SEAL FOR SEWAGE DISPOSAL SYSTEMS

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ABSTRACT

An annular member carried by one of a pair of concentric tubular members, one of which is stationary and the other of which is mounted for rotary movement, the annular member defining an axially opening annular recess containing a sealing ring backed up by an annular compressible element disposed between the sealing ring and the bottom of the annular recess. A circumferential flange, carried by the other tubular member, has a marginal edge surface disposed in face to face sliding engagement with the sealing ring, the compressible element being under predetermined compression during such engagement.

1 Claim, 8 Drawing Figures
SEAL FOR SEWAGE DISPOSAL SYSTEMS

BACKGROUND OF THE INVENTION

Trickling filters of the type herein described generally, are well known in connection with sewage disposal systems, and usually include filter beds of granular filter material, and means for sprinkling liquid sewage over the filter beds. A common type utilizes a liquid distributor system including a vertical tubular column or pipe extending upwardly from the center of the filter bed, a rotary tubular column or pipe concentrically journaled on the upper end portion of the stationary pipe and communicating with the interior thereof, and distributor pipes extending radially outwardly from the rotary column to distribute the liquid uniformly over the filter bed responsive to rotation of the rotary column and distributor pipes.

Heretofore, to prevent excessive leakage of liquid through the journal, the columns have been formed to provide an annular well which contains mercury as a seal. Mercury has provided an effective sealing material in these installations as long as the liquid pressure in the distributor mechanism was accurately maintained. However, when the liquid pressure in the mechanism accidentally rises beyond a given maximum, the liquid forces the mercury outwardly into the filter bed from whence it flows with the filtered and treated liquid to whatever river or body of water into which the filtered liquid is discharged. Thus, the body of water becomes contaminated with the highly poisonous mercury. Mercury contamination of rivers and lakes has risen to such a degree at the present time as to present a real problem on a very wide scale.

SUMMARY OF THE INVENTION

An important object of this invention is the provision of a seal, for a rotary filter distributor, which eliminates the necessity for the presently used mercury seal.

Another object of this invention is the provision of a mechanical seal which effectively reduces leakage between relatively rotating parts to a tolerable minimum.

Another object of this invention is the provision of a seal as set forth which is not materially effected by liquid pressure changes in the system.

Yet another object of this invention is the provision of a seal which has a long effective life.

To the above ends, I provide an annular or cylindrical member mounted on one of a pair of vertically disposed concentric stationary and rotary tubular columns, the rotary one of which receives liquid from the stationary column, and is provided with distributor pipes for discharge of liquid over a filter bed.

The cylindrical member defines an axially opening recess in which is mounted a sealing ring backed up by a compressible element between the sealing ring and the bottom of the recess. A circumferential flange is mounted on the other of the columns, coaxial therewith, and has a marginal edge surface that slidable engages the sealing ring to deter escape of liquid from the columns at the lower end portion of the rotary column.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial section through a conventional filter bed and liquid distributor therefor;

FIG. 2 is an enlarged fragmentary view taken substantially on the line 2—2 of FIG. 1, some parts being broken away and some parts being shown in section;

FIGS. 3 and 4 are transverse sections taken on the lines 3—3 and 4—4 respectively of FIG. 2;

FIG. 5 is a further enlarged fragmentary section taken substantially on the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary view in top plan, with a portion thereof being shown in transverse section, of a modified form of liquid distributor;

FIG. 7 is an enlarged fragmentary section taken on the line 7—7 of FIG. 6 and showing a modified arrangement of the seal of this invention; and

FIG. 8 is a view corresponding to FIG. 7 but showing a still further modified seal arrangement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, a waste treatment filter is shown as comprising a filter tank 1 which may be assumed to be circular, having a bottom wall 2 and a generally cylindrical side wall 3. Other wall structure 4 cooperates with a portion of the peripheral wall 3 to provide a chamber 5 the bottom of which communicates with the interior of the tank 1 below a tile layer 6 therein. The chamber 5 provides an outlet for the tank 1 and has connected thereto a discharge pipe 7. The tank 1 contains a bed of filter media 8 to a predetermined height above the drain tile 6, the filter media 8 comprising granular material, such as rocks of predetermined mesh size and covered with microbiological material, in the usual manner. A power operated fan or blower 9 has its inlet conduit 10 in communication with the chamber 5, and is operative to draw fresh air downwardly through the bed of filter media 8 and outwardly through the chamber 5 to promote filtering action.

A supporting base 11 is disposed at the center or axis of the tank 1 and the mounted thereon a fitting 12 from which a supporting conduit 13 extends upwardly. A generally horizontally disposed pipe or conduit 14 communicates with the conduit 13 through the fitting 12, and is provided in the chamber 5 with a valve 15 for controlling delivery of liquid sewage to the filter bed. The upper end of the conduit 13 is provided with a coupling flange 16 that is bolted to a cooperating coupling flange 17 at the lower end of vertically disposed fixed tubular column 18. At its upper end, the column 18 is provided with a bearing housing 19 which supports a rolling friction bearing 20 that journals a cap 21 that is bolted to a mounting flange 22 screw threaded to the upper end of a rotary tubular column 23. The rotary column 23 is disposed in radially outwardly spaced concentric relation to the fixed tubular column 18, and has screw threaded on its lower end a mounting flange 24 to which is bolted a manifold 25. The manifold 25 defines a manifold chamber 26 that communicates with the interior of the fixed tubular column 18 by a plurality of circumferentially spaced generally rectangular outlet openings 27 in the stationary column 18. The fixed column 18 is provided at its upper end portion just below the bearing housing 19 with a plurality of circumferentially spaced overflow openings 28 which cooperate with other circumferentially spaced overflow openings 29 in the rotary column 23 just below the flange 22 thereof, to permit escape of fluid from the columns 18 and 23 in the event of undue pressure therein. One each of the openings 28 is shown in FIG. 2.

The manifold 25 is provided with a plurality of circumferentially spaced outlet openings 29 which com-
municate with the inner ends of a plurality of circumferentially spaced radially outwardly projecting distributor arms or pipes 30 bolted to the manifold 25 and supported by turnbuckle guy rods or the like 31 secured at their outer ends to the distributor rods or pipes 30 and at their inner ends to anchoring flanges 32 at the upper end portion of the rotary column 23. Although not shown, it will be assumed that the distributor pipes 30 are provided with discharge openings for liquid being pumped to the interiors of the distributor pipes through the inlet pipe 14, supporting conduit 13 and columns 18 and 23 from a suitable source of pressure not shown. As the liquid is pumped through the distributor arms or pipes 30, the arms 30, together with the rotary column 23, rotate by reaction impulse of liquid being discharged through openings in the distributor arms 30.

The structure thus far described is generally of the type commercially used and well known by those skilled in this art. The present invention involves sealing means between the fixed and rotary columns 18 and 23 respectively below the manifold 25.

The sealing means of this invention comprises an annular or cylindrical member 33 that is rigidly and sealingly secured at its lower end to the coupling flange 17 of the fixed tubular column 18, and extends upwardly therefrom in radially outwardly spaced concentric relationship to the fixed column 18, the upper end of the annular or cylindrical member 33 being downwardly spaced from the bottom of the manifold 25, as shown in FIGS. 2 and 5. Near its upper end, the cylindrical member 33 is formed to provide a radially outwardly projecting annular portion 34 having at its radially outer edge an upwardly projecting cylindrical flange 35 which cooperates with the annular portion 34 and upper end of the cylindrical member 33 to define an axially upwardly opening annular recess 36. An annular sealing ring 37 is disposed in the recess 36 and overlies and is backed up by an annular compressible element 38 disposed therebetween and the bottom of the recess 36. The sealing ring 37 is preferably made from metal such as stainless steel, but may be made from any suitable material, such as carbon, ceramics, plastics or other durable material, if desired. The annular compressible element is preferably made from sponge elastomeric material, such as sponge neoprene, silicone or the like. With reference to FIGS. 2 and 5, it will be seen that the annular recess 36 is of such axial depth as to dispose the sealing ring 37 at an appreciable distance below the upper marginal edges of the cylindrical member 33 and cylindrical flange 35.

A circumferential flange 39 is rigidly mounted to the bottom of the manifold 25 by means of mounting screws 40, and is formed to provide downwardly projecting radially inner and outer cylindrical skirts 41 and 42 respectively. The lower end portion of the stationary column 18 and the cylindrical member 33 cooperate with the coupling flange 17 to define an axially upwardly opening annular well in which is received the inner cylindrical skirt 41, the skirt 41, adjacent portion of the stationary column 18, and cylindrical member 33 cooperating to define a labyrinth, indicated generally at 43. As shown in FIGS. 2 and 5, the labyrinth 43 communicates with the manifold chamber 26, and with the recess 36 inwardly of the outer cylindrical skirt 42. Preferably, the skirt 42 is provided at its lower end with a ring of hardened metal or other suitable hard mate-

rial, indicated at 44, the ring 44 having a lower marginal edge surface that slidably engages the top surface of the sealing ring 37. The arrangement is such that, with the entire device assembled, the ring 44 presses downwardly against the underlying annular sealing member 37 to compress the compressible element 38 so that the radially inner and outer sides thereof are deformed into engagement with the adjacent surfaces of the cylindrical member 33 and cylindrical flange 35. It might be here be noted that the cylindrical member 33 is provided with a plurality of circumferentially spaced openings 45 for drainage of liquid from the recess 36 to the labyrinth 43, one of openings being shown in FIGS. 2 and 5.

A plurality of circumferentially spaced guide rollers 46 are journaled on the lower ends of mounting shafts 47 that extend downwardly from slotted mounting plates 48 radially moveably mounted on supporting flanges 49 at the lower end of the manifold 25, by means of mounting and clamping screws 50. The supporting flanges 49 are provided with adjustment screws 51 whereby the guide rollers 46 are moved into engagement with the radially outer surface of the cylindrical flange 35 to hold the rotary column 23 and manifold 25 in concentric relationship with the stationary or fixed tubular column 18.

When liquid to be filtered is pumped into the manifold chamber 26 and distributor arms 30, some of the liquid flows downwardly into the labyrinth 43 and thence into the annular recess 36 radially inwardly of the outer skirt 42. Engagement of the ring 44 with the annular sealing element 37 prevents escape of liquid from the radially inner portion of the recess 36 to an extent sufficient for all practical purposes. In practice, only a sufficient amount of the liquid escapes outwardly between the ring 44 and annular sealing member 37 to provide for effective lubrication between these members. In any event, the sealing engagement between the members 44 and 37 is sufficient to prevent escape of liquid outwardly of the recess 36 in sufficient quantity to wash the filtering material off from the rocks of the filter bed adjacent the control columns. The above described sealing mechanism is capable of withstanding a substantially wide range of internal pressure of the manifold chamber 26 and has been found to be effective over a considerable period of time. With this arrangement, I have eliminated the necessity for use of mercury in the labyrinth 43 and, by permitting a very small amount of liquid to escape between the ring 44 and annular sealing member 37, the seal becomes sufficiently well lubricated to have a substantially long life.

DESCRIPTION OF EMBODIMENTS OF FIGS. 6–8

The form of distributor illustrated in FIGS. 6–8 comprises an axially vertical tubular support member 52 comprising an annular base portion 53 that is rigidly mounted on a supporting base 54, by means of a plurality of nut equipped anchoring studs 55, one of which is shown in FIGS. 7 and 8. The supporting base 54 is preferably made from concrete, and defines a central delivery opening 56 axially aligned with the annular base portion 53. The support member 53 further defines concentric inner and outer cylindrical walls of flanges 57 and 58 respectively the latter of which is formed to provide a radially outwardly projecting annular flange 59 supported from the base portion 53 by a plurality of radial gussets 60, one of which is shown.
A vertically extending rotary tubular column includes a lower manifold portion 61 concentric with the fixed support member 52, and an axially upwardly extending tubular mast portion 62. A plurality of circumferentially spaced distributor arms or pipes 63 have inner ends that are rigidly secured to cooperating discharge portions 64 of the manifold portion 61, and extend radially outwardly therefrom. Although not shown, it may be assumed that the distributor arms or pipes 63 are similar to the distributor arms 30, and are supported from the upper end, not shown, of the mast portion 62, in the same manner as the distributor arms 30. The manifold portion 61 further includes inner and outer depending concentric cylindrical skirt portions 65 and 66 respectively. The cylindrical skirts 65 and 66 cooperate to define a downwardly opening annular recess 67 in which the inner flange 57 is disposed concentric with the skirts 65 and 66.

A metallic sealing ring 68, similar to the sealing ring 37, is disposed in the annular recess 67 in overlying relation to the upper edge of the inner flange or wall 57, and rotatively slidably engages the top surface of a cooperating ring 69 that is welded or otherwise rigidly secured to the upper edge of the inner flange or wall 57. The sealing ring 68 is yieldingly urged into engagement with the ring 69 by an annular compressible element 70 similar to the element 38 of FIGS. 2 and 5, the compressible element 70 being interposed between the sealing ring 68 and the upper portion or bottom of the annular recess 67. The manifold portion 61 and parts carried thereby supporting from the fixed support member by a conventional ball thrust bearing 71, the arrangement being such that the annular compressible element 70 is under sufficient compression to effect substantially sealing engagement between the rings 68 and 69.

It will be appreciated that, with the exception of the sealing arrangement above-described, the distributor shown in FIGS. 6, 7 and 8 is of well-known construction, the inner cylindrical flange or wall 57, prior to the installation of the rings 68 and 69 and compressible element 70, having extended upwardly into close proximity with an overlying wall portion 72, as shown in FIG. 8. Also, prior to installation of my novel sealing means in the manner shown in FIG. 8, the annular skirt 66 having extended downwardly into closely spaced relationship with the annular base portion 53, as shown in FIG. 7. Prior to modification to accommodate the sealing arrangement, the portions 57, 58 and 66 cooperated to define a labyrinth which contained a quantity of mercury to effect a seal.

In a modified arrangement shown in FIG. 8, the cylindrical skirt 66 is shortened and provided with a metallic ring 73 similar to the ring 69 which has rotative sliding engagement with a sealing ring 74 similar to the ring 68. The sealing ring 74 is yieldingly urged into engagement with the ring 73 by an underlying annular compressible element 75 similar to the elements 70 and 38. Although not shown, it will be appreciated that the annular compressible elements 38, 70 and 75 may be in the nature of annular tubes inflated to a pressure which will give the desired sliding sealing engagement between the sealing rings 37, 68 and 74 and their respective rings 44, 69 and 73. Further, while I have shown and described a commercial embodiment of sealing means for a sewage disposal filter, and two modified arrangements, it will be understood that the same is capable of further modification without departure from the spirit and scope of the invention, as defined in the claims.

What is claimed is:

1. Sealing means for a sewage disposal unit, said unit including; an axially vertically fixed tubular support member; a vertically extending rotary tubular column member concentric with said support member; means for delivering liquid under pressure to said rotary column member; and a plurality of circumferentially spaced distributing arms projecting radially outwardly from said rotary column member and arranged to receive liquid from said rotary column member for distribution of said liquid over a filter bed; said sealing means being disposed between said support and rotary members and comprising:

   a. an annular member on said support member, comprising an axially elongated cylindrical sleeve having a lower end portion fixed to said support member, said annular member defining an axially upwardly opening annular recess;

   b. a circumferential flange carried by said column member and having radially spaced concentric inner and outer skirts, said outer skirt projecting axially toward the bottom of said recess and having a marginal edge surface;

   c. a sealing ring in said recess having sliding engagement with said marginal edge surface;

   d. and a compressible element disposed between said sealing ring and the bottom of the recess and urging said sealing ring toward engagement with said marginal edge surface;

   e. said annular member and support member defining opposite sides of an annular well, said inner skirt being axially elongated and disposed in said well between the fixed support member and cylindrical sleeve to define therewith a labyrinth communicating with the interior of said fixed support member.

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