



(22) Date de dépôt/Filing Date: 2004/03/31

(41) Mise à la disp. pub./Open to Public Insp.: 2004/09/30

(30) Priorité/Priority: 2003/03/31 (103 14 722.5) DE

(51) Cl.Int.⁷/Int.Cl.⁷ B28B 21/72

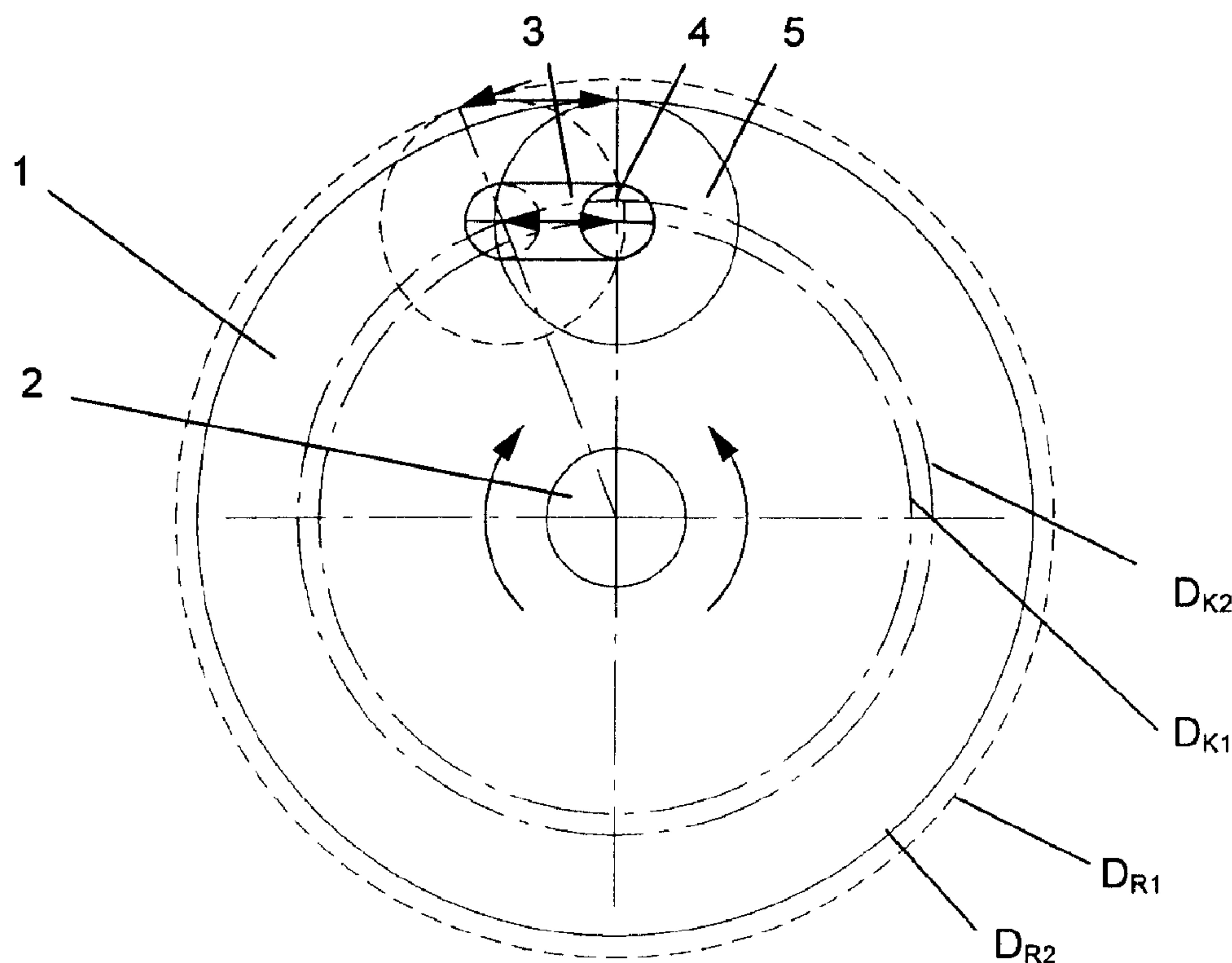
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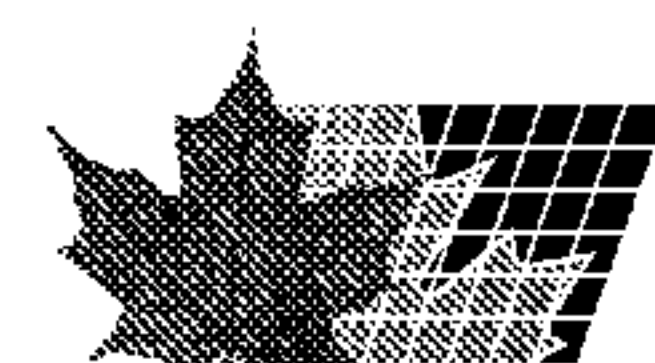
(54) Titre : DISPOSITIF ET METHODE DE PRODUCTION DE TUYAUX EN BETON MULTICOUCHES

(54) Title: DEVICE AND METHOD FOR PRODUCING MULTILAYER CONCRETE PIPES



(57) Abrégé/Abstract:

The invention relates to a compacting tool, in particular a press head, which has at least one distributor or press roll (5) and/or at least one press or smoothing plunger for producing a multilayer concrete pipe in a mold casing or the like, said roll(s) or plunger(s) having an outer casing surface for forming an inner wall of the concrete pipe and rotating about an actuated axis (2). The at least one distributor or press roll (5) and/or the at least one press or smoothing plunger is connected with the actuated axis (2) via an adjusting mechanism (3; 4; 6; 7) such that the distance of the outer casing surface to the actuated axis can be varied.



Abstract:

Device and Method for Producing Multilayer Concrete Pipes

The invention relates to a compacting tool, in particular a press head, which has at least one distributor or press roll (5) and/or at least one press or smoothing plunger for producing a multilayer concrete pipe in a mold casing or the like, said roll(s) or plunger(s) having an outer casing surface for forming an inner wall of the concrete pipe and rotating about an actuated axis (2). The at least one distributor or press roll (5) and/or the at least one press or smoothing plunger is connected with the actuated axis (2) via an adjusting mechanism (3; 4; 6; 7) such that the distance of the outer casing surface to the actuated axis can be varied.

(Fig. 1)

DEVICE AND METHOD FOR PRODUCING A MULTILAYER CONCRETE PIPE

The invention relates to a compacting tool, in particular a press head, which has at least one distributor roll or press roll and/or at least one press or smoothing plunger which has or have an outer casing surface for forming an inner wall of the concrete pipe and rotates about an actuated axis for producing a multilayer concrete pipe in a mold casing or the like. Furthermore, the invention relates to a device for producing, in particular two-layer, concrete pipe having a compacting tool of this type as well as a method method for producing a multilayer concrete pipe.

Concrete pipes of this type are, for example, used for municipal and industrial sewage systems. In this case, the wall of this type of a pipe fulfils various functions. Thus, on the one hand, the wall of the pipe must absorb the static and dynamic loads which act from the outside. On the other hand, the inside surface is exposed to the medium to be transported. For this reason, special properties are required for the inside surface, such as e.g. wear resistance, acid resistance, fire resistance and the like. As a result, it is useful to make the wall of the pipe from several layers, the layers differing from one another by their properties. It is thereby known to line such concrete pipes with an inner layer consisting of an acid-resistant concrete mixture which increases the resistance of the concrete pipe. Since acid-resistant concrete mixtures are considerably more expensive than conventional concrete mixtures, only a very thin layer of the acid-resistant concrete is used for lining the inside of concrete pipes.

This thin layer consisting of acid-resistant concrete is usually applied in a centrifugal process in which the acid-resistant

concrete mixture is introduced into a horizontally lying pipe. The centrifuging step must be carried out until the concrete is at least partially hardened, so that the pipe can be removed from the mold in a horizontal position without being damaged. Since the horizontal pipe production is very time-consuming, single-layer pipes are often also produced in a vertical production process with a press head or the like. In vertically produced pipes, coatings are subsequently applied to the inner surface or so-called plastic liners built in. Inserting these partially very expensive coatings requires additional production steps. Moreover, there is no inner, i.e. chemical, connection between the layers, so that these layers might easily come loose over time.

To produce concrete pipes with different insides diameters, a compacting tool is known from US 4,690,631 whose press rolls can be adjusted in their radial alignment via a control lever. For this purpose, it is necessary to unscrew a threaded bolt fixing the control lever out of a threaded hole and, after adjusting the control lever, screw it into another threaded hole. The adjustment of the press roll is time-consuming and consequently cannot be carried out during production.

Thus, the object of the present invention is to provide a compacting tool and a method of the aforementioned type with which multilayer concrete pipes can be more quickly and more economically produced, in particular, wherein the interconnection of the individual layers is improved.

According to the invention, this object is essentially solved therein that at least one distributor or press roll and/or at least one press or smoothing plunger be connected with the actuated axis via an control device such that the distance of the outer casing surface to the actuated axis can be changed. The control device

thus makes it possible to change, in a defined manner, the diameter of the compacting tool described e.g. by the distributor rolls or runners or the press rolls in order to produce concrete pipes with different inside diameters with the same compacting tool. Since it is not necessary to move the compacting tool out of the mold casing to operate the control device, it is possible, with the compacting tool according to the invention, to produce a two-layer or multilayer concrete pipe without changing the tool. Thus, due to the radial adjustability of the compacting tool, it is possible to first produce the outer layer of the concrete pipe having a larger inside diameter and, after reducing the diameter of the compacting tool, to apply the inner layer of the concrete pipe having a smaller inside diameter. The compacting tool for changing the diameter is radially adjusted by varying the distance between the actuated axis and the outer casing surfaces of the rolls, runners or the like.

According to a preferred embodiment of the invention, the control device has a connecting link guide which extends in a curved or straight path between two points at various distances from the actuated axis and a sliding block sliding in the connecting link guide. The actuated axis can thereby be connected with a disk or the like in which a slot is configured as a connecting link guide. The pivot journal of a distributor or pivot roll or of a smoothing plunger thereby slides like a sliding block in the slot. By turning the compacting tool about the actuated axis, the roll or plunger is forced into its rear position in the connecting link guide in direction of rotation. By reversing the direction of rotation of the compacting tool about the actuated axis, the roll or runner can be pushed into the other end position of the connecting link guide which, in comparison to the first position, has a different distance to the actuated axis, so that the diameter of the compacting tool can be altered by reversing its direction of

rotation.

The reversal of the direction of rotation of the compacting tool between two processing steps can, alternatively, also be used in a control device to change the diameter of the compacting tool if the control device is formed by a rocking lever eccentrically mounted relative to the actuated axis. This rocking lever is connected with the at least one distributor or press roll and/or the at least one press or smoothing plunger at its end facing away from the mounting and can be turned between two points at different distances from the actuated axis. The impact points restricting the swing of the lever can thereby be arranged such that a contamination of the control device by the concrete mixtures is largely avoided, so that no impairments of the exact adjustability of the diameter of the compacting tool can occur during operation.

According to a further embodiment, it is provided that the control device has at least one electrically, hydraulically or pneumatically controllable drive motor which is assigned to the at least one distributor or press roll and/or to the at least one press or smoothing plunger for the adjustment. This drive motor, e.g. a linear correcting element, can centrally adjust all rollers and/or plungers of the compacting tool or be assigned to individual or several rolls or plungers.

Preferably, the drive motor is supplied with power by the actuated axis which is formed by at least two coaxially hollow shafts situated in one another. In this case, an electric, hydraulic or pneumatic line leads through the inner hollow shaft for the control device.

Alternatively, it is also possible that the actuated axis is formed by two coaxial hollow shafts situated in one another, a further

shaft for driving the control device being provided in the inner hollow shaft.

If the adjustment of the distributor or press roll is produced by a reaction force between the roll and the concrete pipe caused by changing the direction of rotation, a power output supplied through the axis configured as a shaft can be used for other functions. Thus, for example, it is possible to clean the distributor or press tool by means of compressed air or the like or the rolls can also be stopped in an end position.

To obtain an especially smooth inside wall and a homogeneous concrete distribution in the walls of the pipes to be produced, a compacting tool according to the invention has a distributor with several, essentially radially acting distributor rolls or distributor runners, a compactor with several, essentially radially acting press rolls or compacting runners and a smoothing tool. The concrete filled into the mold casing is first evenly spread in the mold casing by the distributor rolls of the distributor and precompacted, so that an optionally provided reinforcement of the concrete mixture is included. The press rolls of the compactor then compact the concrete mixture until the desired inside diameter of the concrete pipe is produced. The surface is then finished by the smoothing tool which is preferably configured as a cylindrical plunger and situated below the compacting tool. Alternatively to the described compacting tool, radial slide runners may also assume the distribution and compacting of the material instead of the rolls.

Torsional moments occurring during production of the concrete pipe with a press head can be prevented thereby that the distributor of the press head rotates in opposite direction to the compactor about the longitudinal axis of the mold casing. The compactor and the

distributor can thereby rotate at different speeds. In this case, the speed of the distributor is usually clearly greater than that of the compactor with the press rolls and the smoothing plunger. In this way, reinforcements optionally provided in the concrete pipe are also not distorted during compacting of the concrete mixture, so that they remain in their intended position.

According to a further embodiment, a spray head for distributing and compacting concrete mixtures can be situated on the compacting tool above the smoothing tool. The second concrete mixture can e.g. be spread by centrifugal forces which are produced due to the rotating movement of the spray head. The second concrete mixture is at least partially compacted due to the impact speed of the sprayed material onto the inner surface of the first concrete layer and the connection with the first concrete layer is improved. Consequently, a further distributor and/or additional compactor are not required.

A device according to the invention for producing a multilayer, in particular two-layer, concrete pipe comprises at least one stand in which a drivable compacting tool is mounted, at least one turntable on which several upright mold casings can be cyclically swung into the stand and at least one charging unit for filling at least one concrete mixture into one of the mold casings. Preferably, however, at least two charging units are assigned to a stand, so that different concrete mixtures can be processed in the same stand.

It is preferred if at least one of the charging units has a concrete silo with an associated feed belt. Alternatively or in addition thereto, the charging unit may also be formed by a concrete pump having a pump hose. The use of a concrete pump can be sufficient, in particular, for supplying the second, e.g. fire-

resistant and/or acid-resistant concrete mixture of which only a small portion is required for producing a multilayer concrete pipe.

In addition, the object on which the invention is based is solved by a method for producing a multilayer, in particular two-layer, concrete pipe which comprises the following steps: first, an essentially upright mold casing is swung into a first stand and the casing filled with a first concrete mixture from a first charging unit. This first concrete mixture is then spread and compacted in the mold casing by a rotating and vertically travelling first compacting tool and the inner surface optionally smoothed. Prior to releasing the concrete pipe from the mold, a second concrete mixture is filled into the essentially upright mold casing by means of a second charging unit. In addition, the diameter of the compacting tool is reversibly reduced, so that the second concrete mixture is spread and compacted with the compacting tool and the inner surface optionally smoothed before the concrete pipe is swung out of the stand and released from the mold. This method of the invention is characterized therein that neither a change of the compacting tool nor a transport of the outer part of the multilayer pipe together with the mold casing into a further stand is required. Rather, the compacting tool itself can be altered in its size within the mold casing prior to introducing the second concrete mixture. After the concrete pipe has been swung out and released from the mold, the diameter of the compacting tool is again reversibly enlarged for distributing and compacting a first concrete mixture of a new concrete pipe.

Preferably, the direction of rotation of the compacting tool is changed after the distribution and compacting of the first concrete mixture. In this way, it is possible to change tools which can be shifted in a connecting link guide or pivoted on a lever in their radial alignment to the actuated axis, so that the diameter of the

compacting tool is adapted. Alternatively or in addition thereto, it is also possible to change the rotational speed of the compacting tool after the distribution and compacting of the first concrete mixture. In this way, the diameter of the compacting tool can be varied e.g. due to centrifugal forces.

The invention shall be described in greater detail in the following with reference to embodiments and with reference to the drawings, schematically showing

- Fig. 1 a compacting tool according to a first embodiment of the invention,
- Fig. 2 a compacting tool according to a second embodiment of the invention,
- Fig. 3 a compacting tool according to a third embodiment of the invention,
- Fig. 4 a compacting tool according to a fourth embodiment of the invention, and
- Fig. 5 a sectional view of a pipe during production.

A compacting tool is shown in Figs. 1 to 4 by a circular disk 1 which is connected with an actuated axis 2. A connecting link guide 3, configured as a slot in the embodiment according to Fig. 1, is provided on the disk 1. A pivot journal 4 which supports a press roll 5 is movably mounted in the connecting link guide 3. In this way, the press roll 5 together with the pivot journal 4 can be moved between the first position with a smaller diameter, indicated in Fig. 1 with a solid line, into a second position with a larger diameter, indicated by a broken line.

The two end points of the connecting link guide 3 have a different distance to the actuated axis 2. The centre of the pivot journal 4 describes a circle, identified with D_{K1} in the figures, when the disk 1 is turned about the axis 2 in its first position. After the pivot journal 4 is shifted, indicated by the arrows in Fig. 1, into the second position, indicated by a broken line, the centre of the pivot journal describes a circle D_{K2} when the disk 1 is rotated, the diameter of said circle being larger than that of the circle D_{K1} . In this way, the size of the circles D_{R1} and D_{R2} described by the outer surfaces of the press rolls 5 when the compacting tool is turned also changes. Different wall thicknesses can be produced with a compacting tool in this way during production of a concrete pipe without it being necessary to change the tools.

In the embodiment of the compacting tool shown in Fig. 1, the press roll 5 is adjusted in the connecting link guide 3 by a reaction force. When rotating disk 1 counterclockwise during operation, due to the contact with the inside wall of the concrete pipe, a reaction force results on the press roll 5 which forces it into the first position, indicated by solid lines, in which the roll is closer to the actuated axis 2. By changing the direction of rotation, the contact with the inside wall of the concrete pipe results in an opposite reaction force which shifts the press roll 5 with the pivot journal 4 into the other end position of the connecting link guide 3, shown by a broken line in the figure. In this way, the diameter of the circle D_{R1} described by the outer casing surface of the press rolls during rotation of the compacting tool is enlarged solely by the change in direction of rotation in D_{R2} .

In the embodiment shown in Fig. 2, the press roll 5 is also pivoted on a pivot journal 4 movable in a connecting link guide 3 such that the size of a circle described during rotation of the compacting

tool by the outer casing surface of the press roll can be changed. However, the press roll between the two positions, shown by solid or broken lines respectively, are adjusted in this embodiment not only by changing the direction of rotation of the compacting tool, but can alternatively or in addition thereto be adjusted by a e.g. linear correcting element 6 attacking the pivot journal 4. In this way, it becomes possible to set the diameter of the circle described by the outer surface of the press roll 5 during rotation in an infinitely variable manner.

A further embodiment of the invention is shown in Fig. 3. A lever 7 is pivoted eccentrically to the actuated axis 2 about a support point 8 on the disk-like compacting tool 1. The end of the lever 7 facing away from the mounting 8 carries the pivot journal 4 on which the press roll 5 is pivoted. Furthermore, two stops 9a and 9b are positioned on the disk 1 which limit the swing of the lever 7. The stops 9a and 9b are thereby positioned on the disk 1 in such a way that, when the lever 7 abuts the two stops, the size of the circles D_{R1} and D_{R2} described during rotation of the compacting tool by the casing surface of the press roll 5 are different.

As already noted above with respect to Fig. 1, when the compacting tool 1 is rotated, reaction forces directed in different directions act due to the contact of the outer casing surface of the press roll 5 with the inside wall of the concrete pipe, dependent on the direction of rotation of the compacting tool. Due to these reaction forces, the lever 7 is swung between the two positions, indicated by solid or broken lines respectively in Fig. 3, which are defined by the stops 9a and 9b. As a result, concrete pipes with different wall thickness or with different inside diameters can be produced merely by changing the direction of rotation, without changing the compacting tool.

- 11 -

The construction of the compacting tool shown in Fig. 4 corresponds essentially to that of the embodiment in Fig. 3. However, in this embodiment, the lever 7 or the pivot journal 4 are connected with the linear correcting element 6, described above with reference to Fig. 2, in such a way that the lever 7 can be swung by the linear correcting element 6 independent of the direction of rotation of the compacting tool 1. In this way, the distance between the casing surface of the press roll 5, in contact with an inside wall of the concrete pipe, and the actuated axis 2 of the compacting tool 1 can be set in an infinitely variable manner.

Two manufacturing steps for producing a two-layer concrete pipe 10 are shown in Fig. 5, the right half showing the compacting of the first outer layer 10a with the compacting tool 1 in its second position, shown by a broken line in Figs. 1 to 4, while the application of the second, inner layer 10b in the first position of the compacting tool, illustrated by solid lines in Figs. 1 to 4, is shown in the left half of Fig. 5.

In addition to the press rolls 5 already shown in Figs. 1 to 4, the compacting tool comprises distributor rolls 11 arranged vertically above them which are also pivoted on pivot journals 12, as well as smoothing plungers 13 arranged below the press roll 5. Contrary to the illustrations in Figs. 1 to 4, several press rolls 5 and several compacting rolls 11 can be provided in the compacting tool, each of which - as well as the smoothing plunger 13 or segments of the smoothing plunger 13 - can be positioned individually at different distances to the actuated axis 2 by an adjusting mechanism described above with reference to Figs. 1 to 4.

The production of the two-layer concrete pipe 10 takes place in an upright mold casing 14 in which concrete is first inserted, optionally by the actuated axis 2, to produce the outer layer 10a.

At the start of the production of the concrete pipe, the compacting tool is in a position completely actuated into the mold casing 14 in which the distributor rolls 11 are positioned at the lower end of the mold casing 14. The distributor rolls 11, the press rolls 5 and the smoothing plunger 13 are in the second position, shown by a broken line in Figs. 1 to 4, so that the circle described by the casing surfaces of the press rolls 5 during rotation of the compacting tool about the axis 2 corresponds to the circle D_{R2} , shown by a broken line in Figs. 1 to 4. The compacting tool is rotated by the actuated axis 2 and vertically pulled out upward from the mold casing 4 at the same time it is filled with the concrete mixture. In this case, the distributor rolls 11 first uniformly spread the concrete mixture on the inside wall of the mold casing 14, whereby the concrete can be precompacted. The concrete is further compacted by the press rolls 5, which preferably rotate about the axis 2 in opposite direction to the distributor rolls 1. The smoothing plunger 13 finally smooths the inner wall surface of the outer layer 10a of the concrete pipe.

To form the inner layer 10b of the concrete pipe 10, the compacting tool is again moved into its lower position in the mold casing 14 and the distributor rolls 11, the press rolls 5 and the smoothing plunger 13 are brought into a position at a reduced distance to the rotatable axis 2, described above with reference to Figs. 1 to 4. During or after the material for the inner layer 10b of the concrete pipe has been inserted, said inner layer is finished by the distributor rolls 11, press rolls 5 and the smoothing plunger 13 as described above. The concrete pipe 10 can then be removed from the mold casing 14.

List of Reference Numbers:

1	Disk (compacting tool)
2	Actuated axis
3	Connecting link guide
4	Pivot journal
5	(Press) roll
6	Linear correcting element
7	Rocking lever
8	Mounting
9a, 9b	Stop
10	Concrete pipe
10a	Outer layer
10b	Inner layer
11	Distributor roll
12	Pivot journal
13	Smoothing plunger
14	Mold casing

Claims:

1. A compacting tool, in particular, a press head which has at least one distributor or press roll (5, 11) and/or at least one press or smoothing plunger (13) for producing a multilayer concrete pipe (10) in a mold casing (14) or the like, said roll(s) or plunger(s) having an outer casing surface for forming an inner wall of the concrete pipe (10) and rotating about an actuated axis (2), characterized in that the at least one distributor or press roll (5, 11) and/or the at least one press or smoothing plunger (13) is connected with the actuated axis via an adjusting mechanism (3; 6; 7) such that the distance of the outer casing surface to the actuated axis (2) can be varied.
2. The compacting tool according to claim 1, characterized in that the adjusting mechanism has a connecting link guide (3) which extends in a curved or straight path between two points at different distances from the actuated axis (2) and a sliding block (4) sliding in the connecting link guide (4).
3. The compacting tool according to claim 1, characterized in that the adjusting mechanism has a rocker lever (7) which is eccentrically mounted relative to the actuated axis (2), is connected with the at least one distributor or press roll (5, 11) and/or the at least one press or smoothing plunger (13) and the end of which facing away from the mounting (8) can be swung between two points (9a, 9b) at different distances from the actuated axis (2).
4. The compacting tool according to claim 1, characterized in that the adjusting mechanism has at least one electrically, hydraulically or pneumatically actuated drive motor (6) which

- 15 -

is assigned to the at least one distributor or press roll (5, 11) and/or the at least one press or smoothing plunger (13) for the adjustment.

5. The compacting tool according to claim 4, characterized in that the actuated axis (2) is formed by at least two coaxially hollow shafts situated in one another and that an electric, hydraulic or pneumatic line leads through the inner hollow shaft for the adjusting mechanism (3; 6; 7).
 6. The compacting tool according to claim 1, characterized in that the actuated axis (2) is formed by two coaxially hollow shafts situated in one another, a further shaft being led through the inner hollow shaft for driving the adjusting mechanism (3; 6; 7).
 7. The compacting tool according to one of the preceding claims, characterized by a distributor having several essentially radially acting distributor rolls (11) or distributor runners, a compactor having several essentially radially acting press rolls (5) or compactor runners and a smoothing tool (13).
 8. The compacting tool according to claim 7, characterized in that the distributor (11) rotates about the actuated axis (2) in opposite direction to the compactor (5) and at a different speed.
 9. The compacting tool according to one of the preceding claims, characterized by a spray head for distributing and compacting concrete mixtures which is arranged above the smoothing tool (13).
 10. A device for producing a multilayer, in particular a two-
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layer, concrete pipe (10) having at least one stand in which a drivable compacting tool according to one of the preceding claims is mounted, at least one turntable on which several upright mold casings (14) can be cyclically swung into a stand and at least one charging unit for filling at least one concrete mixture into one of the mold casings (14).

11. The device according to claim 10, characterized in that at least two charging units are assigned to a stand.
 12. The device according to claim 11, characterized in that at least one of the charging units has a concrete silo with an associated feed belt.
 13. The device according to claim 11 or 12, characterized in that one of the charging units has a concrete pump with a pump hose.
 14. A method for producing a multilayer, in particular two-layer, concrete pipe (10), comprising the following steps:
 - swinging a mold casing (14) which is essentially upright into a stand,
 - filling the mold casing (14) with a first concrete mixture (10a) by means of a first charging unit,
 - distributing and compacting the concrete mixture in the mold casing (14) by a rotating and vertically travelling compacting tool (5, 11, 13),
 - swinging the mold casing (14) which is essentially upright out of the stand (2) and releasing the concrete pipe (10) from the mold,characterized in that a second concrete mixture (10b) is filled into the essentially upright mold casing (14) by means of a second charging unit prior to releasing the concrete pipe
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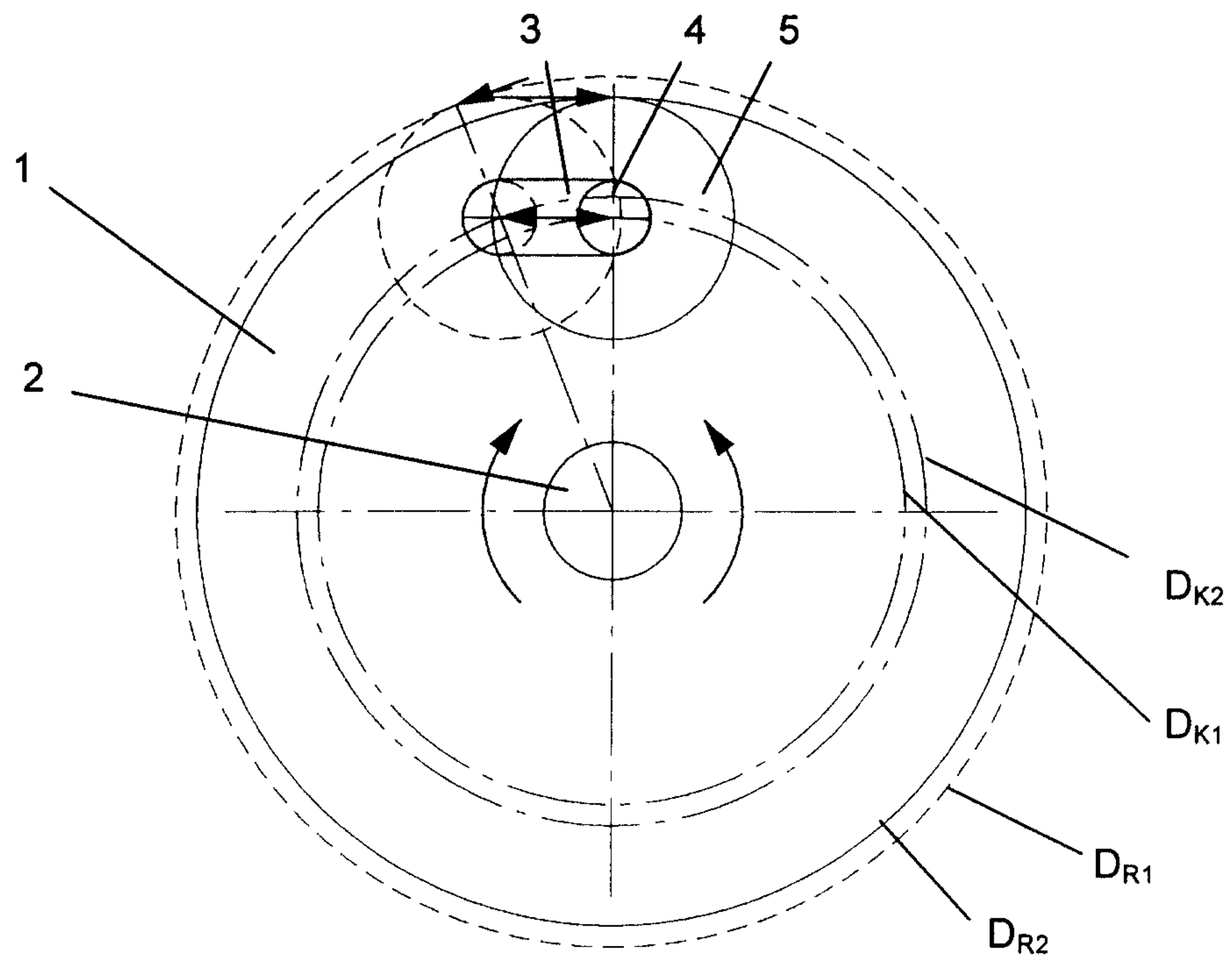
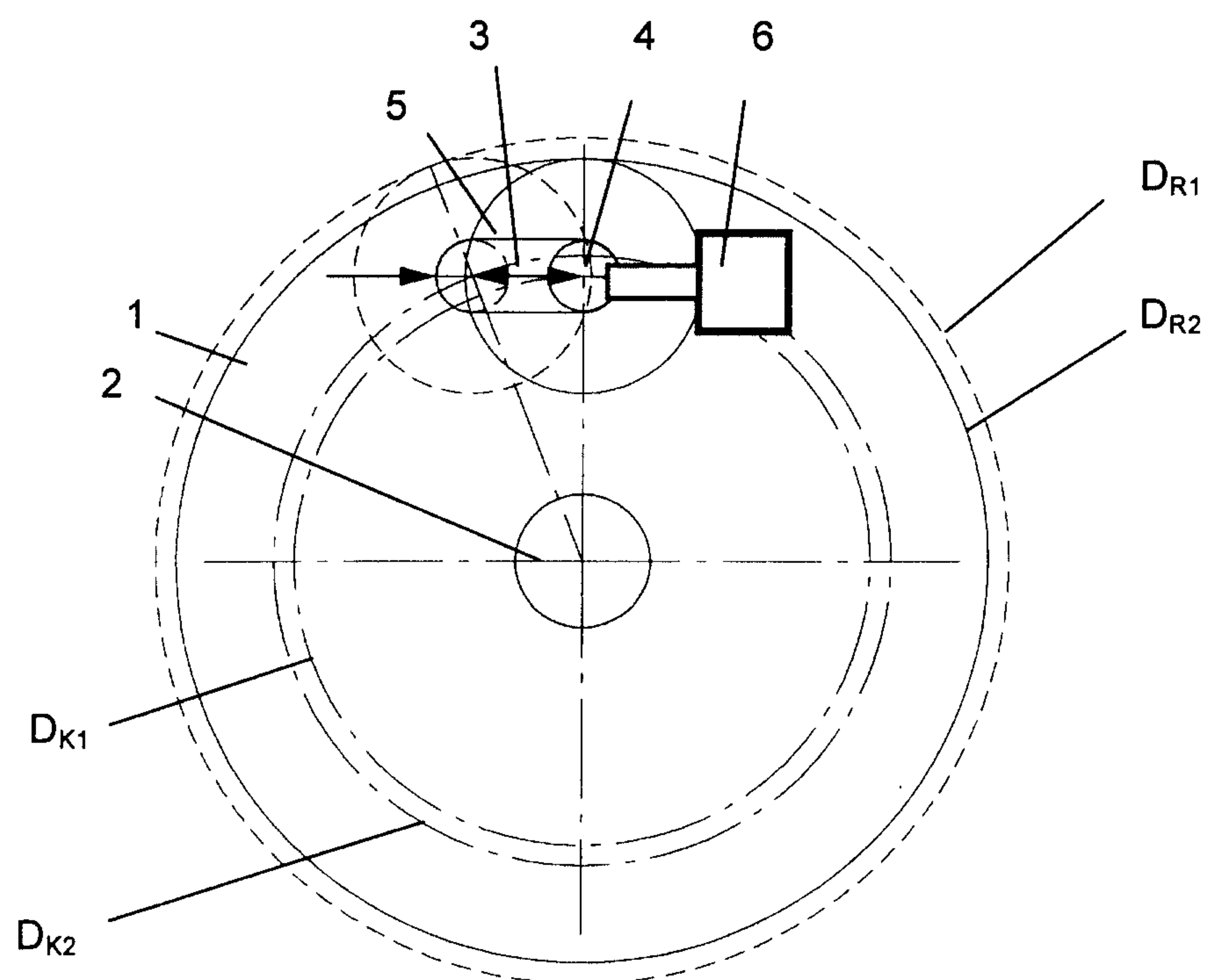
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(10) from the mold and that the diameter of the compacting tool (5, 11, 13) is reversibly reduced for distributing and compacting the second concrete mixture (10b).

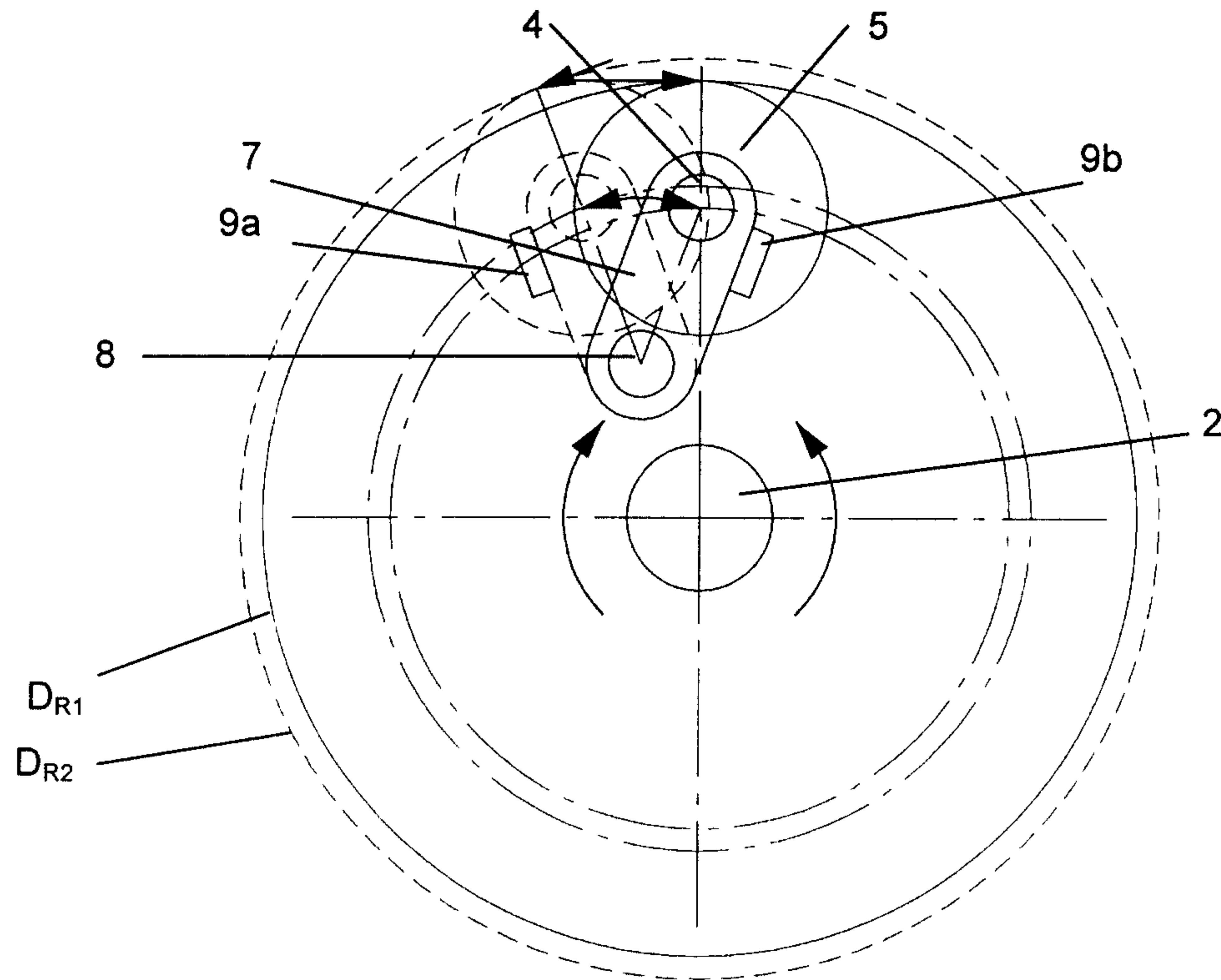
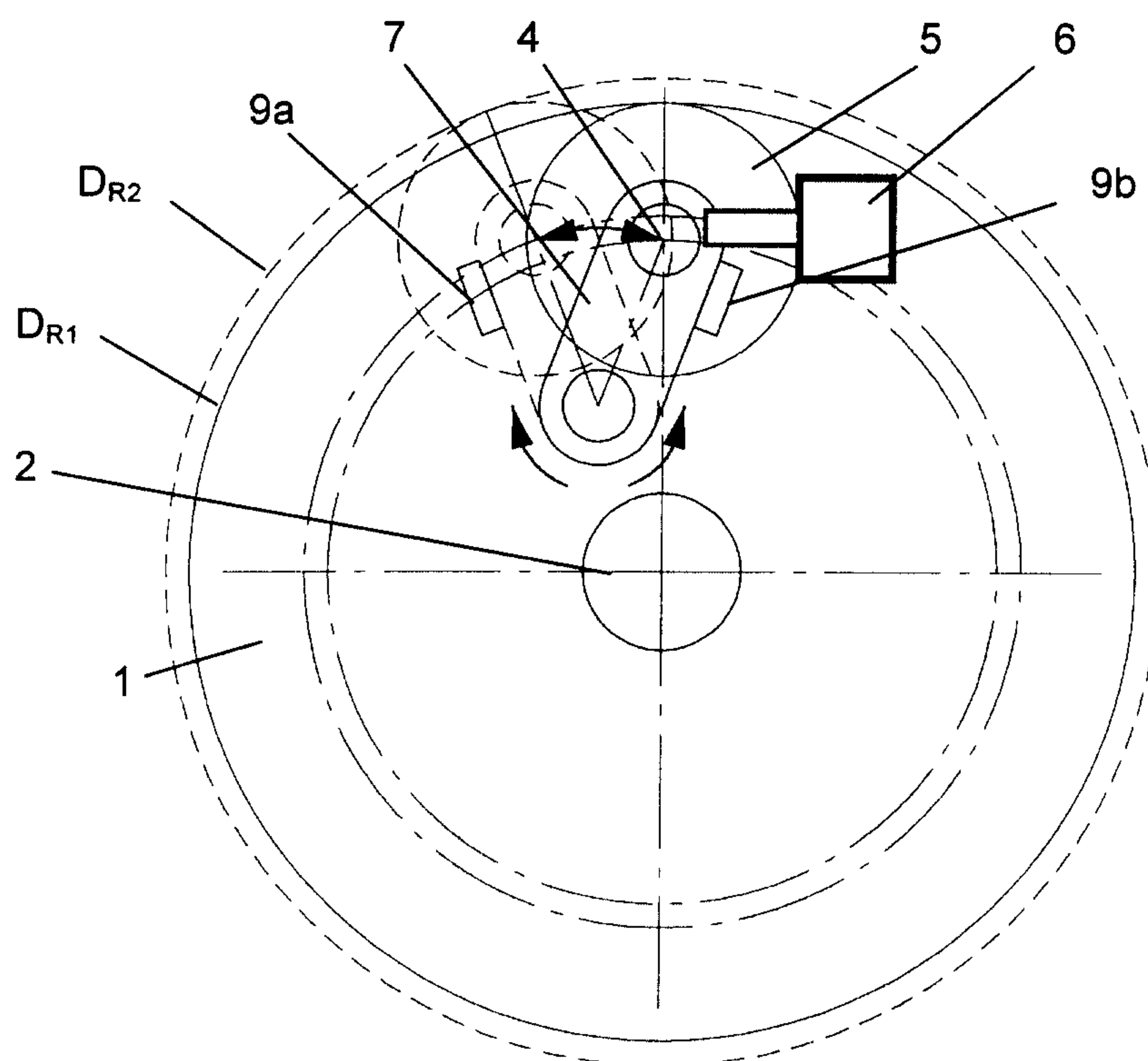
15. The method according to claim 14, characterized in that, after the concrete pipe (10) has been swung out and removed from the mold, the diameter of the compacting tool (5, 11, 13) is reversibly enlarged for distributing and compacting the first concrete mixture (10a).
16. The method according to claim 14 or 15, characterized in that, after the first concrete mixture (10a) has been spread and compacted, the direction of rotation of the compacting tool (5, 11, 13) is changed.
17. The method according to one of the claims 14 to 16, characterized in that, after the first concrete mixture (10a) has been spread and compacted, the speed of rotation of the compacting tool (5, 11, 13) is changed.

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1 / 3

Fig. 1Fig. 2

2 / 3

Fig. 3Fig. 4

3 / 3

Fig. 5