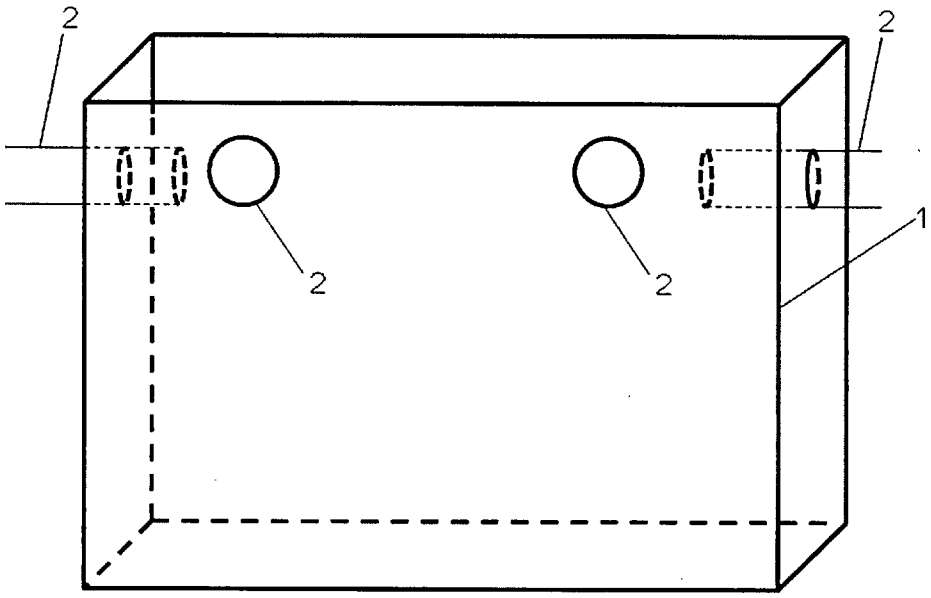

Fig. 20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TH2015/000044

A. CLASSIFICATION OF SUBJECT MATTER

E04G 11/06(2006.01)i, E04G 9/10(2006.01)i, E04B 2/84(2006.01)i

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)
E04G 11/06; E04G 21/10; E04G 21/02; E04G 21/04; E04G 11/08; E04G 21/08; E04G 9/10; E04B 2/84

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: cast-in-place, wall, kicker, formwork, binder, harden, cure, slurry surface level, and gap

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-1998-0053385 A (SK ENGINEERING & CONSTRUCTION LIMITED) 25 September 1998 See abstract, claims 1-14, and figures 1, 7a-7f.	1-4,18-28,35-37 ,40-46
A		5-11
Y	JP 2002-295018 A (PENTA OCEAN CONSTR CO., LTD.) 09 October 2002 See paragraphs [0012], [0014] and figures 1, 6.	1-4
Y	JP 05-202615 A (KYOKUTO KAIHATSU KOGYO CO., LTD.) 10 August 1993 See paragraph [0009] and figure 1.	4,18-28,35-37 ,40-46
A	JP 10-196113 A (KAJIMA CORP.) 28 July 1998 See paragraph [0006].	1-11,18-28,35-37 ,40-46
A	JP 05-025938 A (MAEDA CORP.) 02 February 1993 See paragraph [0018] and figures 1-3.	1-11,18-28,35-37 ,40-46

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 October 2015 (12.10.2015)	**13 October 2015 (13.10.2015)**

Name and mailing address of the ISA/KR
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/TH2015/000044

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 13-14, 16-17, 39, 48
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claims 13-14, 16-17, 39, and 48 are unclear, because they respectively refer to multiple dependent claims 12, 15, 38, and 47, directly or indirectly, which do not comply with PCT Rule 6.4(a). Therefore, claims 13-14, 16-17, 39, and 48 do not meet the requirement of PCT Article 6.

3. ☒ Claims Nos.: 12, 15, 29-34, 38, 47
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/TH2015/000044

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-1998-0053385 A	25/09/1998	KR 10-0219039 B1	01/09/1999
JP 2002-295018 A	09/10/2002	JP 03890552 B2	07/03/2007
JP 05-202615 A	10/08/1993	JP 02716901 B2	18/02/1998
JP 10-196113 A	28/07/1998	JP 03324680 B2	17/09/2002
JP 05-025938 A	02/02/1993	JP 03009510 B2	14/02/2000