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(54) **Method of and slide-casting machine for the casting of hollow slabs out of concrete.**

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Description

The present invention relates to a method for the casting of hollow slabs of concrete by slide-casting, wherein a concrete mix is extruded onto a base around one or more cavity forming members and the mix is compacted by moving the cavity forming member or members. The invention is also concerned wiht a slide-casting apparatus for casting hollow slabs of concrete, which apparatus comprises a deck plate, side walls, one or more feeder members for feeding the concrete mix, as well as one or more movable cavity forming members. The invention is in particular suitable for the production of prestressed hollow slabs. It may also be applied to the manufacture of hollow slabs of reinforced concrete.

Slide-casting machines for producing hollow slabs are known in the prior art. One example is shown in U.S. Patent Specification US—A—3,159,897. These machines operate on similar principles to those outlined in the preceding paragraph. In them the concrete mix is extruded by means of spiral screws. The machine moves along rails placed on a base. The spiral screw is of conical shape with the cone expanding towards the discharge end. Hence, an efficient compacting of the concrete can be achieved.

As a direct extension of the spiral screw, there is a shaping member, i.e. a so-called cavity forming mandrel, which is vibrated by means of a vibrator fitted inside the mandrel. Moreover, a vibrator beam fitted on the deck portion of the machine is vibrated, wherein the vibration of the cavity forming mandrel together with the surface vibration at the top of the machine produces the desired extent of compaction of the concrete.

The cavity forming mandrel is followed by a so-called follower tube, whose function is to support the cavity wall at the discharge end of the machine.

Drawbacks of the cavity forming mandrel are the high noise (higher than 85 kBA) resulting from the high vibration frequency, the high power requirement, and the low efficiency of the vibration power used for the vibration.

By means of the present invention, the prior art cavity vibration is replaced by using a compacting process suitable for compacting a soil-moist concrete mix.

According to the present invention in one aspect there is provided a method for the casting of hollow slabs of concrete by slide-casting, in which concrete mix is extruded onto a base around one or more cavity forming members each supported by a respective support member, and the mix is compacted by eccentrically moving the or each cavity forming member, characterized in that the longitudinal axis of the or each cavity forming member intersects the axis of the respective support member during movement.

According to the present invention in another aspect there is provided slide-casting apparatus for casting hollow slabs of concrete, comprising a deck plate, side walls, one or more feeder members for feeding the concrete mix, and one or more cavity forming members for forming the cavities, the or each cavity forming member being supported by a respective support member, characterized in that the or each cavity forming member is eccentrically movable such that its longitudinal axis intersects the axis of the respective support member during movement.

The cavity forming member may be attached to its support shaft by means of a universal-joint.

In front of each cavity forming member, a spiral screw may be provided as the feeder member. Most appropriately, at least the upstream end of the mandrel is eccentrically moved. Within the path of movement of the upstream end of the cavity forming mandrel, the stroke length of the mandrel may be a few millimetres. At the same time, the mandrel may additionally either rotate around its longitudinal axis or it may not rotate. The path of movement of the end of the mandrel may be of circular shape, but it may also be of some other shape, e.g. square.

When a mandrel rotating about its longitudinal axis is used, usually cavities of circular section are produced in the hollow slabs. When the mandrel does not rotate around its longitudinal axis, the cross-sectional form of the mandrel may also be different from circular. In this way, the cavities can be shaped as desired. Even when a rotating mandrel is used, according to the present invention, it is possible to produce cavities of a sectional form different from circular if the path of movement of the end of the mandrel is not circular.

Advantages of the method in accordance with the invention are:

essentially lower noise level as compared with cavity vibrators whose vibration frequency is 150 to 250 Hz,

owing to the wide path of movement of the end of the mandrel next to the spiral screw, the compacting process of the concrete can be shifted from the area of the screws to the area of the mandrel.

Some embodiments of the invention will now be described, by way of examples, with reference to the accompanying drawings, in which:—

Figure 1 is a longitudinal sectional view of a slide-casting apparatus in accordance with the invention,

Figure 2 shows the same machine as viewed from above and in section,

Figure 3 is an enlarged view of a detail of embodiment, wherein the cavity forming mandrel rotates around its axis,

Figure 4 shows a detail of a second embodiment, wherein the cavity forming mandrel does not rotate around its axis,

Figure 5 shows a detail of a third embodiment, wherein the spiral screw rotation at the end of the cavity mandrel,

Figure 6 shows a detail of an embodiment in which the cavity forming mandrel consists of two members located one after the other,

Figures 7*a* to 7*d* show different paths of movement of the cavity forming mandrel, and

Figures 8*a* to 8*c* show an example of the shape of a cavity forming mandrel.

A feeding funnel 1 is connected to the receiving end of the slide-casting apparatus. Depending on the size of the slab to be cast, the apparatus comprises three to eight spiral screws 2, which are frusto-conical and located such that they increase in diameter towards the discharge end of the apparatus. After the spiral screws 2, a cavity forming mandrel 3 is provided, which is followed by a follower tube 4. The apparatus additionally comprises a deck plate 6 and side boards 7. A vibrator 8 is fitted above the deck plate 6. The position of the upstream end 9 of the deck plate 6 can be adjusted by means of a front rib 10.

Each spiral screw 2 is attached to a shaft 11, which is driven by means of a motor 12. A shaft 11*a* extends through the screw 2 up to the upstream end of the acvity forming mandrel 3, and it is driven by a motor 12*a*. The apparatus moves on a base 18 on wheels 19 in the direction indicated by an arrow in Figure 1.

In the embodiment shown in Figure 3, the cavity forming mandrel 3 rotates on a support shaft 13 which extends through the drive shaft 11*a* of the mandrel 3. The bearing 15 at the upstream end of the cavity forming mandrel 3 rotates about the shaft 11*a*. Thereby the upstream end of the longitudinal axis of the mandrel 3 moves along a circle around the longitudinal axis of the spiral screw 2. The downstream end of the mandrel 3 moves about a part-spherical face formed by a bearing 14. The shape of the cavity forming mandrel 3 may be a cone widening towards the downstream end, in which case the cavity formed by it is of circular cross-section.

In the embodiment shown in Figure 4, the upstream end of the cavity forming mandrel 3 is journalled on the drive shaft 11*a* by means of an eccentric bearing 16 and its downstream end is mounted on the support shaft 13 by means of a ball joint 17. The mandrel 3 does not rotate around its own axis. When the drive shaft 11*a* revolves, the eccentric bearing 16 causes the upstream end of the longitudinal axis of the mandrel 3 to move along a circle extending around the longitudinal axis of the spiral screw 2.

Figure 5 shows an embodiment in which the upstream end of the mandrel is attached to the downstream end of the spiral 2 eccentrically by means of the bearing 16. The downstream end of the mandrel 3 is attached to the support shaft 13 by means of a ball joint 17. As the spiral screw 2 rotates its rotation of movement is transferred and converted to a movement of the mandrel 3 mounted to the end of the the spiral screw 2 so that the upstream end of the longitudinal axis of the mandrel 3 again circulates around the longitudinal axis of the screw 2.

In the embodiment in accordance with Figure 6, two cavity forming mandrels 3 and 3' are provided, which are located one after the other and which are, at their downstream ends, attached to the shafts 13 and 11*a* respectively by means of respective ball joints 17 and 17'. The upstream ends of the mandrels 3, 3' are attached to the shaft 11*a* eccentrically by means of respective bearings 16 and 16'. The path of movement of the mandrel 3 closer to the upstream end is somewhat wider than that of the mandrel 3' closer to the downstream end. Moreover, the radius of the ball face of the ball joint 17 closer to the upstream end is larger than the radius of the ball joint 17', wherein the centre point of the swinging movement is outside the mandrel.

The movement of the upstream end of the mandrel 3 may also be produced by means of various mechanisms in themselves known. When the mandrel 3 does not rotate, its end next to the follower tube 4 may also have a cross-section different from a circular cavity. In such a case, the end next to the spiral screw 2 may be circular or slightly shaped so as to correspond to the cavity.

Figures 7*a* to 7*d* show how different cavity forms can be obtained by using different paths of movement of the mandrel 3. The path of movement may be, e.g., square or triangular. The movement may also be horizontal or vertical reciprocal linear movement.

The mandrel 3 may be either cylindrical or conical, in which case circular cavities are obtained. When a mandrel 3 is used whose section is not circular, a cross-section of a cavity shaped in a corresponding way is obtained.

Figures 8*a* to 8*c* show an example of the shape of the mandrel 3. Figure 8*a* shows a circular section of the initial end of the mandrel. Figure 8*b* is a side view of the mandrel. Figure 8*c* is a sectional view of the final end of the mandrel.

It is also possible to place the ball joint so that the downstream end of the cavity mandrel moves while the upstream end also moves, or that only the downstream end of the mandrel moves.

Claims

1. A method for the casting of hollow slabs of concrete by slide-casting, in which concrete mix is extruded onto a base (18) around one or more cavity forming members (3) each supported by a respective support member (13), and the mix is compacted by eccentrically moving the or each cavity forming member (3), characterized in that the longitudinal axis of the or each cavity forming member (3) intersects the axis of the respective support member (13) during movement.

2. A method as claimed in claim 1, in which the downstream end of the longitudinal axis of the or each cavity forming member (3) intersects the axis of the respective support member (13).

3. A method as claimed in claim 1 or claim 2, in which the concrete mix is extruded onto the base (18) by means of a respective rotatable spiral screw (2) located in front of the or each cavity forming member (3), one end or both ends of the longitudinal axis of the cavity forming member (3) being moved along a path that passes around the axis of the spiral screw (2).

1. A method as claimed in any one of claims 1 to 3, in which one or both ends of the or each cavity forming member (3) are moved along a path of circular shape.

5. A method as claimed in claim 3 or claim 4, in which the rotary movement of the end of the or each cavity forming member (3) is produced by means of an eccentric (16) attached to the rotating spiral screw (2) provided in front of the or each cavity forming member (3).

6. A method as claimed in any one of claims 1 to 3, in which the or each cavity forming member (3) is additionally rotated about its longitudinal axis.

7. A slide-casting apparatus for casting hollow slabs of concrete, comprising a deck plate (6), side walls (7), one or more feeder members (2) for feeding the concrete mix, and one or more cavity forming members (3) for forming the cavities, the or each cavity forming member (3) being supported by a respective support member 13, characterized in that the or each cavity forming member (3) is eccentrically movable such that its longitudinal axis intersects the axis of the respective support member (3) during movement.

8. Apparatus as claimed in claim 7, in which the or each cavity forming member (3) is attached to its support member (13) by means of a universal-joint fastening (14 or 17).

9. Apparatus as claimed in claim 8, in which the or each cavity forming member (3) can be additionally rotated about its longitudinal axis.

10. Apparatus as claimed in any one of claims 7 to 9, in which the or each cavity forming member (3) is of a generally cylindrical or conical shape or has a non-circular cross-section.

11. Apparatus as claimed in any one of claims 7 to 10, in which two or more cavity forming members (3) are located are after the other and each is movable relative to a respective ball joint (17, 17').

12. Apparatus as claimed in any one of claims 7 to 11, in which the or each feeder member (2) includes a rotatable spiral screw (2) located in front of the or each cavity forming member (3), the upstream end of the or each cavity forming member (3) being journalled (16) eccentrically on the downstream end of the associated screw spiral (2).

Patentansprüche

1. Verfahren zum Gießen hohler Betonplatten mittels Gleitformers, bei welchem eine Batonmischung auf eine Grundplatte (18) um ein oder mehrere, Hohlräume formende Stücke (3) extrudiert wird, von deren jedes von einem zugehörigen Tragteil (13) getragen wird und die Mischung durch exzentrische Bewegung des oder jedes Hohlräume formenden Stückes (3) verdichtet wird, dadurch gekennzeichnet, daß die Längsachse des oder jedes Hohlräume formenden Stükkes (3) während der Bewegung die Achse des zugehörigen Tragteiles (13) schneidet.

2. Verfahren nach Anspruch 1, bei welchem das stromab gelegene Ende der Längsachse des oder jedes Hohlräume formenden Stückes (3) die Achse des zugehörigen Tragteiles (13) schneidet.

3. Verfahren nach Anspruch 1 oder 2, bei welchem die Betonmischung mittels einer jeweiligen, drehbafen, vor dem oder jedem Hohlräume formenden Stück liegenden Schnecke (2) auf die Grundplatte ausgestoßen wird, wobei ein Ende oder beide Enden der Längsachse des Hohlräume formenden Stückes (3) längs eines um die Achse der Schnecke (2) verlaufenden Weges bewegt wird.

4. Verfahren nach irgendeinem der Ansprüche 1 bis 3, bei welchem ein oder beide Enden des oder jedes Hohlräume formenden Stückes (3) längs eines kreisförmigen Weges bewegt werden.

5. Verfahren nach Anspruch 3 oder 4, bei welchem die Drehbewegung des Endes des oder jedes Hohlräume formenden Stückes (3) mittels eines Exzenters (16) erzeugt wird, der an der vor dem oder jedem Hohlräume formenden Stück (3) vorgesehene, rotierende Schnecke angebracht ist.

6. Verfahren nach irgendeinem der Ansprüche 1 bis 5, bei welchem das oder jedes Hohlräume formande Stück (3) um seine Längsachse zusätzlich gedreht wird.

7. Vorrichtung zum Geißen hohler Betonplatten durch Gleitformen, mit einer Deckplatte (6), Seitenwänden (7), mit einem oder mehreren Zuführgliedern (2) zum Zuführen der Betonmischung und einem oder mehreren, Hohlräume formenden Stücken (3) zum Formen der Hohlräume, wobei das oder jedes Hohlräume formende Stück (3) von einem zugehörigen Tragteil (13) getragen ist dadurch gekennzeichnet, daß das oder jedes Hohlräume formande Stück (3) exzentrisch so bewegbar ist, daß seine Längsachse während der Bewegung die Achse des jeweiligen Tragteiles (13) schneidet.

8. Vorrichtung nach Anspruch 7, in der das oder jedes Hohlräume formende Stück (3) an seinen Tragteil (13) mittels einer Universalgelenkhalterung (14 oder 17) angefügt ist.

9. Vorrichtung nach Anspruch 8, bei welcher das oder jedes Hohlräume formande Stück (3) um seine Längsachse zusätzlich gedreht werden kann.

10. Vorrichtung nach irgendeinem der Ansprüche 7 bis 9, bei welcher das oder jedes Hohlräume formende Stück (3) eine im wesentlichen zylindrische oder konische Form oder einen nicht kreisförmigen Querschnitt besitzt.

11. Vorrichtung nach irgendeinem der Ansprüche 7 bis 10, bei welcher zwei oder mehrere Hohlräume formende Stücke (3) eines hinter dem anderen liegen und jedes bezüglich eines jeweiligen Kugelgelenkes (17, 17') bewegbar ist.

12. Vorrichtung nach irgendeinem der Ansprüche 7 bis 11, bei welcher das oder jedes Zuführglied (2) eine drehbare Schnecke (2) aufweist, die sich vor dem oder jedem Hohlräume formenden Stück (3) befindet, wobei das stromauf gelegene Ende des oder jedes Hohlräume formenden Stückes (3) an dem stromab gelegegene Ende der zugehörigen Schnecke (2) exzentrisch gelagert (16) ist.

Revendications

1. Procédé pour le moulage de plaques creuses en bêton par moulage glissant, dans lequel le mélange de bêton est extrudé sur une base (18) autour d'un ou de plusieurs éléments formant cavités (3) supportés chacun par un élément support respectif (13), et le mélange est compacté en déplaçant excentriquement le ou chaque élément formant cavité (3), caractérisé en ce que l'axe longitudinal du ou de chaque élément formant cavité (3) coupe l'axe de l'élément support respectif (13) au cours du mouvement.

2. Procédé selon la revendication 1, dans lequel l'extrémité avale de l'axe longitudinal du ou de chaque élément formant cavité (3) coupe l'axe de l'élément support (13) respectif.

3. Procédé selon la revendication 1 ou la revendication 2, dans lequel le mélange de béton est extrudé sur la base (18) au moyen d'une vis en spirale (2) rotative respective située devant le ou chaque élément formant cavité (2), une extrémité ou les deux extrémités de l'axe longitudinal de l'élément formant cavité (3) étant déplacées le long d'un trajet qui passe autour de l'axe de la vis en spirale (2).

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel l'une ou les deux extrémités du ou de chaque élément formant cavité (3) sont déplacées le long d'un trajet de forme circulaire.

5. Procédé selon la revendication 3 ou la revendication 4, dans lequel le mouvement rotatif de l'extrémité du ou de chaque élément formant cavité (3) est produit au moyen d'un excentrique (16) fixé à la vis en spirale (2) rotative prévue devant le ou chaque élément formant cavité (3).

6. Procédé selon l'une quelconque des revendications 1 à 5, dans lequel le ou chaque élément formant cavité (3) tourne en outre autour de son axe longitudinal.

7. Appareil de moulage glissant pour mouler des plaques creuses en bêton, comprenant une plaque formant toit (6), des parois latérales (7), un ou plusieurs éléments d'alimentation (2) pour l'alimentation en mélange de béton, et un ou plusieurs éléments formant cavités (3) pour former les cavités, le ou chaque élément formant cavité (3) étant supporté par un élément support respectif (13), caractérisé en ce que le ou chaque élément formant cavité (3) est déplaçable excentriquement de telle façon que son axe longitudinal coupe l'axe de l'élément support (3) respectif au cours du mouvement.

8. Appareil selon la revendication 7, dans lequel le ou chaque élément formant cavité (3) est fixé à son élément support (13) au moyen d'une fixation à joint universel (14 ou 17).

9. Appareil selon la revendication 8, dans lequel le ou chaque élément formant cavité (3) peut en outre tourner autour de son axe longitudinal.

10. Appareil selon l'une quelconque des revendications 7 à 9, dans lequel le ou chaque élément formant cavité (3) est d'une forme généralement cylindrique ou conique ou à une section traversale non circulaire.

11. Appareil selon l'une quelconque des revendications 7 à 10, dans lequel deux ou plus de deux éléments formant cavités (3) sont situés l'un après l'autre et chacun est déplaçable par rapport à un joint à rotule (17, 17') respectif.

12. Appareil selon l'une quelconque des revendications 7 à 11, dans lequel le ou chaque élément d'alimentation (2) comprend une vis en spirale (2) rotative située devant le ou chaque élément formant cavité (3), le tourillon (16) de l'extrémité amont du ou de chaque élément formant cavité (3) étant monté excentriquement sur l'extrémité avale de le vis en spirale (2) associée.

Fig. 1.

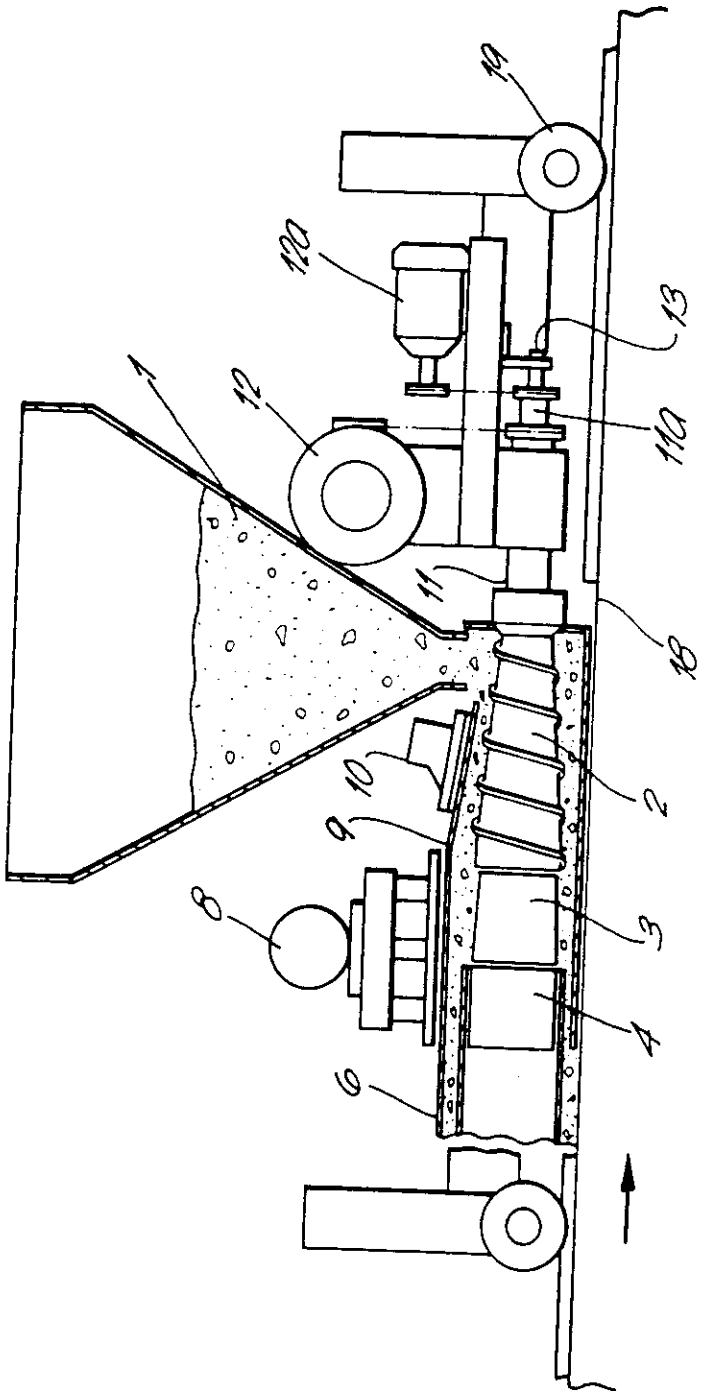
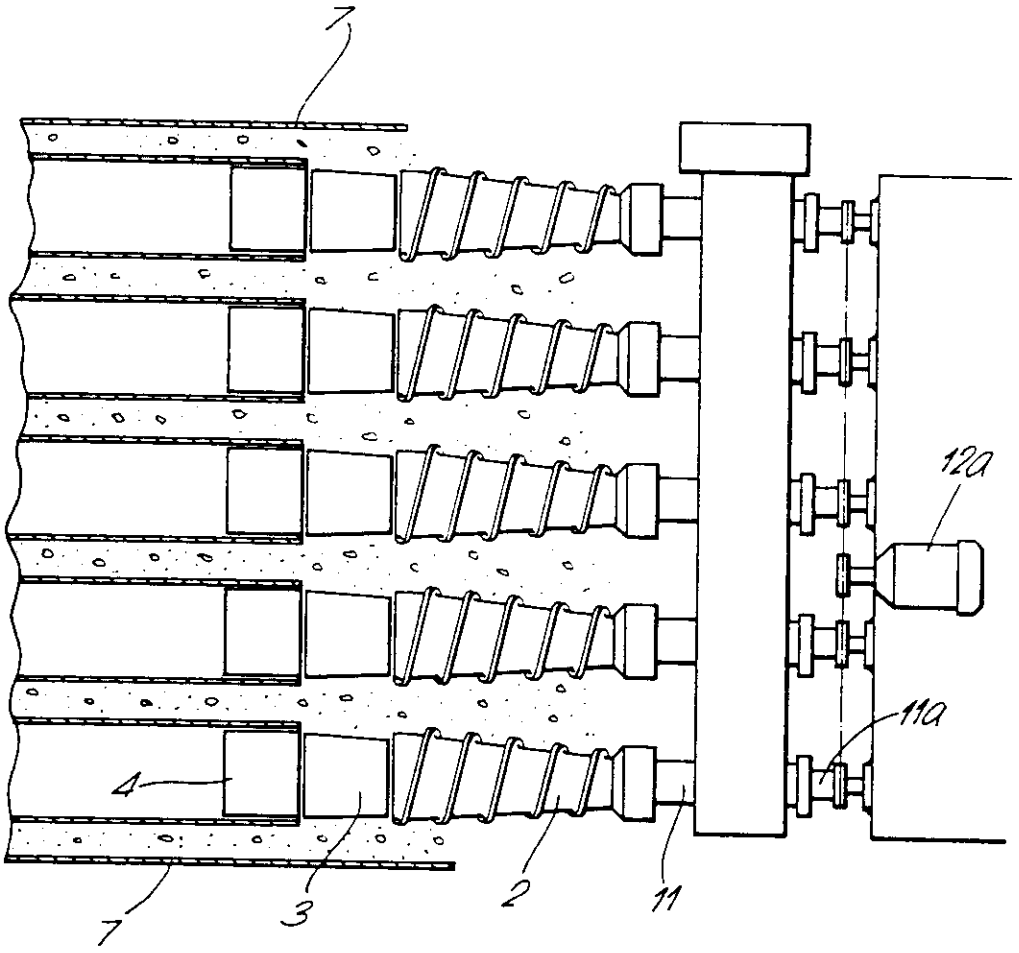


Fig. 2



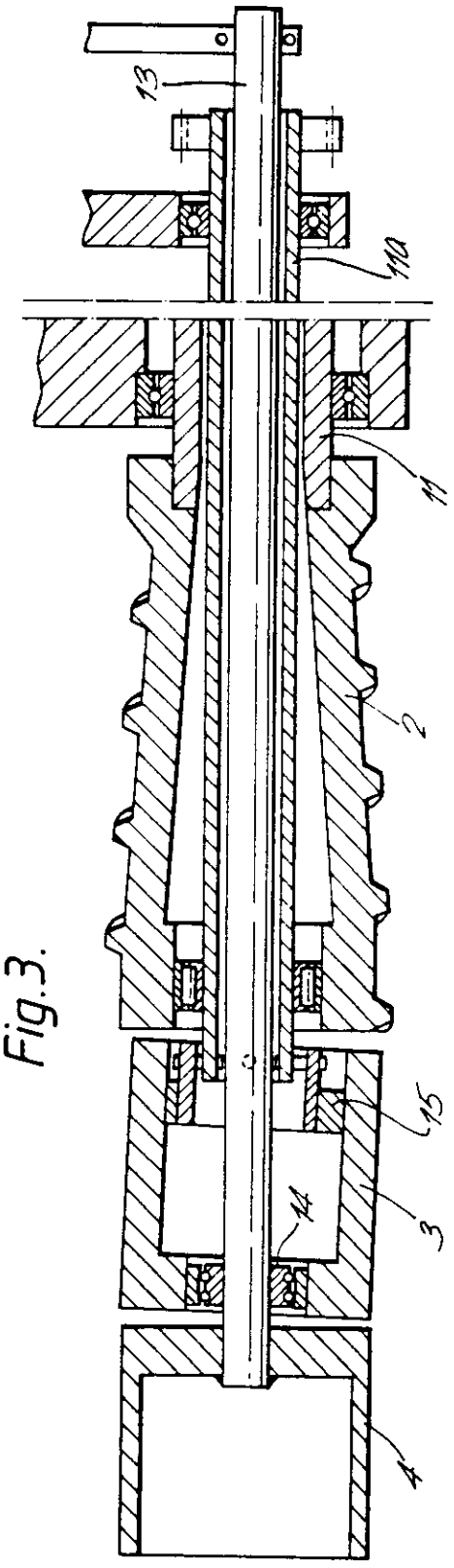


Fig.3.

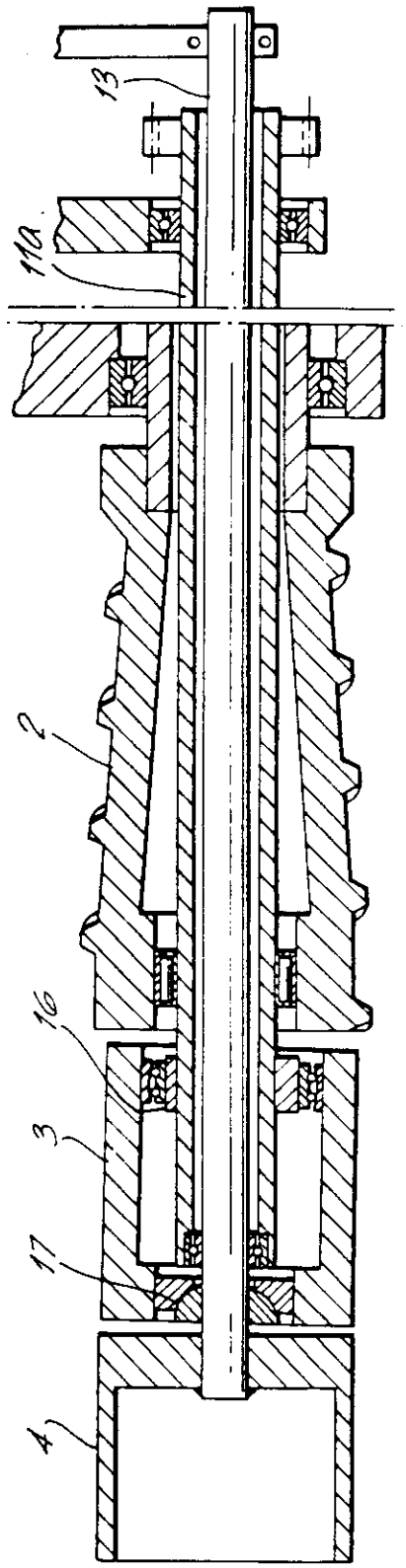


Fig. 4.

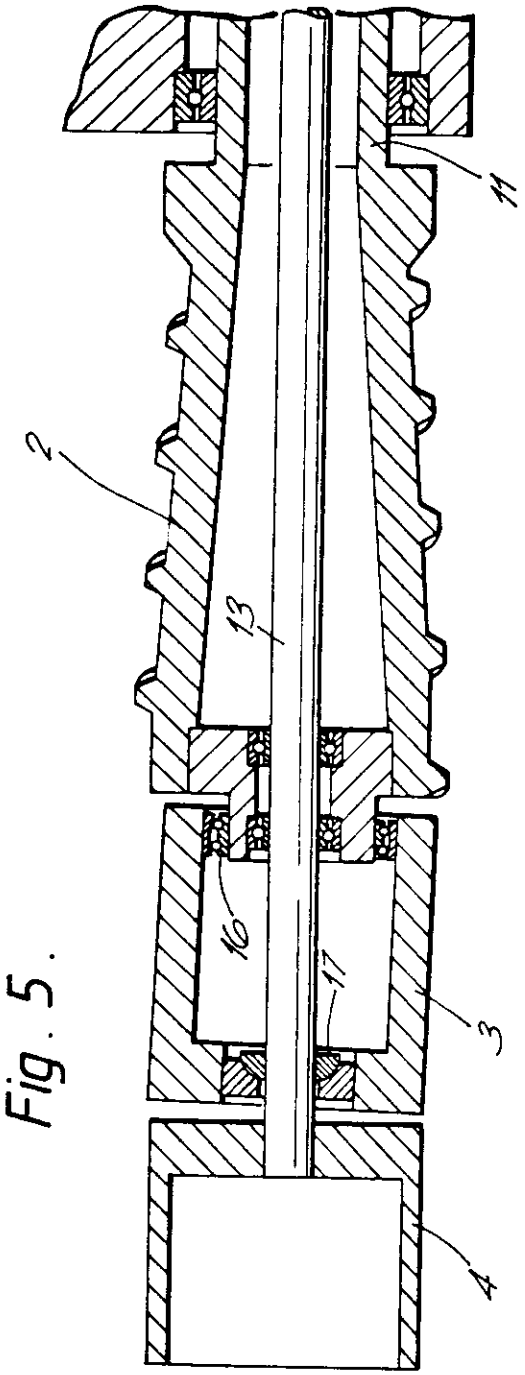


Fig. 5.

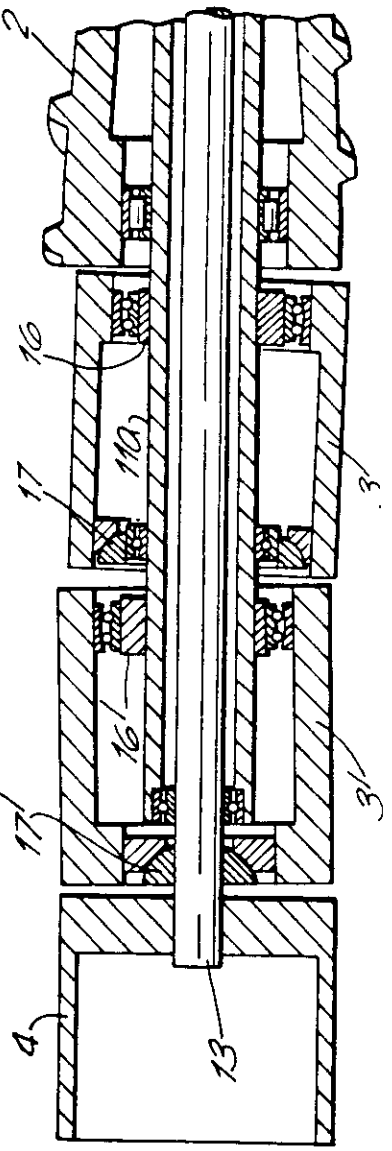


Fig.6.

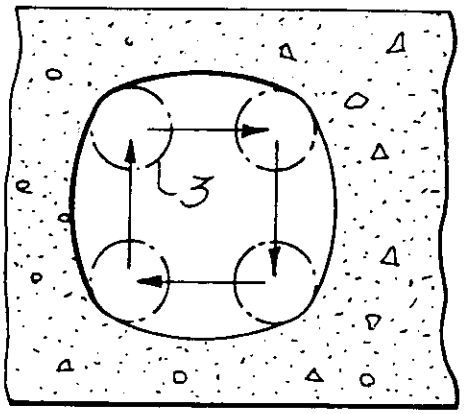


Fig. 7a.

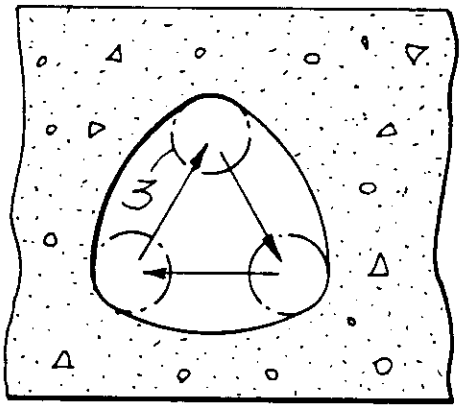


Fig. 7b.

Fig. 7c

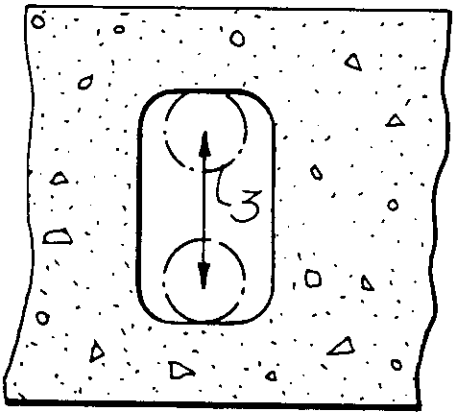
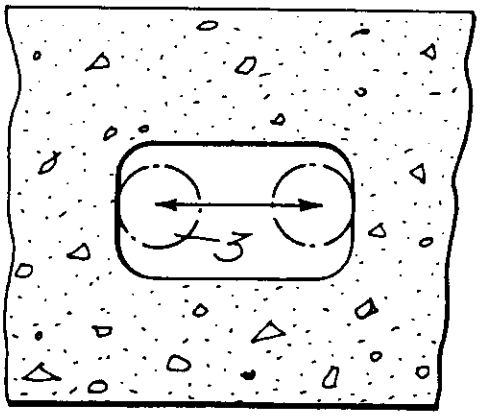


Fig. 7d.



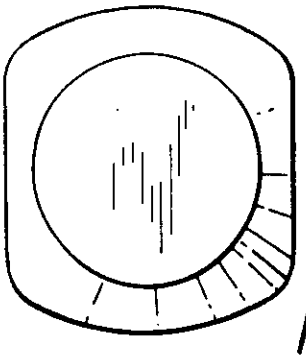


Fig.8a.

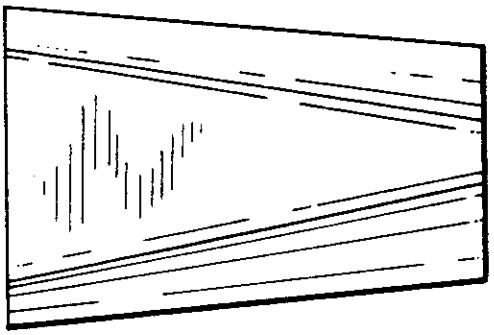


Fig.8b.

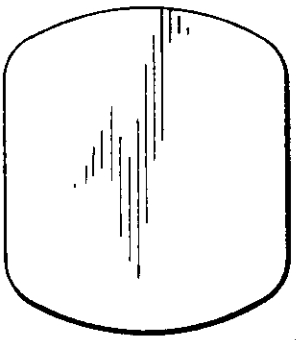


Fig.8c.

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Title METHOD AND SLIDE-CASTING MACHINE FOR THE CASTING OF HOLLOW SLABS OUT OF CONCRETE

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**** END OF REGISTER ENTRY ****