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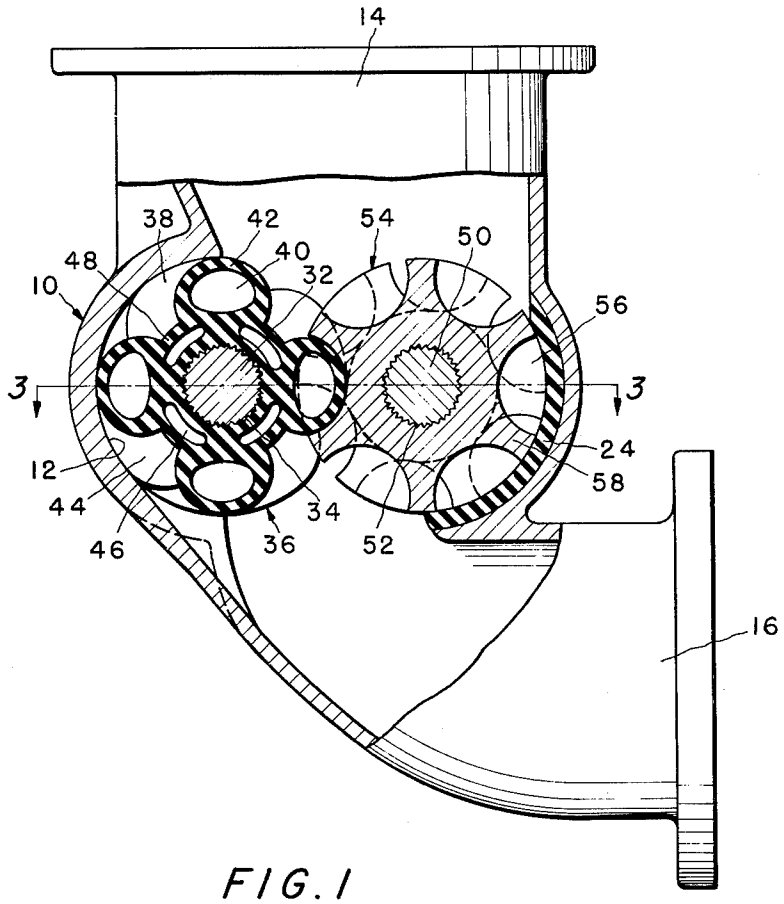


FIG. 1

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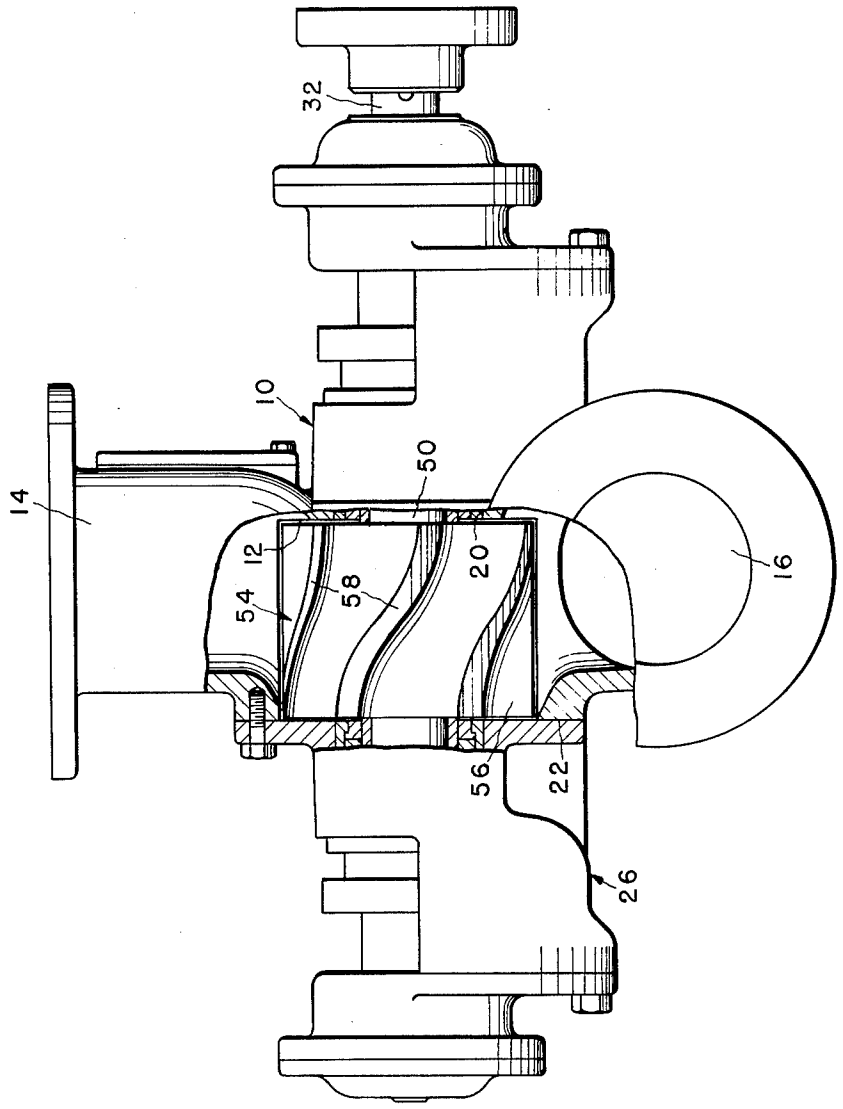


FIG. 2

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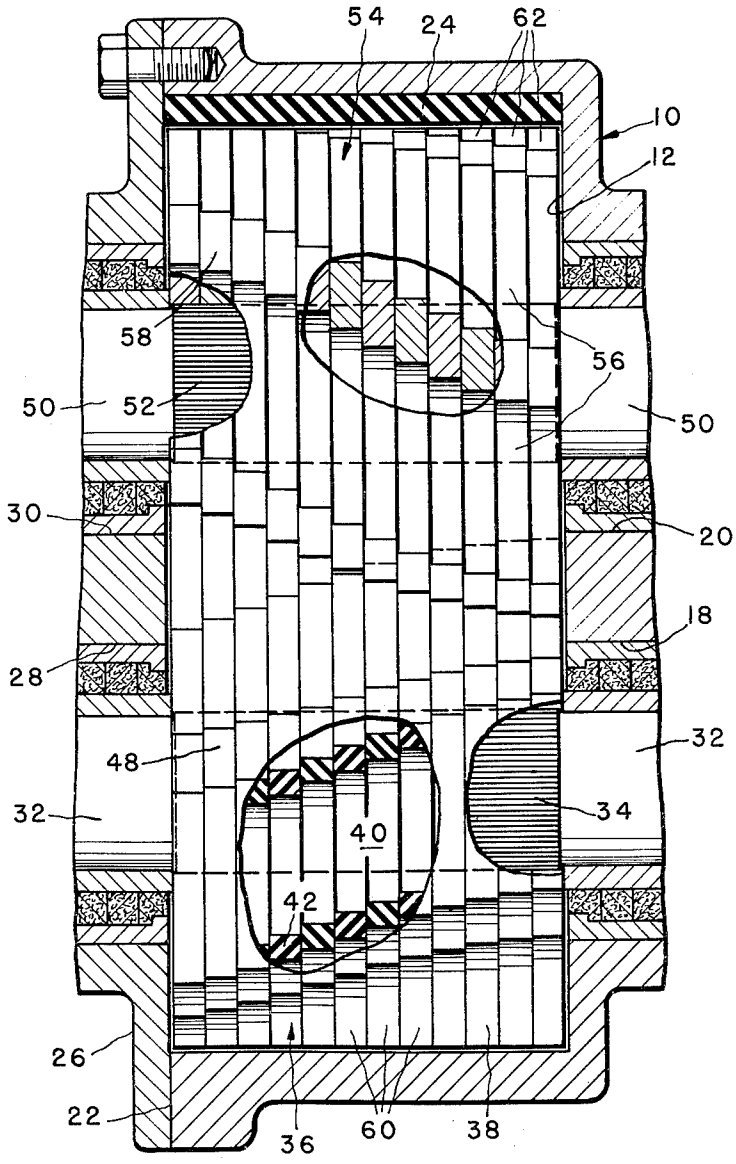


FIG. 3

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This invention relates to positive displacement fluid pumps and more specifically to those of the lobe type.

Lobe type pumps are used primarily for semi-liquids such as sludge, paper manufacturing wastes, etc. However, these pumps also must be capable of pumping almost pure liquids. In addition, it is desirable to have a pump capable of pumping semi-liquids having solids or semi-solids larger than the receivers in the rotors without clogging the pump.

An object of this invention is to provide a lobe type pump in which the rotor members are self timing.

Another object of this invention is to provide a lobe type pump incorporating anti-clogging features for handling semi-liquids.

Still another object of this invention is to provide a lobe type pump for handling semi-liquids also adapted to handle almost pure liquids.

These and other objects of the invention will become apparent by referring to the following description and the accompanying drawings in which

FIGURE 1 is a side elevational view of a pump in accordance with the invention in which a portion of the casing has been removed to illustrate the internal components thereof,

FIG. 2 is a front elevational view of FIG. 1 having a portion of the casing removed, and

FIG. 3 is a sectional view looking in the direction of the arrows and taken along line 3—3 of FIG. 1 illustrating modified rotor components.

Referring now to the drawings, the pump has a casing 10 with a passage therethrough forming a pump chamber, with a non-resilient wall 12 divided into an inlet chamber 14 and a discharge chamber 16 by the intermeshing rotors 36 and 54. The other wall 24 of the pump chamber is resilient. One side of the casing 10 is open and has a finished face 22 which receives a flanged cover 26 having a pair of parallel bores 28 and 30 which are aligned with bores 18 and 20, respectively, in the case 10.

A drive shaft 32 having the usual power connection on one end is received in the bores 18 and 28 and is suitably packed to prevent leakage along its length. The drive shaft 32 has a splined portion 34 to receive a male drive rotor 36. The rotor 36 may be fixedly connected to the shaft 32 in any of the well known methods. The male rotor 36 has a series of spaced lobes 38 which extend helically from one end of the rotor to the other and are spaced by intervening recesses 44. Each of the lobes 38 has a passage or void 40 extending its full length which forms an outer wall 42 having a generally circular cross-sectional profile. Passages or voids 46 extending the length of the rotor 36 are spaced inwardly of the recesses 44 to form recess walls 48. The rotor 36 is formed of a resilient material and provides a running fit between the peripheral edges of the lobes 38 and the non-resilient wall 12 of the pump chamber.

A driven shaft 50 is received in the bores 20 and 30 and is also suitably packed to prevent leakage along its length. The shaft 50 has a splined portion 52 for receiving a female rotor 54. The female rotor 54 is of a generally circular cross-sectional shape with a series of spaced semi-circular peripheral pockets which extend helically from one end of the rotor to the other and form intervening walls 58. The semi-circular recesses or pockets

56 are so formed as to receive the various lobes 38 of the male rotor 36. The lobes 38 of the male rotor 36 and the semi-circular recesses 56 of the female rotor 54 are so pitched that there is always a full contact between lead portion of one of the resilient walls 42 of a lobe 38 with a portion of the surface of the corresponding recess 56 prior to the time that the lagging portion of the previous lobe leaves the preceding recess. It is the full contact of the lobe surface 42 of the male rotor 36 with the surface of the pockets 56 in the female rotor 54 which permits the use of a resilient material for the drive rotor and alleviates the requirements for timing gears. The resilient wall 24 of the pump chamber is adjacent to the periphery of the female rotor 54 and forms a running fit therewith.

As the pump operates, the male drive rotor 36 is driven counter-clockwise and the female rotor 54 is rotated clockwise relative to FIG. 1 of the drawings. The fluids or semi-fluids to be pumped are received from the inlet chamber 14 and are carried by entrapments, formed by the lobes 44 of the male rotor cooperating with the non-resilient wall 12 and the recesses 56 of the female rotor cooperating with the resilient wall 24, into the discharge chamber 16. The various lobes 38 and recesses 56 intermesh and return into the inlet area to receive additional fluid. Should some solid matter received in one of the recesses 44 be larger than the entrapment formed by the resilient walls 42 and 48 of the rotor 36 and the non-resilient wall 12 of the pump chamber, the wall 42 or 48 will deflect due to its resiliency and the passage or void 46 adjacent thereto. Should a solid or semi-solid substance extend across one of the lobes 38, the flexible wall 42 will deflect inwardly due to its resiliency and the pocket 40 adjacent thereto thus permitting the rotor to carry the oversize solid or semi-solid substance from the inlet to the outlet. Deflection of the resilient wall 24 on the other side of the pump housing adjacent to the female rotor 54 permits the portage of substantially larger solid or semi-solid materials by that rotor without jamming the pump.

A modified rotor construction is shown in FIG. 3 wherein the drive rotor 36 is formed of a series of plate members 60 each having the same profile and pockets 40 and 46 therein. The plates 60 are then mounted on the shaft 32 in a serially stepped relationship to one another thus providing the helical extension of the running lobes 38 from one end of the formed rotor to the other. The female rotor 54 is similarly formed of a series of plate portions 62 each being profiled as are the others and having a series of peripheral recesses 56. These plates are also serially mounted on the shaft 50 in a stepped manner such that the recesses 56 extend helically around the rotor from one end to the other and are adapted to receive the stepped lobe portions 38 of the members 60 that form the modified male rotor.

Because of the resiliency of the mating surfaces between the rotors, and the rotors and pump housing respectively, very close or running contact fits may be used. This particularly adapts the pump for service with almost pure liquids in addition to preventing clogging of the pump.

Having thus described our invention, we claim:

1. A non-clog pump for handling liquids and semi-liquids, comprising a case having a flexible wall member capable of being deformed and a non-flexible wall member, a rotor member having helical lobes and a second rotor member having helical pockets to receive such lobes rotatably mounted in said casing and forming working chambers defined in part by said case, one of said rotors being flexible and capable of being deformed and the other rotor being non-flexible, said rotor members rotatable in opposite directions to one another and cooperating with said wall members to form entrapments for delivering liquids and semi-liquids from one

chamber to the other, said flexible rotor member in part in face to face relationship with said non-flexible wall member, said non-flexible rotor member in part in face to face relationship with said flexible wall member, such that the entrapments are formed between cooperating flexible and non-flexible members such that said entrapment may be enlarged by deformation of the flexible member, and said flexible rotor member capable of deforming when in mesh with said non-flexible rotor, said flexible rotor having a series of spaced helical passages therein closed off from the exterior of the flexible rotor forming peripheral walls of said lobes and the recesses formed therebetween, said flexible walls capable of being deformed into said such passages.

2. A non-clog pump for handling liquids and semi-liquids, comprising a case having a flexible wall member capable of being deformed and a non-flexible wall member, a rotor member having helical lobes and a second rotor member having helical pockets to receive such lobes rotatably mounted in said casing and forming working chambers defined in part by said case, one of said rotors being made of a flexible deformable material having passages therein to provide spaces for said material as it is deformed and the other rotor being constructed of a rigid material, said rotor members rotatable in opposite directions to one another and cooperating with said wall members to form entrapments for delivering liquids and semi-liquids from one chamber to the other, said flexible rotor member in part in face to face relationship with said non-flexible wall member, said non-flexible rotor member in part in face to face relationship with said flexible wall member, such that the entrapments are formed between cooperating flexible and non-flexible members such that said entrapment may be enlarged by deformation of the flexible member, and said flexible rotor member capable of deforming when in mesh with said non-flexible rotor, the lead portion of one of said helical lobes being adapted to fully engage the lead portion of one of the helical grooves prior to the withdrawal of the lag portion of the previous lobe from the previous helical pocket, the male rotor being the sole means for rotating the female rotor.

3. A pump for handling liquids and semi-liquids comprising a casing having a resilient wall member capable of being deformed and a non-resilient wall member, a resilient male rotor capable of being deformed rotatably mounted in the casing and having helical lobes extending from one end of the rotor to the other and having passages in the helical lobes extending from one end of the rotor to the other and closed off from the exterior of the rotor and recesses being formed between the helical lobes and having helical passages between the helical lobes inwardly of the recesses extending from one end of the rotor to the other and closed off from the exterior of the rotor and forming connecting walls between the helical lobes, a non-resilient female rotor rotatably mounted in the casing and having helical pockets to receive the helical lobes, part of the liquid being carried by the male rotor between the male rotor and the casing and part of the liquid being carried by the female rotor between the female rotor and the casing, the resilient male rotor in part in face to face relationship with the non-resilient wall member and the non-resilient female rotor in part in face to face relationship with the resilient wall member, the helical lobes being deformable into the first named passages and the connecting walls being deformable into the second named passages to allow solids or semi-solids to pass between the resilient male rotor and the non-resilient wall member and the resilient wall member being deformable to allow solids or semi-solids to pass between the non-resilient female rotor and the resilient wall member.

4. A pump comprising a casing, a first rotor having a series of spaced lobes extending helically from one end of such rotor to the other end thereof and forming recesses therebetween, a second rotor having a series of spaced peripheral pockets of substantially semi-circular cross sectional form and extending helically from one end of such rotor to the other end thereof and forming walls therebetween, the inter-meshing portions of one of said rotors being of a resilient deformable material, and the inter-meshing portions of the other of the rotors being of a rigid material fixedly secured to the rotor, said lobes and said pockets adapted to inter-mesh to form the interlock between the rotors in such a manner that the lead portion of one of said lobes substantially fully engages the lead portion of one of the pockets before the lagging portion of the preceding load moves out of full mesh with the preceding pocket, the male rotor being the sole means for rotating the female rotor and part of the fluid being carried by the male rotor between the male rotor and the casing and part of the fluid being carried by the female rotor between the female rotor and the casing, said one rotor formed of resilient deformable material having helically extending passages closed off from the exterior of the resilient rotor forming a series of peripheral walls capable of being formed into such passages.

5. A non-clog pump for handling liquids and semi-liquids, comprising a casing, a flexible wall member in said casing capable of being deformed, a rigid wall member in said casing, a rotor having lobes rotatably mounted in said casing, a second rotor having pockets to receive such lobes rotatably mounted in said casing, one of said rotors being constructed of a flexible deformable material and having passages therein to provide space for said flexible material as it is deformed, said flexible rotor cooperating with said rigid wall member to form a closed pocket, the other of said rotors being constructed of a rigid material and cooperating with the flexible wall member to form a closed pocket, said closed pockets being movable upon rotation of said rotors to deliver a liquid or semi-liquid.

References Cited in the file of this patent

UNITED STATES PATENTS

630,932	Rock	Aug. 15, 1899
870,311	Okamoto	Nov. 5, 1907
2,220,588	Thompson	Nov. 5 ,1940
2,258,371	Wernert	Oct. 7, 1941
2,325,617	Lysholm et al.	Aug. 3, 1943
2,349,022	Ungar et al.	May 16, 1944
2,362,106	Ungar et al.	Nov. 7, 1944
2,403,796	Hanna	July 9, 1946
2,467,524	Fernstrum	Apr. 19, 1949
2,567,699	Devlin	Sept. 11, 1951
2,633,083	Smith	Mar. 31, 1953
2,868,442	Nilsson	Jan. 13, 1959