Nov. 17, 1942. J. J. SERRELL 2,302,578

CENTRIFUGAL MACHINE

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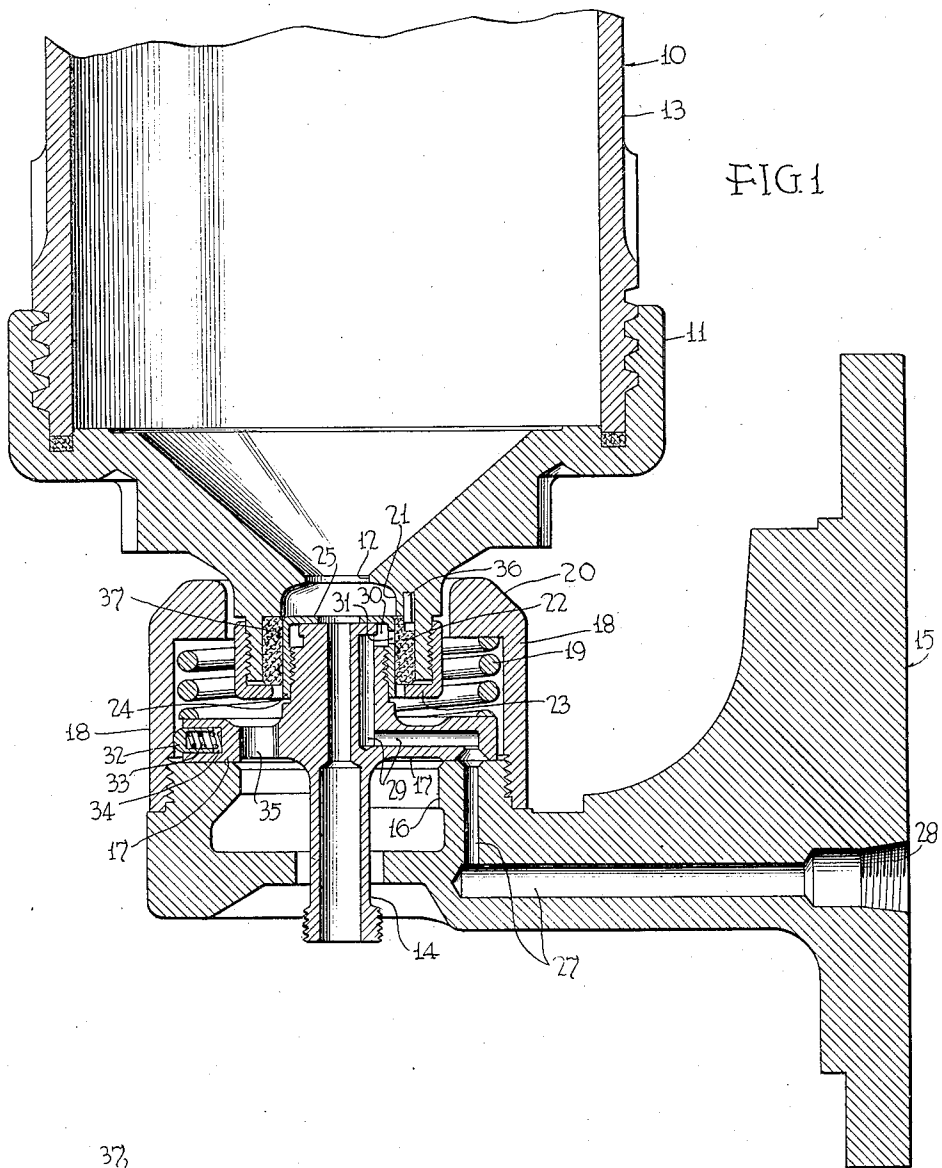


FIG. 1

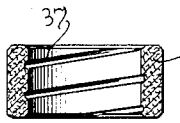


FIG. 2

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CENTRIFUGAL MACHINE

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8 Claims. (Cl. 233—21)

This invention relates to centrifugal machines, and particularly to provision of an improved arrangement for feeding liquids to such machines. It may be regarded as a detailed improvement over the liquid feeding and centrifugal machine guiding arrangement of the patent to W. H. Bath, 1,750,154.

The invention relates particularly to the provision of liquid feed and guiding means for a centrifugal rotor by which leakage of liquid from the rotor may be avoided, even though the operation of the machine involves maintaining the rotor substantially full of liquid.

It is sometimes desirable to operate a centrifugal separator in such a way that the liquid fills the rotor practically completely to the axial center line thereof during the normal operation of the machine. Operation of a centrifugal separator in this manner is sometimes advantageous because of the fact that it enables the operator to minimize turbulence and air contamination which would otherwise occur incident to feed of liquid to the centrifugal rotor and discharge of liquid from the centrifugal rotor.

Machines designed to operate in this manner present certain problems in operation. Leakage of liquid from the machine through the opening to which such liquid is fed to the centrifugal rotor may occur because of swirling in the centrifugal rotor due to inadequate acceleration of liquid fed thereto. In cases in which the liquid in the rotor is maintained at a depth extending inwardly beyond the feed opening through which liquid is fed thereto, a part of the liquid will overflow that feed opening.

Previous arrangements designed to permit operation of a rotor substantially full of liquid have involved deliberately permitting leakage of a small part of the liquid fed to the rotor through a sealing connection, which is maintained under sufficient pressure to prevent a very large proportion of the liquid from escaping. This slight outward leakage affords lubrication for the sealing connection. In the case of treatment of many substances, however, even a small amount of leakage is undesirable, and it has been the aim of the present invention to provide means for sealing the feed connection to the rotor without permitting any of the liquid under treatment to escape. The provision of a tight gland which permits some leakage but prevents excessive leakage is also undesirable because of the fact that the friction incident to use of such glands causes an increase in power consumption in driving the rotor.

A further object of the invention has been to provide, in connection with an arrangement adapted to accomplish the sealing function discussed above, effective means for lubricating a connection between the rotating and stationary members of that sealing connection.

A further object of the invention has been to provide a feed connection for a centrifugal rotor mounted for oscillatory and gyratory movement, which feeds liquid to the rotor directly along the center line thereof at all times, regardless of the oscillation or gyration of the rotor.

Further objects and advantages of the invention, and the manner in which they have been attained, will be evident from a reading of the following specification in the light of the attached drawing, in which,

Figure 1 illustrates the lower part of a centrifugal rotor and associated feeding and guiding connections embodying the principles of the invention, and

Figure 2 is a cross section illustrating a detail of a guide bushing forming a part of the invention.

Referring to the drawing by reference characters the rotor 10 may include a base section 11 having a central opening 12 through which liquid is fed to the rotor, a main body portion 13, and a top portion (not shown) provided with suitable weirs or other arrangements for discharging liquid effluents. The liquid is fed through the opening 12 in the base of the rotor by means of a feed nozzle 14, which is connected to any suitable form of flexible feed conduit. In the operation of a machine of this kind in such a way as to maintain the centrifugal rotor substantially full of liquid, the liquid passed through the feed nozzle 14 to the centrifugal rotor must be under pressure. In view of this fact, the nozzle, feed conduit, and connections between the nozzle and rotor must be adequately sealed to prevent leakage of liquid under treatment.

The guiding and sealing means are mounted on a stationary support 15, which is provided with an upstanding flange 16 for supporting an annular extension 17 of the feed nozzle. A drag shell 18 is secured to the flange 16, and the extension 17 is maintained in contact with the flange 16 by a spring 19 between the upper face of the extension 17 and the lower face of an overhanging flange 20 of the drag shell or housing 18.

The rotor bottom is provided with a tubular extension 21 surrounding the upper end of the

feed nozzle, and a drag sleeve or bushing 22 fits within this tubular extension and is secured in place by a thimble 23 which may be secured to the extension 21 by screw threaded engagement. The bushing 22 is locked to the rotor for rotation therewith by a pin and slot connection 36.

A bearing sleeve 24 for the bushing 22 is secured to the upper end of the nozzle 14 and is provided with a flange 25 at its upper end, which abuts the top of the nozzle when sleeve 24 is screwed into place on nozzle 14.

The support 15 is provided with passages 27 communicating with a conduit (not shown) for feeding liquid under pressure to these passages through a connection 28. The passages 27 in turn communicate with passages 29 in the nozzle, which terminate in an outlet 30 in an upper part of the nozzle within the sleeve 24. The outlet 30 communicates with a series of holes 31 in the sleeve 24, and thus permits liquid fed through passages 27 and 29 to enter the space between the sleeve 24 and bushing 22. The bearing engagement between the sleeve 24 and bushing 22 causes the feed nozzle 14 to partake of the lateral movement of the under side of the rotor upon oscillation or gyration of the rotor, thus keeping the feed nozzle in line with the geometrical axis of the rotor, regardless of such gyratory or oscillatory motion. Movement of the feed nozzle to partake of such motion is permitted by provision of a plurality of sliding plungers 32 which engage the inner wall of drag shell 18 and are pressed outwardly by means of springs 33 contained in recesses 34 in the outer wall of extension 17.

In the operation of the machine, the liquid to be subjected to centrifugation is fed to the centrifugal rotor and treated in that rotor in a manner which will be well understood by those skilled in the art. During the feed of this liquid into the rotor for treatment therein, an auxiliary liquid is fed under pressure through the connection 28, passages 27 and 29, outlet 30 and holes 31 of sleeve 24 into the space between the sleeve 24 and bushing 22. A helical groove is preferably formed on the outer surface of the bearing sleeve 24 or on the inner surface of the bushing 22, this helical groove extending in such a direction as to cause an upward pumping action with respect to liquid delivered between the sleeve 24 and bushing 22. In the form of the invention illustrated, this groove is formed on the inner surface of the bushing 22, as illustrated in Figure 2 of the drawing. The pressure under which the auxiliary liquid is passed into the space between sleeve 24 and bushing 22 will be sufficient, in conjunction with the impelling effect of the helical groove 37, to overcome the pressure tending to cause the liquid under treatment to flow downwardly through the space between this sleeve and bushing, and to cause a part of the liquid fed through passages 27, etc., to pass upwardly through the space between bearing sleeve 24 and bushing 22. There may be a slight leakage of auxiliary liquid downwardly through the space between the bearing sleeve 24 and bushing 22, and this liquid will be discharged from the drag assembly through holes 35 in extension 17. The rotor will be enabled to undergo the necessary gyratory and oscillatory movement to prevent damage to the drive or bearing connections, by the yielding connections 32, 33, 34, but at the same time the nozzle 14 will be maintained in constant alignment with the geometrical axis of the rotor by its bearing within the drag bushing 22.

A part of the liquid which leaks upwardly between the bearing sleeve 24 and bushing 22 will, in the course of time, enter the rotor, by passage through the opening 12 in the base thereof, but this factor does not involve a serious disadvantage in connection with the method of operation described above, since a liquid will be chosen for feed through the passages 27, etc., which does no damage through admixture with the liquid under treatment. Thus, if an aqueous material is being treated in the rotor, the liquid fed through passages 27, etc., may be water, and if an oily material is under treatment, this liquid may be an oil. In either case, the auxiliary liquid fed through passages 27 and 29 will serve to lubricate the space between the bearing sleeve 24 and the bushing 22, and will fulfill this useful function at the same time that it prevents escape of liquid under treatment in the rotor, by counteracting the pressure normally tending to cause discharge of that liquid through the space between bearing sleeve 24 and bushing 22. The auxiliary liquid fed through passages 27, etc., may be a liquid which is immiscible with liquid under treatment, and special outlets may be provided for separate discharge of the auxiliary liquid, if desired.

Many modifications will be obvious to those skilled in the art. For example, the invention has been described as applied to a centrifugal separator of the general type illustrated in Bath Patent 1,750,154, for the purposes of illustration, although it may be applied to machines having bearing and driving connections very different from those of that Bath patent. The features of affording a liquid seal for preventing escape of liquid under treatment may, for example, be applied to machines mounted in fixed bearings, and to machines fed from above, as well as to underfed machines of the type illustrated.

Still further modifications will be obvious to those skilled in the art, and I do not therefore wish to be limited except by the scope of the subjoined claims.

I claim:

1. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary nozzle communicating with an opening in said rotor for feeding liquid thereto, a sleeve snugly surrounding said nozzle and rotatable with the rotor, means for feeding an auxiliary liquid under pressure into the space between said nozzle and surrounding sleeve, and means supporting said nozzle for lateral movement with the rotor upon oscillation or gyration of said rotor.

2. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary nozzle communicating with an opening in said rotor for feeding liquid thereto, a sleeve snugly surrounding said nozzle and rotatable with the rotor, means for feeding an auxiliary liquid under pressure into the space between said nozzle and surrounding sleeve, a housing surrounding said nozzle, and means interposed between said nozzle and said housing for supporting said nozzle for lateral movement with the rotor upon oscillation or gyration of said rotor.

3. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary nozzle communicating with an opening in said rotor for feeding liquid thereto, a sleeve snugly surrounding said nozzle and rotatable with the rotor, means for feeding an auxiliary liquid under pressure into the space between said nozzle and surrounding sleeve, and spring-pressed means for supporting said nozzle for lateral

movement with said rotor upon oscillation or gyration of said rotor.

4. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary nozzle communicating with an opening in said rotor for feeding liquid thereto, a sleeve snugly surrounding said nozzle and rotatable with the rotor, means for feeding an auxiliary liquid under pressure into the space between said nozzle and surrounding sleeve, a housing surrounding said nozzle, and spring-pressed means between said nozzle and said housing for supporting said nozzle for lateral movement with said rotor upon oscillation or gyration of said rotor.

5. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary nozzle communicating with an opening in said rotor for feeding liquid thereto, a sleeve surrounding said nozzle and rotatable with the rotor, and means for feeding an auxiliary liquid outwardly under pressure into the space between said nozzle and surrounding sleeve, said nozzle and surrounding sleeve having co-acting surfaces tending to impel into the rotor liquid fed into the space therebetween.

6. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary feed nozzle mounted within a circular opening communicating with the interior of said rotor for feeding liquid thereto, said nozzle being snugly surrounded by the interior surface of said opening, means for feeding an auxiliary liquid under pressure into the space between said nozzle and surrounding opening, and means supporting said nozzle for lateral movement with the rotor upon oscillation or gyration of said rotor.

7. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary conduit mounted within a circular opening communicating with the interior of said rotor for feeding liquid thereto, said conduit being snugly surrounded by the interior surface of said opening, means for feeding an auxiliary liquid under pressure into the space between said conduit and surrounding opening, and means supporting said conduit for lateral movement with the rotor upon oscillation or gyration of said rotor.

8. In a centrifugal machine, the combination comprising a centrifugal rotor, a stationary conduit communicating with an opening in said rotor for feeding liquid thereto, a sleeve snugly surrounding said conduit and rotatable with the rotor, means for feeding an auxiliary liquid under pressure into the space between said conduit and surrounding sleeve, and means supporting said conduit for lateral movement with the rotor upon oscillation or gyration of said rotor.

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