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(54) **DRIVE PUMP FOR VISCOUS MASS WITH SUSPENDED SOLID ELEMENTS**

(57) The invention relates to a drive pump (1) for viscous mass with suspended solid elements having a determined maximum size, comprising a drive wheel (2) and a driven wheel (3) accommodated in a pump body (4) with an inlet (4.1) and an outlet (4.2) for the viscous mass, wherein when a tooth (2.1) of the drive wheel (2) is in contact with a tooth (3.1) of the driven wheel (3), the

minimum distance (5) between the tooth (2.1) of the drive wheel (2) and the adjacent tooth (3.2) of the driven wheel (3) allows accommodation with play of a suspended solid element (12) of the viscous mass, and in case it is a metallic element, it will be blocked, preventing it from coming out of its outlet (4.2).

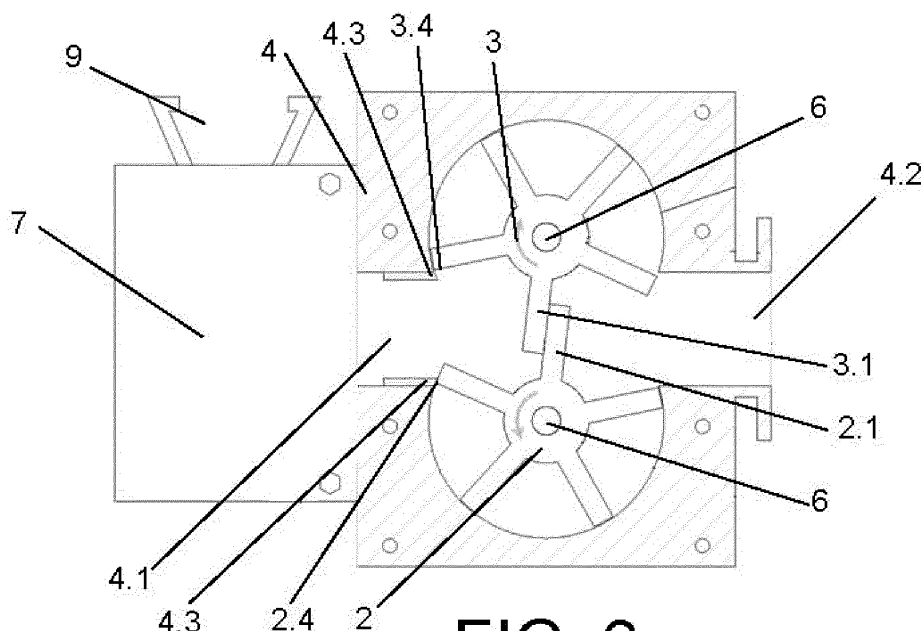


FIG. 3

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Description

Technical field

[0001] The present invention relates to the industry dedicated to the transfer of a viscous mass with suspended elements, more specifically to the pump used to drive said viscous mass, for example, an olive paste with suspended olive pits, which is driven from a thermomixer to a decanting centrifuge in order to obtain oil in oil factories also called oil mills.

State of the art

[0002] In oil mills, the process of extracting oil starts with the olive that, after a crushing process carried out in a mill, is poured into a thermomixer where it is mixed with water to form an "olive mass" that is subsequently taken to a centrifuge for its separation and oil extraction. To do so, a drive system that takes the olive mass with a high pit content from the thermomixer to the decanting centrifuge or decanter is required.

[0003] Different types of drive pumps are used for this purpose, such as piston pumps in which it is difficult for clogging to occur; however, in pumps of this type the flow is not constant, which is a necessary requirement for the decanter to operate correctly. Therefore, said pump is not optimal for this purpose.

[0004] Another pump used for the same purpose is the gear pump, which in this case has a continuous flow, but with continuous blockage problems at the inlet and between the teeth, due to the fact that the olive pits present in the viscous olive mass cause pumps of this type to become clogged and blocked. Therefore, said pumps are rejected and used exclusively for fluids of a certain viscosity, but without suspended solid elements.

[0005] The use of lobe pumps is also known, which provide a constant flow to the decanter and do not allow foreign metallic bodies, such as screws or sheet metal of different kinds, to pass during the transfer. However, in practice it has been found that frequent internal clogging occurs due to the olive pits present in the viscous olive mass. This circumstance makes it necessary to stop the production line to clear the clogging, which normally requires disassembling the pump to eliminate said clogging and its subsequent assembly to start up again. These problems slow down production, resulting in economic losses that cause most oil mills to reject them.

[0006] Helical screw pumps are another drive system usually used. Pumps of this type have the advantage of driving viscous mass with a large amount of suspended solids. However, pumps of this type show gradual wear of the stator, such that over time they lose flow, and when this wear is very significant, the stator must be completely replaced, this being a complicated and expensive task and requiring regular maintenance that increases economic costs. But, moreover, they entail an even bigger problem, which is that they allow the passage of unwanted

solids, such as the aforementioned screws or sheet metal, which would pass into the decanter. These elements can damage the decanter and cause breakdowns that require very costly repairs, and in the event of serious breakdowns, the decanter will remain unusable for a long period of time since it requires very complex and labour-intensive repairs.

[0007] In view of the described drawbacks or limitations of the currently existing solutions, a solution is needed that allows viscous mass with suspended elements to be driven without clogging and that prevents the entry of foreign metallic bodies, while at the same time providing a continuous flow.

Object of the invention

[0008] In order to meet this objective and solve the technical problems discussed so far, in addition to providing additional advantages that can be derived later, the present invention provides a drive pump for viscous mass with suspended solid elements having a determined maximum size, comprising a drive wheel and a driven wheel accommodated in a pump body with an inlet and an outlet for the viscous mass, wherein when a tooth of the drive wheel is in contact with a tooth of the driven wheel, the minimum distance between the tooth of the drive wheel and the tooth of the driven wheel allows accommodation with play of a suspended solid element of the viscous mass.

[0009] Maximum size of the suspended solid elements is taken to mean the maximum size of the elements measured by taking a sample of the viscous mass. In oil mills, said maximum size would correspond to the average size of an olive pit split by the mill upstream of the drive pump inlet, and an average dimension between 4 and 6 mm, preferably 5 mm, can be taken as said size of a split olive, this not being a limiting example. The drive pump object of the present invention can be used to drive any viscous mass with suspended elements of a known size.

[0010] Minimum separation distance between teeth is taken to mean the minimum distance between opposing surfaces of a tooth of the drive wheel and an adjacent tooth of the driven wheel, at the moment when contact occurs between a tooth of the drive wheel and a tooth of the driven wheel, where adjacent tooth of the driven wheel is understood to be the tooth following the first tooth of the driven wheel that comes in contact with the drive wheel, such that it allows passage with play of suspended elements, of a split olive pit in this particular case.

[0011] As mentioned, a non-limiting example of implementation would be in an oil mill in which the viscous olive mass contained in the thermomixer, resulting from crushing and the addition of water, must be driven towards a decanting centrifuge or decanter. Due to the configuration of this drive pump, which establishes said minimum separation distance between teeth, clogging of the pump is avoided since it has accommodation with suffi-

cient play for the suspended elements, the maximum size of a split olive pit in this case, to circulate without blocking the rotation of the pump wheels.

[0012] This minimum separation distance also allows free movement of the driven wheel relative to the drive wheel, with which the contact tooth of the driven wheel can move forward relative to the tooth of the drive wheel. In this way, the loss of contact between teeth is possible due to the presence of some suspended solid element accommodated therebetween, forcing the driven wheel to move forward freely due to the thrust produced by a solid element that in turn is driven by the tooth of the drive wheel. Therefore, it is possible to adapt at all times to the size and amount of elements present in said separation area between teeth, thus avoiding the locking of wheels that could occur in gear or lobe pumps in which there is no such play between teeth.

[0013] Therefore, maintenance work and stoppages are reduced, and production is increased by avoiding stoppages that could arise from clogging caused by the locking of the wheels when the olive pits are jammed between the teeth or between a tooth and the pump inlet. This in turn allows a continuous flow of the viscous olive mass required for the proper functioning of the decanter.

[0014] According to a feature of the invention, the pump body where both drive wheels are accommodated comprises therein, at the pump inlet, at least one edge-shaped projection that provides a cutting effect when a cutting ridge also passes on the edge of the tooth of a drive wheel and/or driven wheel.

[0015] Due to this configuration, when an olive pit is trapped at the pump inlet between the body and the wheel, instead of blocking the pump and causing it to stop, said pit is split again and the wheel continues to rotate without clogging, in addition to reducing the size of the split pit that avoids major problems in the transfer of the viscous olive mass through the pump. In this way, unnecessary stoppages that increase maintenance work and, consequently, production costs are avoided.

[0016] Furthermore, this configuration allows that when there are foreign elements in the viscous mass such as metallic elements such as screws or sheet metal, in their interaction between the pump projection and the wheel ridge, a retention effect of said elements that remain trapped is provided, causing the pump to stop. This situation protects the decanter from breakdowns by preventing elements of this type from reaching its interior.

[0017] In order to remove these foreign elements that would be retained at the inlet or to carry out other maintenance tasks, it is envisaged that the pump comprises, prior to the inlet and in connection with the same, a maintenance drawer with at least one access to its interior, preferably in the form of covers. This configuration makes it possible to access the position of the pump in which the foreign elements to be removed to clear up the clogging would be retained. Thus, the need to disassemble the pump is avoided, saving on stoppage times.

[0018] Preferably, it is envisaged that said maintenance

drawer comprises a tap for supplying water to the interior that will facilitate the cleaning tasks of the pump without disassembling same.

[0019] According to another feature of the invention, the pump body includes a front cover that allows the axle to be removed from the wheels, which allows for its easy assembly and maintenance.

Description of the figures

[0020]

Figure 1 shows a schematic view of an oil mill installation with a drive pump object of the present invention.

Figure 2 shows a perspective view of the pump object of the invention.

Figure 3 shows a schematic front view of the drive pump with a section for showing the interior of the drive pump.

Figure 4a shows a detailed view of a pump of the state of the art with the viscous mass with suspended solid elements.

Figure 4b shows a detailed view like the previous one for the drive pump object of the invention.

Figures 5a, 5b and 5c show a detailed view of the pump in different embodiments of the invention to achieve the minimum play necessary to avoid clogging.

Figure 5d shows a detailed view in which a pit is lodged between a tooth of the driven wheel and a tooth of the drive wheel at the moment of contact.

Figure 6 shows a schematic perspective view of the drive pump in which a partial section has been made for showing a clogging situation with a metallic element.

Figure 7 shows a schematic and enlarged detailed view of the interaction of an internal projection of the pump and the ridge of a wheel tooth with an olive pit.

Figure 8 shows a perspective view of a detail of the pump which shows a front cover that accommodates seals for the axles of the pump wheels.

Detailed description of the invention

[0021] In light of the aforementioned figures, and in accordance with the adopted numbering, one may observe therein a preferred exemplary embodiment of the invention, which comprises the parts and elements indi-

cated and described in detail below.

[0022] Figure 1 shows a practical exemplary embodiment of the drive pump (1) object of the present invention for an oil extraction mill. Thus, as shown in said figure 1, crushing occurs in a mill (14) and it is sent to a thermomixer (9) where it is mixed with hot water to form a viscous mass that comprises suspended solid elements having a determined maximum size, in this case the solid element (12) being a split olive pit, and an average size of the split pit being considered to be 5 mm.

[0023] Said viscous mass of olive paste must be taken to a decanting centrifuge or decanter (10) in which the olive pits (12), the water and the final oil are separated. For this purpose, a drive pump (1) is provided which, through a conduit, sucks the olive paste contained in the thermomixer (9) and sends it through another conduit to the decanter (10) with a continuous flow.

[0024] This drive pump (1) consists of a pump body (4) preferably eight-shaped and inside of which a drive wheel (2) driven by a motor (11) and a driven wheel (3) are accommodated, the olive mass arriving from the thermomixer (9) towards said drive wheels (2, 3) through an inlet (4.1) and exiting towards the decanter (10) through an outlet (4.2).

[0025] These gear-shaped wheels (2, 3) comprise teeth that drive the olive mass; however, in this transfer, as occurs in gear pumps, the olive pits (12) can get stuck between the teeth and cause the pump to stop. This situation can be seen in figure 4a of a gear pump from the state of the art, in which it can be seen how the olive pits (12) get stuck between the teeth (2.1, 3.1, 3.2, 2.2). As can be seen in figure 4b of a practical embodiment of the invention, due to the configuration of the drive pump (1), there is a separation between teeth (2.1, 3.2) that allows passage with play of an olive pit (12).

[0026] Said configuration is achieved by determining a minimum separation (5) between a first tooth (2.1) of the drive wheel (2) and an adjacent tooth or second tooth (3.2) of the driven wheel (3), at the moment when the first tooth (2.1) is in contact with a first tooth (3.1) of the driven wheel (3) during the rotation of the wheels (2, 3). In the practical case represented in the figures, in addition to said contact between the first tooth (2.1) of the drive wheel (2) and the first tooth (3.1) of the driven wheel (3), there is simultaneous contact between the second tooth or tooth adjacent to the previous one (2.2) of the drive wheel (2) and a second tooth or tooth adjacent to the previous one (3.2) of the driven wheel, (figure 4b). Therefore, a separation is established between a first tooth (2.1) of the drive wheel (2) and an adjacent tooth (3.2) of the driven wheel.

[0027] As can be seen in figure 5d, in the event that there is a pit between the teeth (2.1) and (3.1), the minimum distance (5) would be distributed between both sides of the tooth (2.1), due to the free movement of the driven wheel (3) relative to the drive wheel (2), adapting at all times to the size and amount of pits present, being, in this case, the pit (12) itself that which transmits the

movement to the tooth (3.1) of the driven wheel (3), being thrust by the tooth (2.1) of the drive wheel (2) and thus avoiding the locking of the wheels (2, 3).

[0028] In order to determine said minimum separation (5) according to a design option represented in figure 5a, it is envisaged that the number of teeth of the wheels (2, 3) relative to a number of teeth of a typical gear pump with the same features is reduced. In this way, there is a minimum separation (5) that allows an olive pit (12) to be transferred with sufficient play so that it does not get stuck between the teeth (2.1) and (3.2). According to an example of this embodiment, the minimum number of teeth was considered to be five, as can be seen in figure 3.

[0029] According to another design option, as can be seen in figure 5b, to determine the minimum separation (5) between the first tooth (2.1) of the drive wheel and the second tooth or adjacent tooth of the driven wheel (3.2), it is envisaged that the distance of the axles (6) of both wheels (2, 3) relative to the distance of a typical gear pump with the same features is increased. In this way, the minimum separation (5) that allows passage with play of an olive pit (12) is achieved, while ensuring continuous contact between teeth that guarantees a continuous flow of the olive mass.

[0030] As can be seen in figure 5c, another design option to define the minimum separation (5) between teeth is to decrease the thickness of the teeth.

[0031] In the three previous examples, said minimum separation (5) was considered as the separation defined by the chord length of the arc formed by the end ridge (2.3) of the tooth (2.1) of the drive wheel (2) on its path to the adjacent tooth (3.2) of the driven wheel (3). This separation (5) will be the separation required to adapt to the needs of each type of mass to be driven, choosing in each case the number of teeth of the rotors, their length, the distance between axles and the section of each tooth, the aforementioned alternatives being combinable to determine the suitable separation (5), being able to increase said minimum distance (5) to a greater separation in order to allow the passage of a large amount of olive pits (12). The option of a practical embodiment is also contemplated in which only a single tooth of the drive wheel (2) and a single tooth of the driven wheel (3) make simultaneous contact, without producing simultaneous contact of four teeth, in pairs of two, so that the minimum separation (5) will be defined as the minimum distance marked from the perpendicular to the longitudinal axis of the first tooth of the drive wheel (2) to the adjacent tooth (3.2) of the driven wheel (3).

[0032] According to the practical embodiments represented, the teeth of the wheels (2, 3) will preferably be in the shape of rectangular blades, without this being a limiting configuration, and they may for example be rectangular with a rear chamfer that better guarantees that there is contact between the ridge of one wheel and the surface of another, which provides a continuous flow without knocking, or a rounded rear ridge that minimises friction. Any type of tooth geometry can be used as long

as the invention's requirements of a constant flow and a minimum play between teeth are met.

[0033] According to an alternative embodiment of the invention, it is envisaged that the pump body (4) comprises therein an edge-shaped projection (4.3) that provides a cutting effect when a cutting ridge (2.4, 3.4) of the tooth (2.1, 3.1) passes, which, in the event of coinciding with an olive pit (12), splits it and avoids clogging, producing a mill effect, (figure 7).

[0034] Said projection can be formed in the pump body (4) itself, or be an attachment such as a plate with a cutting edge at its end (4.3) and fixed to the pump body (4). This final design alternative allows it to be replaced in case of deterioration.

[0035] This projection configuration (4.3) is advantageous for preventing the entry of foreign elements into the pump that could reach the decanter (10), since in the event that, for example, a screw (13) reaches the inlet (4.1) of the pump (1) as can be seen in figure 6, said screw would be retained between the projection (4.3) and the tooth (2.1), intentionally blocking the pump (1) since, by not being able to split it, the wheels would lock and stop the motor. Therefore, said screw (13), which would be removed manually, does not enter the interior.

[0036] According to an alternative of the invention, for maintenance work and especially for removing the foreign elements that block the pump (1), such as the aforementioned screw (13), it is envisaged that the drive pump (1) comprises a maintenance drawer (7) that has access to its interior. Preferably, said access will be through at least one cover (7.1). Due to this configuration, it will not be necessary to disassemble the drive pump (1), it only being necessary to remove the corresponding cover (7.1) of the maintenance drawer (7).

[0037] Additionally, said maintenance drawer (7) will have a cleaning tap (8) or water inlet that will facilitate the cleaning of the pump (1) without having to disassemble it.

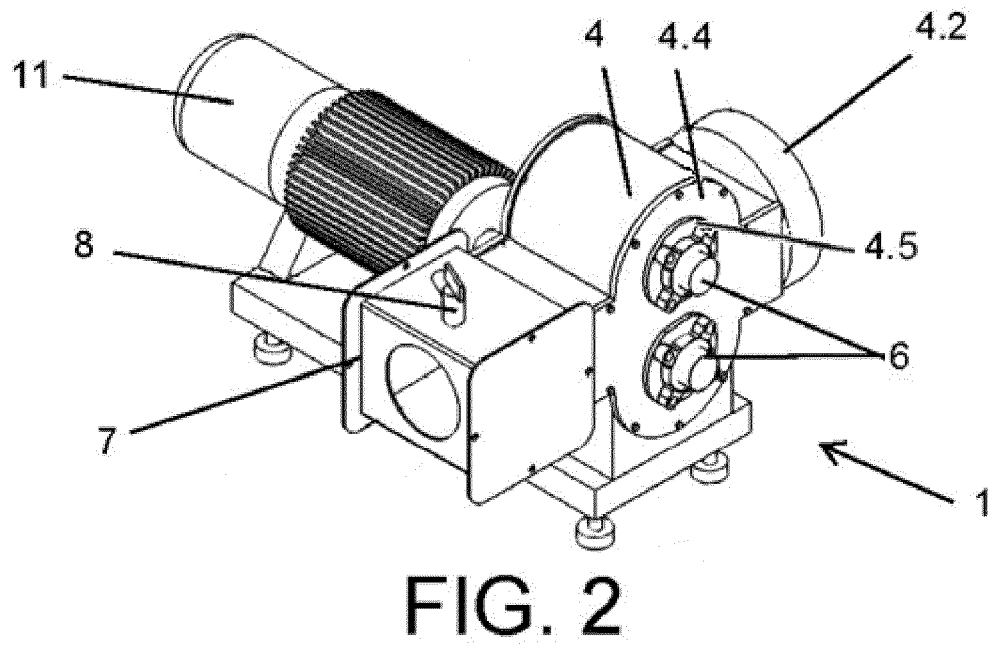
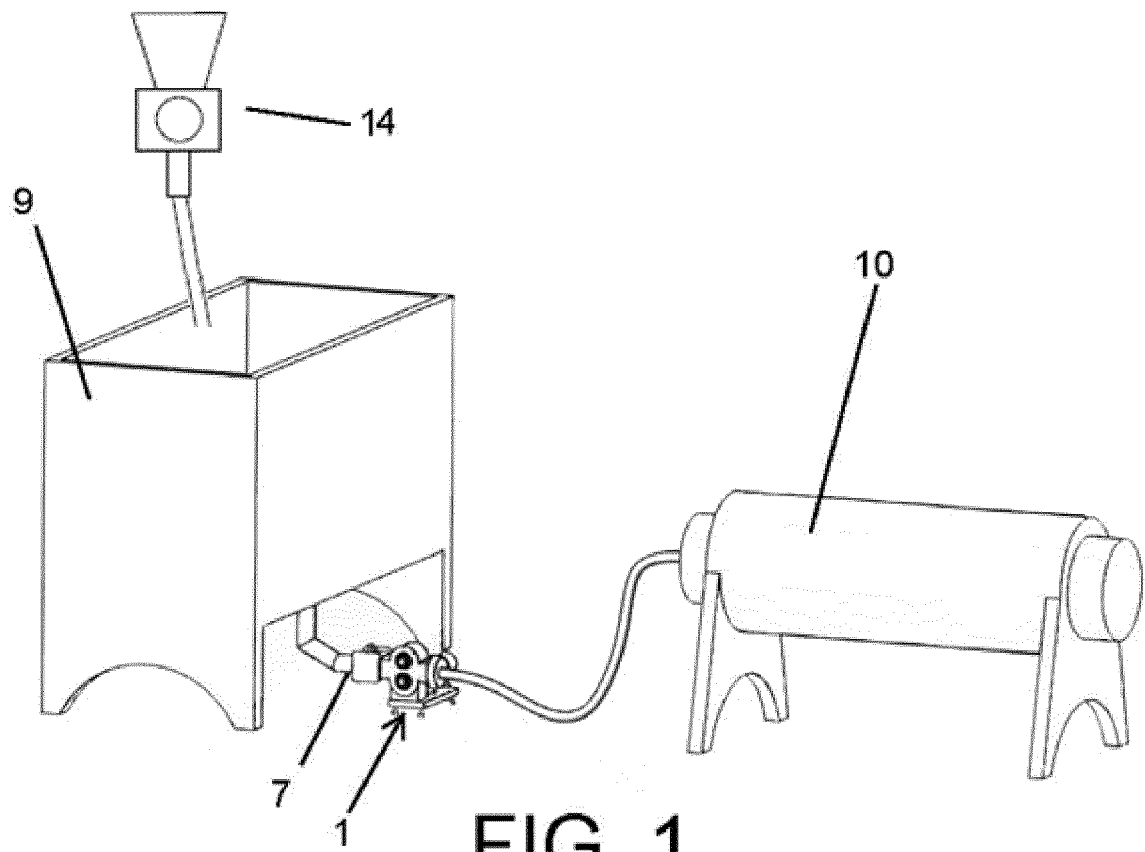
[0038] According to a design option, as can be seen in figures 2 and 8, the pump body (4) comprises a front cover (4.4), which allows the axles (6) to be removed from the wheels (2, 3). The pump body (4) will be closed by said front cover (4.3) by means of screws, said cover comprising respective seals (4.5) with a corresponding gasket to ensure its airtightness. In this way, the removal of the axles (6) is allowed, anchoring the axles (6) to the front cover (4.4) by bearings (4.6). The configuration of both this front cover (4.4) and the pump body (4) may be eight-shaped as shown in figures 2 and 8 or have any other geometry, such as the rectangular geometry shown in figures 3 and 6.

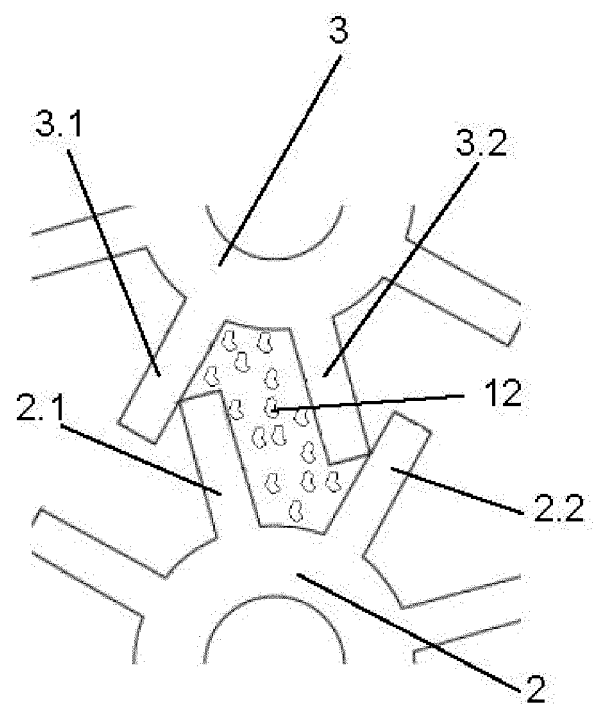
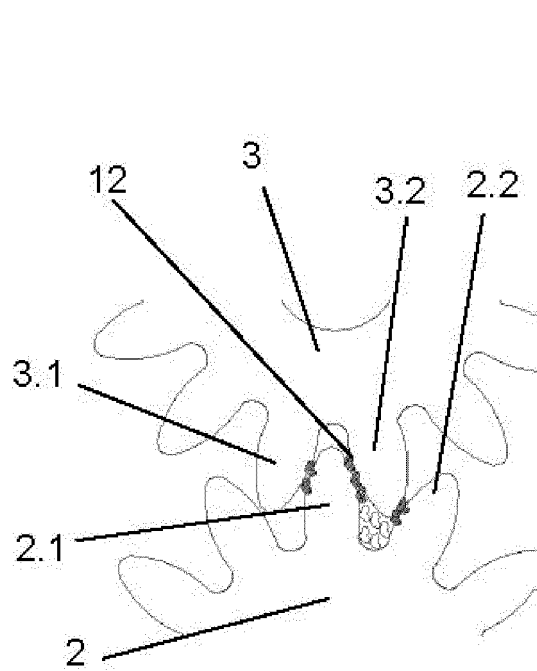
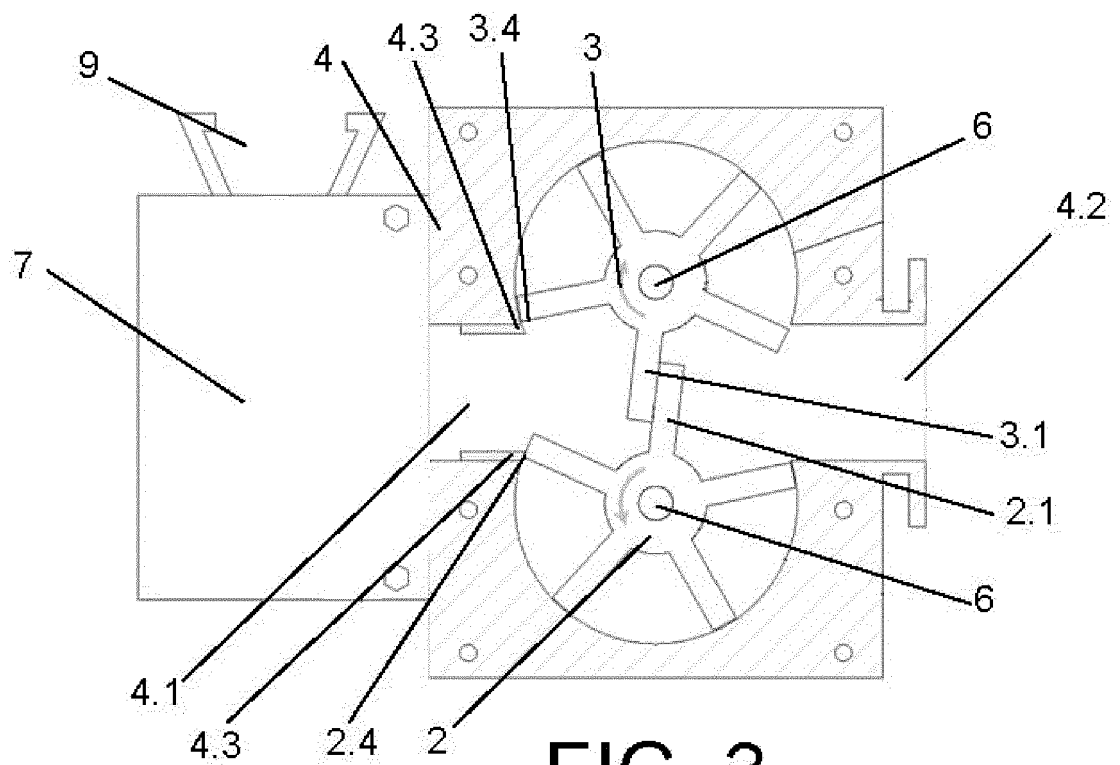
accommodated in a pump body (4) with an inlet (4.1) and an outlet (4.2) for the viscous mass, **characterised in that** when a tooth (2.1) of the drive wheel (2) is in contact with a tooth (3.1) of the driven wheel (3), the minimum distance (5) between the tooth (2.1) of the drive wheel (2) and the adjacent tooth (3.2) of the driven wheel (3) allows accommodation with play of a suspended solid element (12) of the viscous mass.

2. The drive pump (1) according to claim 1, **characterised in that** the pump body (4) comprises therein, at the inlet of the pump (1), at least one edge-shaped projection (4.3) that provides a cutting effect when a cutting ridge (2.4, 3.4) passes on the edge of the tooth of a wheel (2, 3).
3. The drive pump (1) according to any one of the preceding claims, **characterised in that** upstream of the pump inlet (4.1) it comprises a maintenance drawer (7) connected to the pump inlet (4.1), with at least one access to its interior.
4. The drive pump (1) according to the preceding claim, **characterised in that** the maintenance drawer (7) comprises a cleaning tap (8).
5. The drive pump (1) according to any one of the preceding claims, **characterised in that** the pump body (4) comprises a front cover (4.4) that allows the axles (6) to be removed from the wheels (2, 3).

Claims

1. A drive pump (1) for viscous mass with suspended solid elements having a determined maximum size, comprising a drive wheel (2) and a driven wheel (3)





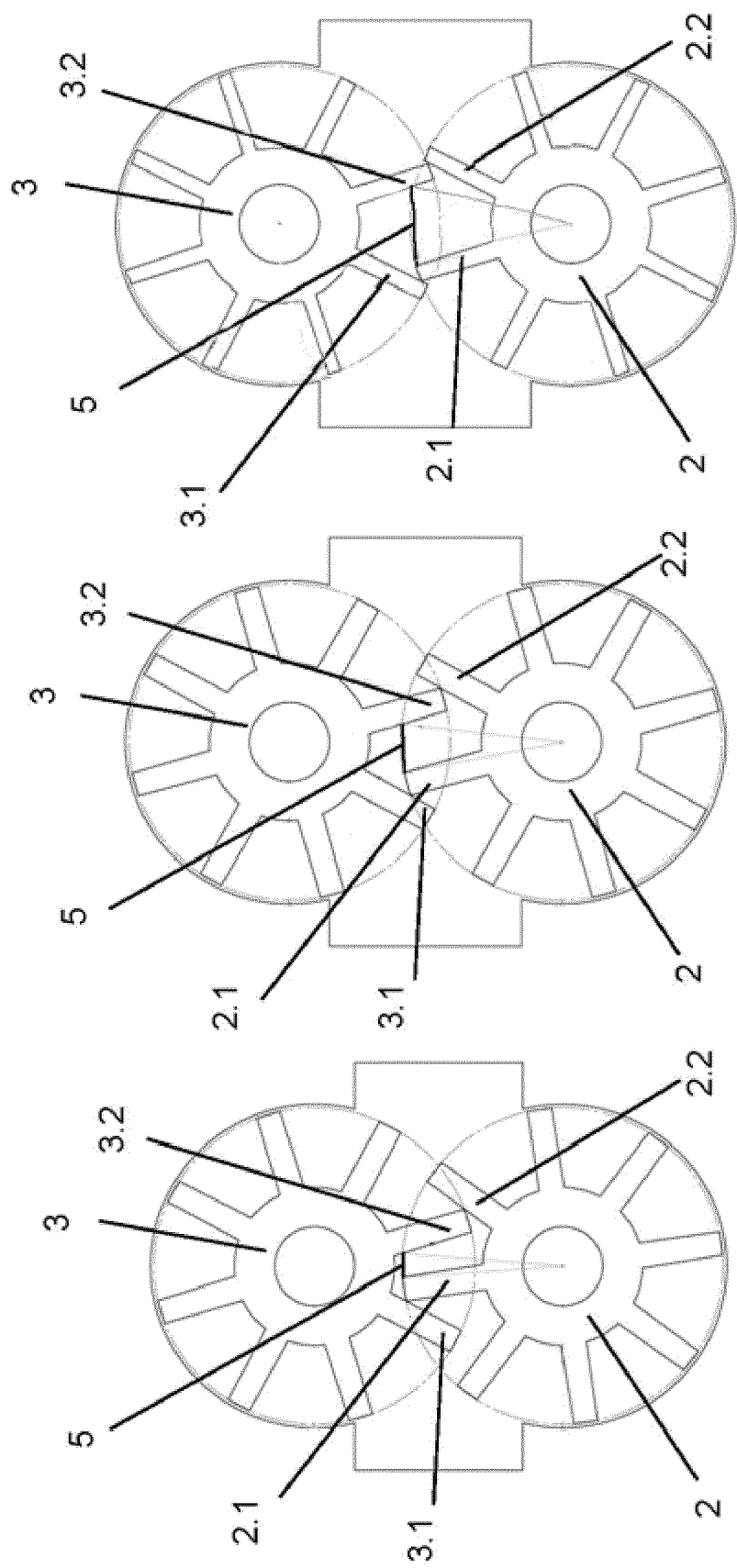


FIG. 5c

FIG. 5b

FIG. 5a

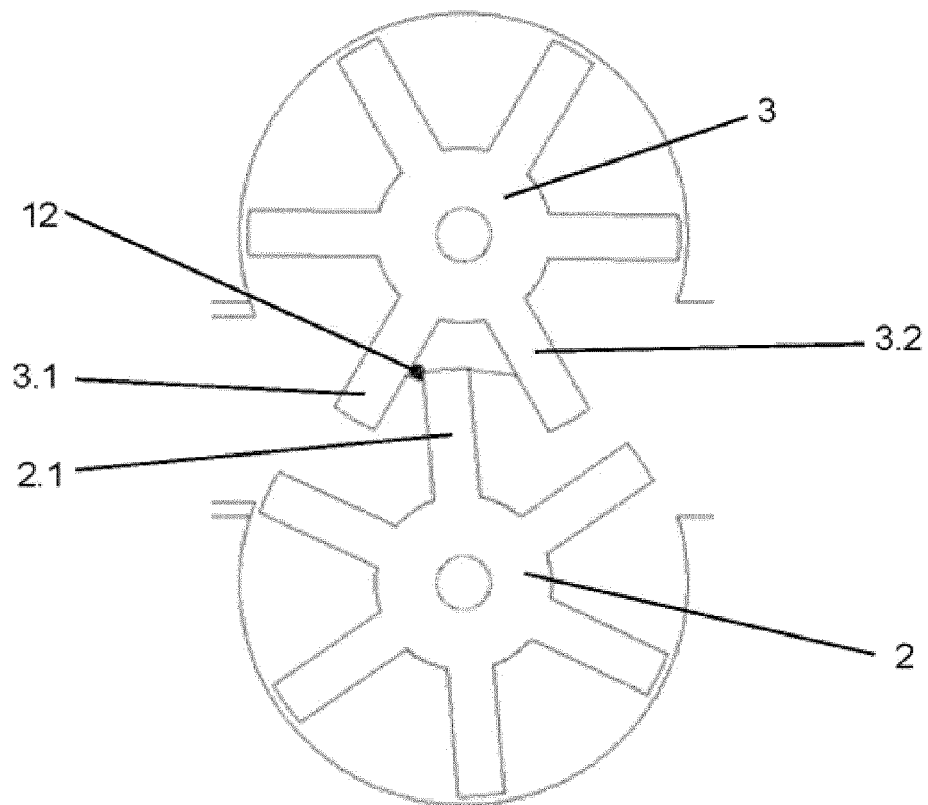


FIG. 5d

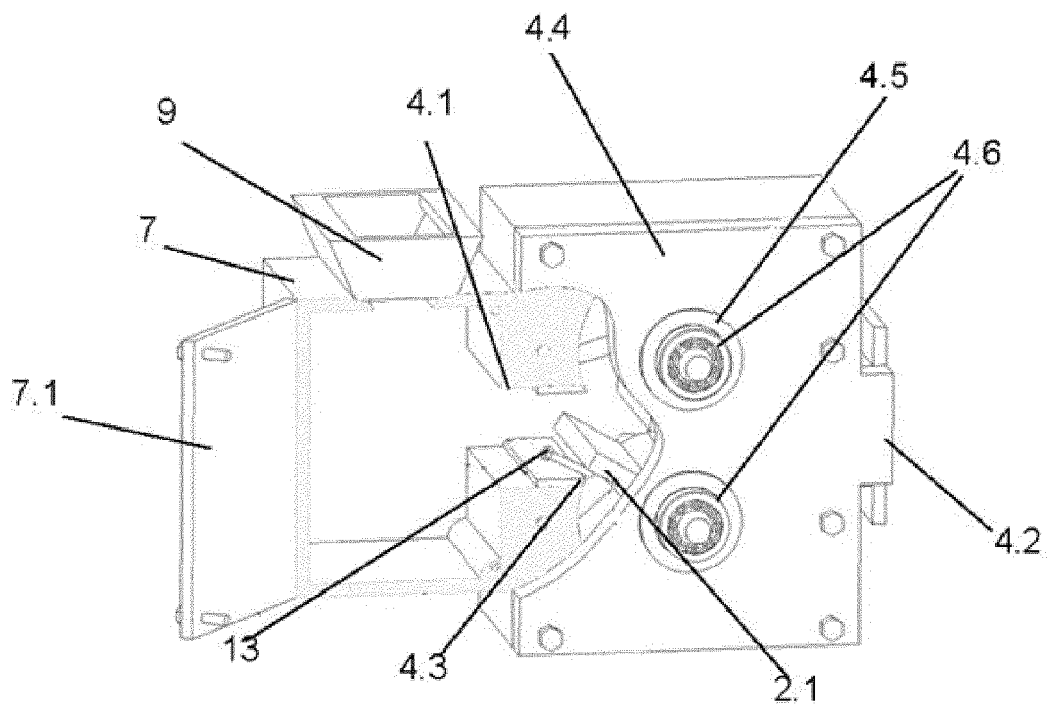


FIG. 6

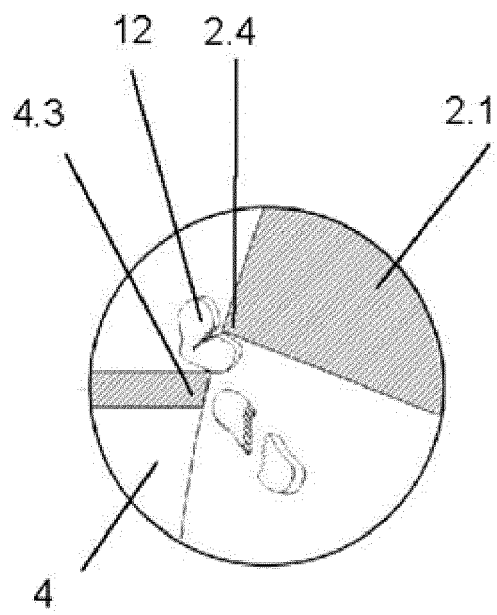


FIG. 7

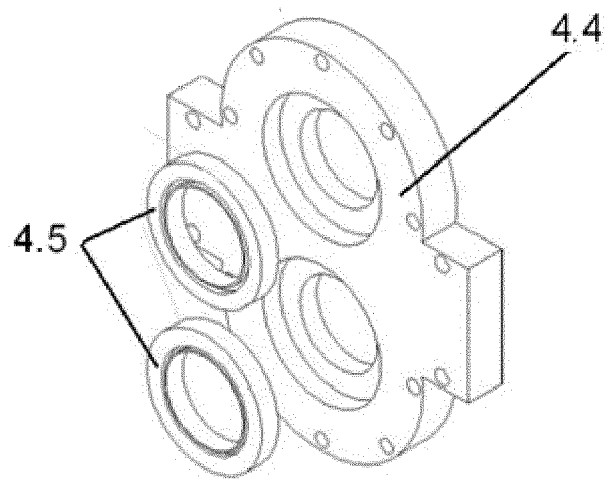


FIG. 8



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Place of search Munich		Date of completion of the search 11 October 2023	Examiner Descoubes, Pierre
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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