

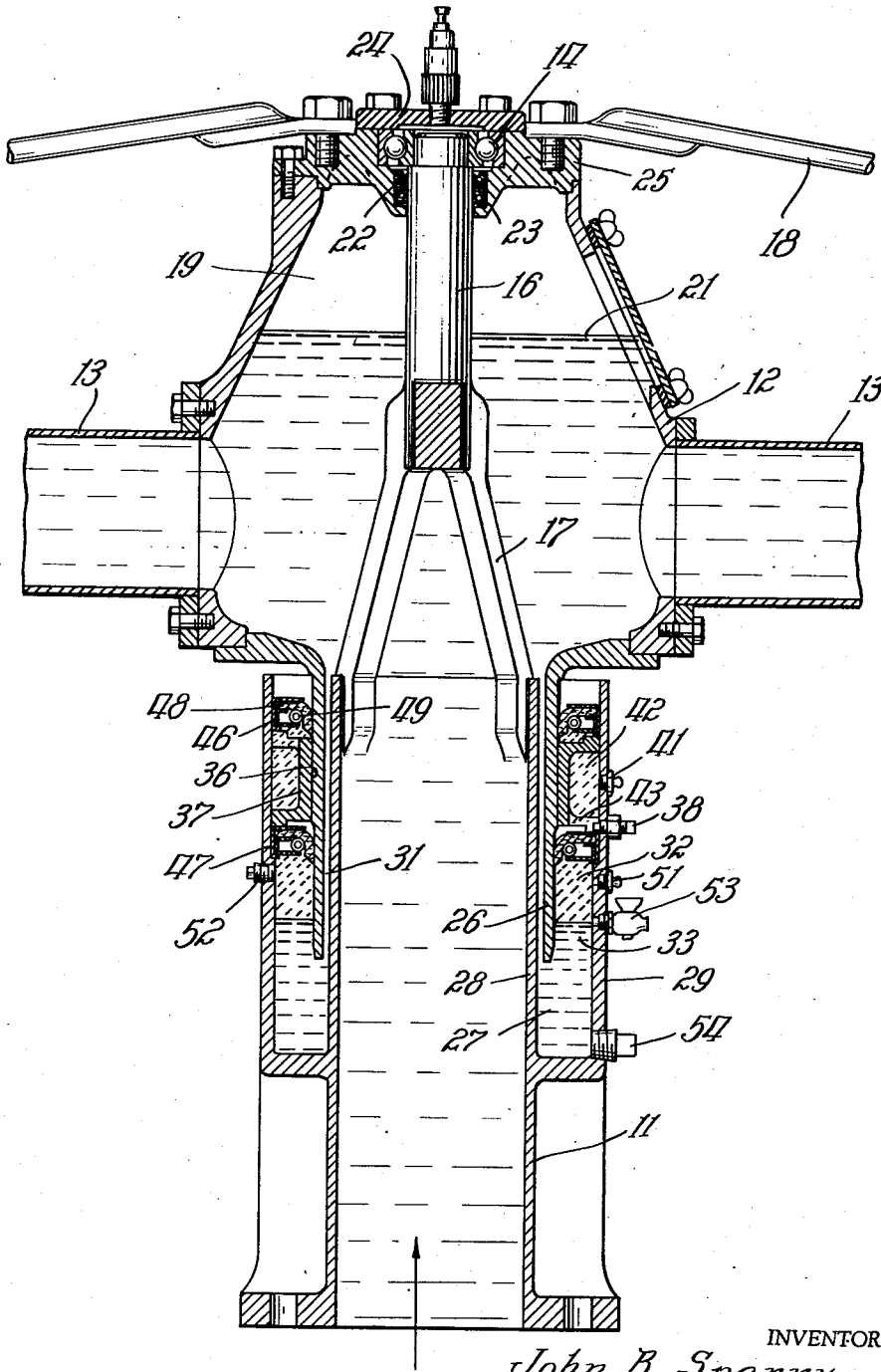
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FLOATING GREASE SEAL

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FLOATING GREASE SEAL

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One of the most difficult problems in connection with rotary distributors for sewage and water treatment is in connection with the rotary seal. The rotary distributor comprises two oppositely extending pipes, each provided with orifices along its length and which rotate together about a central point so as to sprinkle the liquid being treated uniformly over a large area. Obviously, there must be a rotary seal somewhere between the rotating structure and the fixed supply pipe for delivering the liquid to the rotating structure.

According to conventional practice, the supply pipe extends upwardly through the center of the filter bed to be sprinkled and a manifold rotates at the top of the supply pipe or column, being carried by suitable bearings and having the oppositely disposed distributor arms or pipes communicating therewith and carried thereby. Before the present invention, the most satisfactory seals heretofore have comprised mercury seals. For this purpose an annular well was provided around the supply column and partially filled with mercury and the manifold was provided with a skirt which dips into the mercury. The hydrostatic pressure of the liquid being treated would force the mercury somewhat higher on the outside than on the inside, but the mercury is heavy enough so that, unless something goes wrong, it stays within the well and effectuates the seal. Sometimes, however, an excess of hydrostatic pressure causes a blowout of the mercury seal, blowing the mercury out of the well. This would render the seal ineffective, with the result that the rotary distributor would cease to function properly. Furthermore, the mercury is expensive and the seal, therefore, has represented a major expense both in initial cost and in maintenance. A bearing was usually provided between the manifold and the supply column, being located on the outside of the well. This made access to the well difficult and also subjected the bearing to injury in the case of a blowout.

According to the present invention, the mercury is dispensed with, the possibility of blowouts is completely removed, and the bearing is located in a protected position within the well. All of this is accomplished by providing a seal of floating oil, the floating oil being prevented from being blown out not by its own weight, but by flexible sealing rings. The skirt of the manifold extends into the well and into a body of water near the bottom of the well. On the outside of the ring a pool of oil is provided and, since oil is lighter than water, it floats on the water and,

hence, stays up above the bottom of the skirt. The flexible sealing ring and the bearing are positioned in the pool of oil and are lubricated thereby and, in addition, an upper flexible sealing ring is preferably positioned above the bearing for reasons which are brought out below. Of course, this upper ring is also lubricated by the oil.

Additional objects and advantages of the invention will be apparent from the following description and from the drawing, which is a vertical cross-sectional view of a rotary distributor embodying the present invention, the distributor arms being broken away.

A preferred form of the invention has been chosen for illustration and description, in compliance with Section 4888 of the Revised Statutes, but persons skilled in the art will readily perceive other means for accomplishing the same results, and the claims are therefore to be construed as broadly as possible, consistent with the prior art.

The rotary distributor chosen for illustration includes a main support 11 and a manifold 12 which rotates with respect thereto. The support 11 comprises a conduit of large cross-section through which water, sewage or other liquid to be treated is supplied to the manifold 12. The manifold 12 carries distributor arms 13 which are provided along their length with a plurality of orifices, not shown, for sprinkling the liquid being treated on a filter bed at the center of which the main support 11 is located. According to conventional practice, each orifice is probably provided with a spreader plate for spraying out the liquid. The manifold 12 and its arms 13 may be rotated by reaction of the water being forced out of the orifices or off of the spreader plates or it may be rotated by a motor. In any event, it will be provided with a suitable main bearing. In the illustrated form, the bearing comprises a ball-bearing assembly 14, the inner ring of which is carried by a vertical stub shaft 16 carried by three legs 17 which are in turn carried by the main support 11. The shaft 16, legs 17 and support 11 may comprise an integral casting.

A plurality of braces 18 are preferably provided for supporting the outer portions of the distributor arms. The manifold may be constructed to provide an air cushion 19 in the upper portion thereof so that the liquid level would be at about the line 21, even though the hydrostatic pressure might be considerably more than would be indicated by this height. The bearing assembly 14 is preferably protected by a pair of

sealing rings 22 and 23, the upper ring being cupped upwardly to retain the grease and the lower sealing ring being cupped downwardly to exclude water from the grease.

Rotary seal

The sealing of the running joint between the manifold 12 and the supply column 11 is a more serious problem. This is partly because of the large diameter of the main column and partly because of the complete absence of a dome such as the top of manifold 12 which lends itself to the formation of a completely sealed air pocket 19, which is sealed not only by the sealing rings 22 and 23, but also by the plate 24, gaskets being provided for this plate and also below top 25 of the manifold. Furthermore, the air pocket 19 is replenished with air frequently because every time the rotary distributor is shut off even momentarily the water level drops approximately to the bottom of the distributor arms 13 and, hence, air can get into the pocket 19 through the distributor arms 13.

To effectuate the running seal in question between the manifold 12 and the supply column 11, the manifold 12 is provided with a skirt which projects into an annular well 27 formed by the inner wall 28 which is the main wall of the supply standard 11, and an outer wall 29 which is formed integrally with the column 11.

Water flows down through the annular space 31 to form a pool of water in the bottom of the well 27. It is prevented from rising more than slightly above the bottom of skirt 26 by a ring of grease or oil 32 which forms a pool floating on the water 33.

The skirt 26 is preferably machined to form a bearing surface 36 thereon and a bearing ring 37 is positioned to engage this bearing surface. The bearing ring 37 not only has a smooth running fit with the bearing 36, but it fits smoothly within the upper portion of the wall 29. It may fit fairly tightly against this wall, but it need not be tight enough to prevent its rotation as rotation of the bearing ring 37 may be prevented by a bearing lock 38 which may be threaded to the wall 29 and provided with a lock nut.

A pressure fitting 41 is also preferably secured to the wall 29 so that oil may be supplied under pressure to the chamber 42 on the outside of the bearing ring. The pressure fitting 41 will, of course, have the conventional check valve incorporated therein. The bearing ring 37 preferably has passages, such as the openings 43, through its upper and lower flanges and in any event will be provided with some passages through which oil can get to the bearing surfaces. The bearing surfaces may be provided with helical oil grooves, if desired.

Seal rings 46 and 47 are preferably provided above and below the bearing ring 36. These seal rings may be identical and similar to conventional seal rings. Each may comprise a metallic outer ring 17, having a driven fit with the wall 29 so that leakage will be prevented therebetween and a flexible sealing ring 48 made of leather or other oil resistant material clamped in a tight leak-proof manner to the ring 47. These flexible rings are preferably cupped downwardly to resist upward pressure, the cupped portion being reliably urged against the skirt 26 by a coil spring 49 therearound.

If oil is supplied through fitting 41 with sufficient pressure, it will ooze through the lower sealing ring 47, since these rings resist upward pressure much more effectively than downward

pressure. Supplying oil through the nipple 41 will, therefore, ordinarily be all that is necessary to maintain the supply of oil both for lubricating the bearing ring 37 and for maintaining the floating pool of oil 32. However, another pressure fitting 51 may be provided below the lower ring 47 and, if desired, a pipe plug 52 may also be provided below the lower ring 47 to serve as an air vent when desired or for pouring in a supply of oil initially. It is also desirable to provide a pet cock 53 through which the level of the pool of oil 32 may be checked. Of course, if desired, a gauge could be provided with its glass tube communicating at its opposite ends above and below the intended water-oil level. A drain and sediment removing plug 54 is preferably provided at the bottom of the well 27.

The oil used for the seal is preferably a fairly heavy (viscous) oil, such as S. A. E. 60 or 70. A light grease could also be used. In fact, any floating lubricant could be used, if it lubricated the bearing properly and did not appreciably ooze through the mechanical seals (rings 46 and 47).

From the foregoing, it is seen that a very satisfactory rotary seal and bearing structure is provided. The portion of the oil pool 32 below the lower ring 47 serves as an oil lock for preventing any oil from reaching the ring 47. It also lubricates the ring so that skirt 26 rotates therewithin with very little friction. The ring 47 and pool 32 together give the bearing 37 absolute protection against the possibility of water being forced into the bearing by the hydrostatic pressure on the water. Even if the lower ring 47 should develop a defect, the upper ring 47, together with the oil 32 would prevent the water from reaching the bearing 37, since the oil would not be permitted to escape and the water could not rise as long as the oil were retained. The upper ring 47 also protects the bearing from dirt and moisture, although there is no pressure downwardly on it and it is in a sheltered position, so that ordinarily no moisture falls on the upper ring and very little dust. By locating the bearing within the well 27 and specifically within the oil pool therein, it is thus thoroughly protected from harmful substances. Furthermore, it permits use of the skirt 26 for one bearing member instead of necessitating extra parts.

I claim:

1. A rotary seal between first and second conduit members, one of which rotates with respect to the other, including an annular well formed by the first member around the passage therethrough and open at its top, a skirt carried by the second member and extending into said well, a pool of oil outside of said skirt within said well and floating on water at the bottom of the well, and a mechanical sealing ring adapted to retain said oil within the well against the upward hydrostatic pressure exerted thereon by the water as water is supplied to the rotary member through the other member.

2. A rotary seal between a vertically disposed member and another member, one of which is adapted to rotate with respect to the other and to form with it a passage for a given fluid under pressure, comprising a sealing ring, including a flexible cupped member sealing the space between the rotary and stationary members and having a running fit with one of them, said sealing ring including a material deleteriously affected by said fluid and a pool of a second fluid, which does not deleteriously affect said seal ring

and which lubricates said seal ring, positioned between the seal ring and the given fluid, and floating on the given fluid.

3. A rotary seal between a vertically disposed member and another member, one of which is adapted to rotate with respect to the other and to form with it a passage for a given fluid under pressure, comprising a sealing ring including a flexible cupped member sealing the space between the rotary and stationary members and having a running fit with one of them, said sealing ring including a material deleteriously affected by said fluid and a pool of a second fluid, which does not deleteriously affect said seal ring and which lubricates said seal ring, positioned between the seal ring and the given fluid.

4. A running seal including a first and a second member communicating with each other; one of which forms a conduit, and one of which is adapted to move with respect to the other, a well formed around one of the members and open at its upper end, a skirt formed on the other member and projecting downwardly into the well, a ring of lubricant in the well on the outside of the skirt and adapted to float on the fluid to be carried by the conduit, and a flexible seal in the well around the skirt cupped in a direction to resist the pressure differential between the conduit and the atmosphere and exposed to said lubricant in the direction toward which it is cupped.

5. A running seal including a first and a second member communicating with each other; one of which forms a conduit, and one of which is adapted to move with respect to the other, a well formed around one of the members and open at its upper end, a skirt formed on the other member and projecting downwardly into the well, a ring of lubricant in the well on the outside of the skirt and adapted to float on the fluid to be carried by the conduit, a flexible seal in the well around the skirt cupped in a direction to resist the pressure differential between the conduit and the atmosphere and exposed to said lubricant in the direction toward which it is cupped, and a bearing in the lubricant between the outside of the skirt and the wall of the well.

6. A running seal including a first and a second member communicating with each other; one of which forms a conduit, and one of which is adapted to move with respect to the other, a well formed around one of the members and open at its upper end, a skirt formed on the other member and projecting downwardly into the well, a ring of lubricant in the well on the outside of the skirt and adapted to float on the fluid to be carried by the conduit, and a mechanical sealing ring adapted to retain said lubricant within the well against the pressure differential between the conduit and the atmosphere.

7. A running seal including a first and a second member communicating with each other; one of which forms a conduit, and one of which is adapted to move with respect to the other, a well formed around one of the members and open at its upper end, a skirt formed on the other mem-

ber and projecting downwardly into the well, a ring of lubricant in the well on the outside of the skirt and adapted to float on the fluid to be carried by the conduit, and a mechanical sealing ring adapted to retain said lubricant within the well against the pressure differential between the conduit and the atmosphere, said mechanical sealing ring being more resistant to the flow of fluid in the direction it is urged by said pressure differential than in the other direction.

8. A running seal including a first and a second member communicating with each other; one of which forms a conduit, and one of which is adapted to move with respect to the other, a well formed around one of the members and open at its upper end, a skirt formed on the other member and projecting downwardly into the well, a ring of lubricant in the well on the outside of the skirt and adapted to float on the fluid to be carried by the conduit, and a mechanical sealing ring adapted to retain said lubricant within the well against the pressure differential between the conduit and the atmosphere, a second ring spaced outwardly toward the atmosphere from said ring, and means for introducing the lubricant under pressure between said rings; the outer ring being more resistant to the flow of lubricant outwardly than is the inner ring to the flow of lubricant inwardly.

9. A running seal including a first and a second member communicating with each other; one of which forms a conduit, and one of which is adapted to move with respect to the other, a well formed around one of the members and open at its upper end, a skirt formed on the other member and projecting downwardly into the well, a ring of lubricant in the well on the outside of the skirt and adapted to float on the fluid to be carried by the conduit, and a mechanical sealing ring adapted to retain said lubricant within the well against the pressure differential between the conduit and the atmosphere, and a second ring of like characteristics spaced outwardly toward the atmosphere from said ring, and means for introducing the lubricant under pressure between said rings, a bearing in said space and exposed to the grease therein; the outer ring being more resistant to the flow of lubricant outwardly than is the inner ring to the flow of lubricant inwardly.

10. A rotary seal between a vertically disposed member and another member, one of which is adapted to rotate with respect to the other and to form with it a passage for a given fluid under pressure, comprising a sealing ring including a flexible cupped member sealing the space between the rotary and stationary members and having a running fit with one of them, said sealing ring including a material deleteriously affected by matter carried by said fluid, and a pool of fluid substantially free from said matter, which does not deleteriously affect said seal ring and which lubricates said running fit, positioned between the seal ring and the fluid carrying said matter.

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