A. G. M. MICHELL.

METHOD AND APPARATUS FOR PUMPING FLUIDS.

APPLICATION FILED AUG. 5, 1919.

1,421,976.

Patented July 4, 1922.

2 SHEETS—SHEET 1.

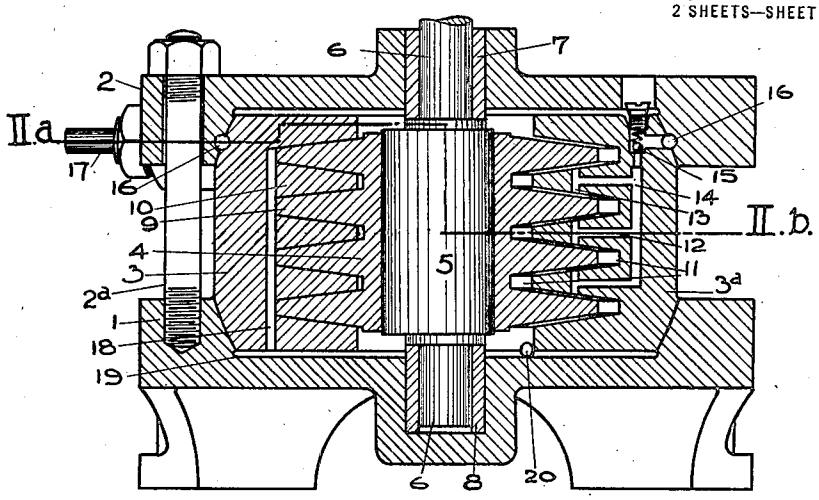


FIG. 1.

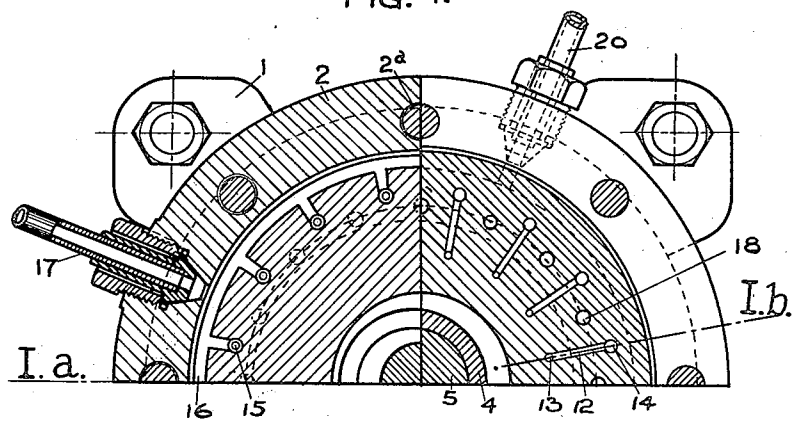


FIG. 2.

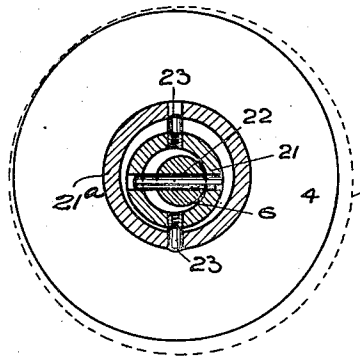


FIG. 3.

Witnesses

Norris L. Sumby.

Inventor

Anthony G. M. Michell,

by Norris L. Norris

Attorney.

A. G. M. MICHELL.

METHOD AND APPARATUS FOR PUMPING FLUIDS.

APPLICATION FILED AUG. 5, 1919.

1,421,976. Patented July 4, 1922.

2 SHEETS—SHEET 2.

FIG. 4.

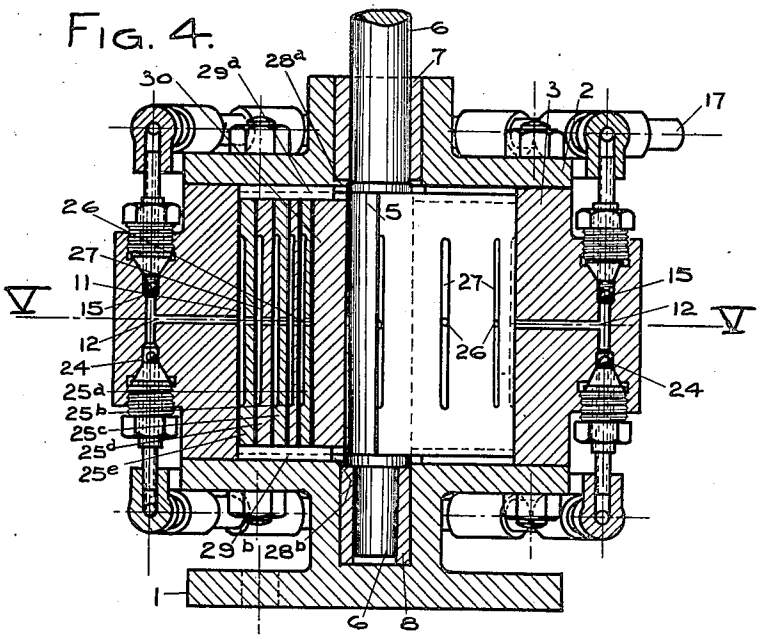
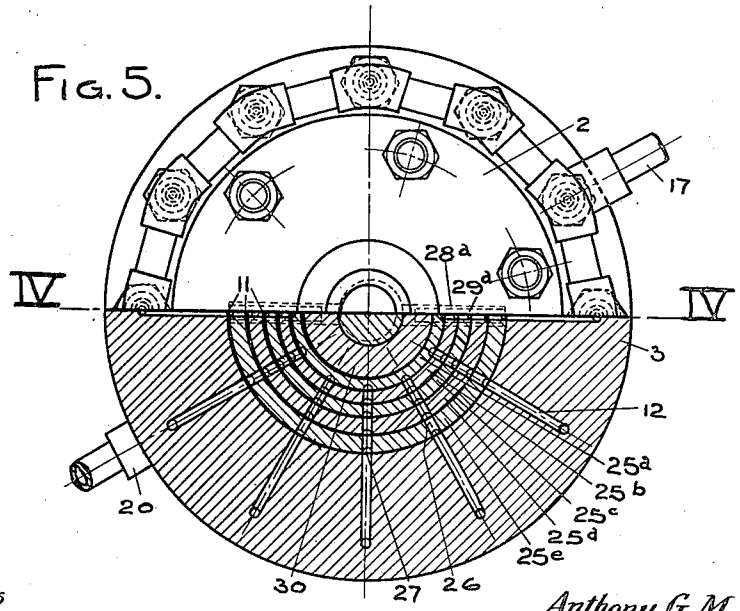


FIG. 5.



Witnesses

Norris L. Bumby.

Inventor

Anthony G. M. Michell,

by James L. Norris,

Attorney.

UNITED STATES PATENT OFFICE.

ANTHONY G. M. MICHELL, OF MELBOURNE, VICTORIA, AUSTRALIA, ASSIGNOR TO MICHELL BEARINGS LIMITED, OF WESTMINSTER, ENGLAND.

METHOD AND APPARATUS FOR PUMPING FLUIDS.

1,421,976. Specification of Letters Patent. Patented July 4, 1922.

Application filed August 5, 1919. Serial No. 315,476.

To all whom it may concern:

Be it known that ANTHONY GEORGE MALDON MICHELL, a subject of the King of Great Britain, and resident of 450 Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia, has invented certain new and useful Improvements in Improved Methods and Apparatus for Pumping Fluids, of which the following is a specification.

According to this invention the improved method of pumping fluid consists in utilizing the viscous resistance which fluid films oppose to change of thickness by means effecting the cyclic variation of one or more narrow interspaces between relatively moving parts the fluid being admitted to the interspace or interspaces in the form of a thin film.

During continuous motion of the walls of the interspace the thickness of the fluid film at any given point is cyclically varied causing generation of pressure in the film during that phase of the cycle in which the thickness of the film is diminished.

The apparatus is of rotary type, and the relative motions of the parts by which the thickness of the fluid film is varied as above stated, is as far as possible of the nature of rolling rather than of shearing or sliding. By this means the generation of unnecessary viscous resistance in the fluid film is avoided, or minimized.

Although pumps operating by the viscosity of fluids are already known, (e. g. the vacuum pump for rarefied gases known as the Gaede pump described in British patent specification No. 27457/1909 and the means for effecting pressure-lubrication described in the present applicant's Commonwealth Patent No. 1138/'16), in such appliances hitherto considerable pressures have only been generated by relatively rapid shearing or sliding motions whereby useless and deleterious resistances have been produced in the fluid, and such pumps have been correspondingly inefficient. One of the objects of the present invention is to render pumps of this class more economical in the application of power.

Another object of the present invention is the provision of co-acting surfaces in multiple whereby the capacity of the pump is proportionately increased.

In the drawings accompanying my provisional specification two practical types of construction incorporating the invention are shown.

Fig. 1 is an axial section of a pump of the first of these types, the section being taken along the radial planes marked 1^a, 1^b, in Fig. 2.

Fig. 2 comprises two partial transverse sections on planes marked 11^a, 11^b, respectively in Fig. 1, each section showing one-quarter of the pump.

Fig. 3 is a transverse section of an alternative method of connecting the impelling element of the pump to the driving spindle.

Fig. 4 is an axial section of a pump according to the second type of construction, being taken on the line IV—IV of Fig. 5.

Fig. 5 comprises a plan and partial transverse section on a plane marked V—V in Fig. 4, each view showing one-half of the pump.

The pump illustrated in Figs. 1 and 2 comprises a bed-plate 1, and cover 2, between which are clamped by bolts 2^a, the stationary elements (hereinafter termed collectively the stator) in halves 3, 3^a, and within which is contained a revolving or rolling element or rotor 4. The rotor is rotatably mounted on the eccentric 5 formed on the spindle 6, which is rotated at a high speed by power applied at its upper end. Bearings 7 and 8 for the spindle 6 are provided in the bed-plate 1 and cover 2 respectively being concentric with the stator 3, 3^a. The rotor 4 is furnished with several external flanges 9, which engage closely between corresponding internal flanges 10, formed on the stator halves 3, 3^a. Each of the flanges 9, 10, is of slightly greater thickness at its root, where it is attached to the rotor or stator, than at its free or distal portion, the faces of the flanges thus forming portions of very flat cones. For the sake of clearness in the drawing, this variation of thickness, and also the clearance spaces 11, between the rotor-flanges and stator-flanges and the eccentricity of the eccentric 5 are greatly exaggerated.

The stator-flanges 9—10 are formed with

a series of radial ducts 12, each communicating with ports 13 near the middle of the radial widths of the flanges, and also with longitudinal ducts 14, debouching through valves 15 into a circumferential canal 16, which leads to the discharge-pipe 17 of the pump. Another series of longitudinal ducts, 18 formed through the stator-flanges 10 near their roots, supplies the fluid to be pumped from the space 19 into the interspaces 11, whence the fluid is forced by the co-action of the rotor-flanges 9 and stator-flanges 10 into the ports 12. The intake-branch 20 admits the fluid from the external source of supply to the space 19

The rotor 4 being rotatably mounted on the eccentric 5, has its motion retarded by the viscosity of the fluid on the side where its flanges 9 engage most closely with the flanges 10 of the stator 3, 3^a, and thus revolves with a kind of rolling motion, the successive parts of the rotor periphery engaging in turn with the various parts of the periphery of the stator 3, 3^a, and forcing oil successively through the various ports 13, ducts 12, 14 and valves 15.

The necessary quasi rolling motion of the rotor 4 with respect to the stator-element 3, 3^a, may be imparted in other ways than that shown in Figs. 1 and 2. For instance as shown in Fig. 3, the rotor 4 may be caused to move eccentrically in the stator (indicated by the dotted line 3), with a combined rotary and rolling motion by being connected to the driving-spindle 6, through a suitable coupling. As shown in Fig. 3 the coupling consists of a loose sleeve 21, connected with the spindle 6 and rotor 4, by sliding pins designated by 22 and 23 respectively. The sleeve 21 is thus compelled to rotate at high speed with the spindle 6, but the rotor 4 is free to assume an eccentric position under the action of centrifugal force, and to rotate on its moving axis, so as to perform the same kind of rolling motion as already described in connection with Figs. 1 and 2. The construction shown in Fig. 3 is applicable not only to the pump illustrated in Figs. 1 and 2 but also to that shown in Figs. 4 and 5 which will now be described.

In this form also, the pump comprises a base-plate 1 and cover-plate 2, carrying bearings 7 and 8 respectively in which a spindle 6 revolves, formed with an eccentric 5. The stator 3 which is a hollow-cylinder concentric with the bearings 7 and 8, is provided with a series of radial ducts 12, communicating both with the delivery pipe 17 and intake pipe 20, through a series of delivery valves 15, and suction valves 24. The rotor element consists of a series of cylindrical sleeves, 25^a, 25^b, 25^c, 25^d, 25^e, fitted within one another in succession, and the last within the stator 3, with small clearances or interspaces (exaggerated in the drawing), and bored with a series of radial ducts 26 near the middle of their lengths. They may also be provided with a series of longitudinal grooves 27, intersecting the holes 26. The sleeves 25^a, 25^b, 25^c, 25^d, 25^e, and roller 30 described below, are prevented from rotating by having formed in them at the top and bottom slots 28^a, 28^b, engaging with keys 29^a, 29^b, in the cover 2 and base 1 respectively. The slots 28^a, 28^b, being wider than the keys 29^a, 29^b, respectively. The sleeves 25^a, 25^b, 25^c, 25^d, 25^e, are enabled to execute an eccentric quasi rolling motion with respect to one another and to the stator 3 without rotating bodily. They are impelled to perform this motion by the pressure of the roller 30, rotatably mounted on the eccentric 5, which acts successively at the various parts of their peripheries. By the co-action of the sleeves 25^a, 25^b, 25^c, 25^d, 25^e, with one another and with the inner surface of the stator 3, the fluid on account of its viscosity is drawn from the intake pipe 20, suction-valves 24, holes 12, 26, and grooves 27 to the interspaces 11 on one side of the pump, while fluid previously admitted to the interspaces 11, is forced by the same action from them through grooves 27, holes 26, 12, and delivery valves 15 on the other side to the discharge pipe 17.

It will be understood that the invention is not limited to the particular forms of pump hereinbefore described and illustrated, as it is evident that the means for cyclically varying the thickness of a fluid film, which constitutes the basic principle, can be carried out in apparatus of other analogous forms.

The essential character of the apparatus is the provision of closely fitting and co-acting surfaces which approach and recede from each other cyclically, so that a film of fluid bounded by such surfaces is subjected to rapid deformations or variations of thickness, whereby fluid pressure due to viscosity are generated in the film without excessive shearing resistances.

I claim—

1. A method of pumping consisting in cyclically varying the thickness of a film of the fluid to be pumped between closely fitting and relatively moving surfaces, whereby pressure, dependent on the viscous resistance of the fluid, is generated in the film during the portion of the cycle in which the thickness of the film is diminished.

2. A pump comprising a stationary element and a moving element having closely fitting opposed surfaces, means for communicating an eccentric motion of small amplitude to the moving element, and valve-elements by which fluid is alternately admitted to and abstracted from interspaces between the stationary and moving element.

3. A pump comprising an external stationary hollow cylinder one or more internal cylindrical sleeves, forming one or more thin cylindrical interspaces, and a central rotating element adapted to impart an eccentric motion to the inner or innermost sleeve, whereby the width of the interspace or interspaces, is cyclically varied at each point of the circumference, and the fluid therein subjected to cyclic alternations of pressure.

A. G. M. MICHELL.