Feb. 11, 1958 L. HORNBOSTEL Re. 24,430

PERFORATED DRUM TYPE LIQUID FILTER

Original Filed July 28, 1953 2 Sheets-Sheet 1

Fig. 1

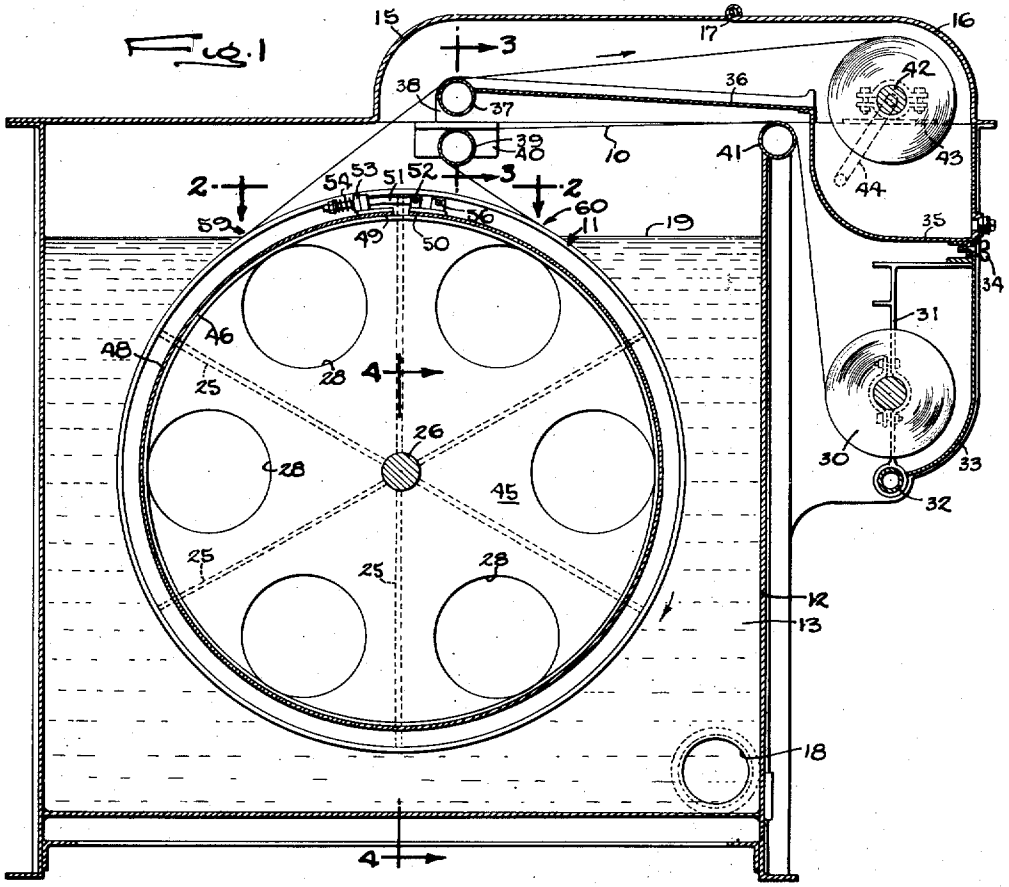


Fig. 2

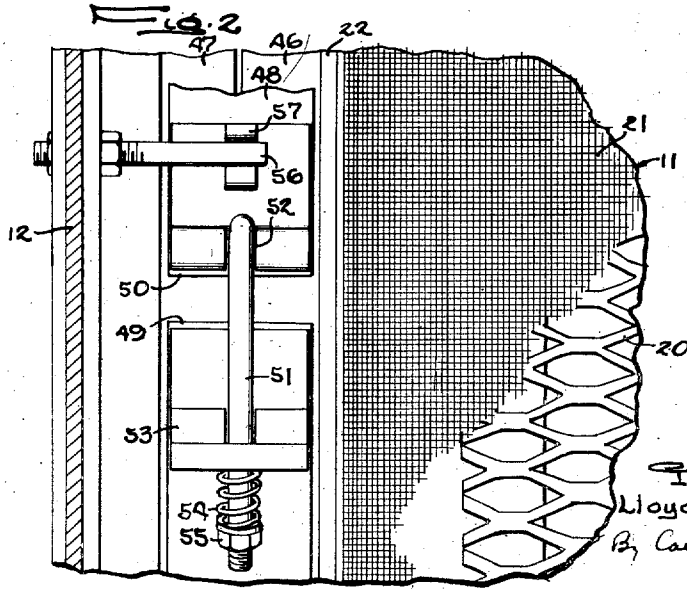
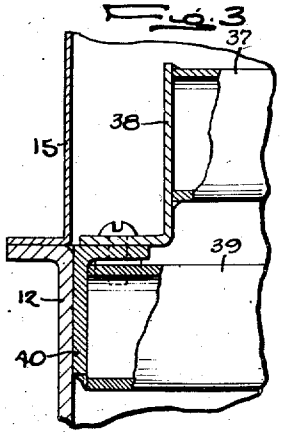


Fig. 3



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Fig. 4

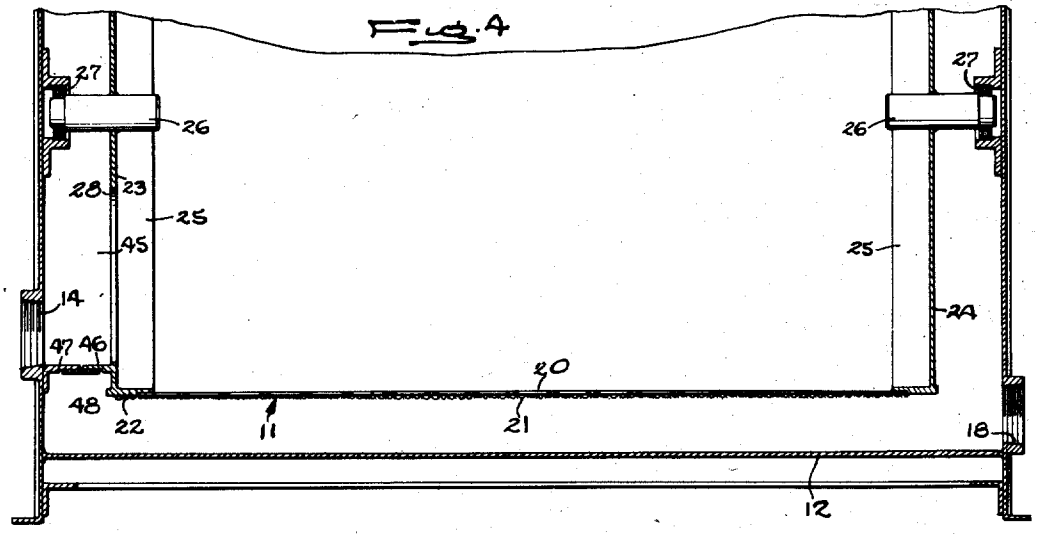
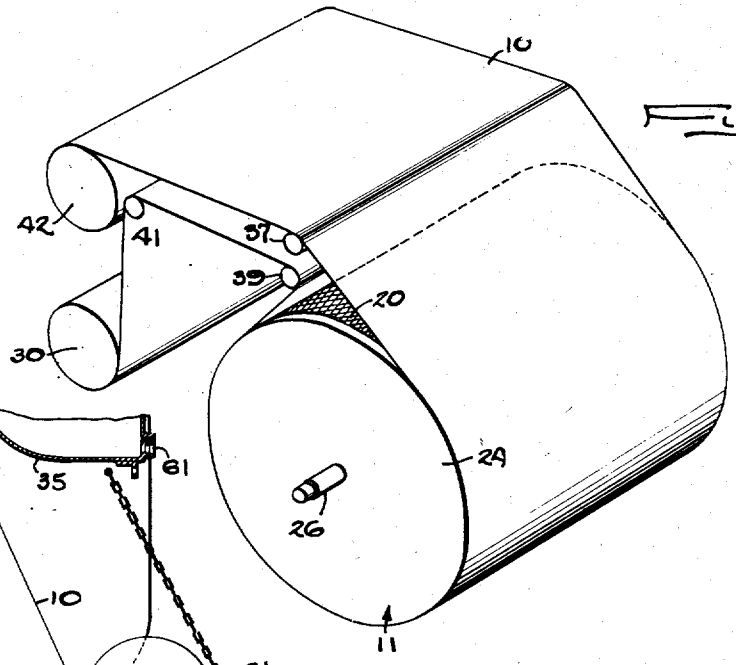


Fig. 5



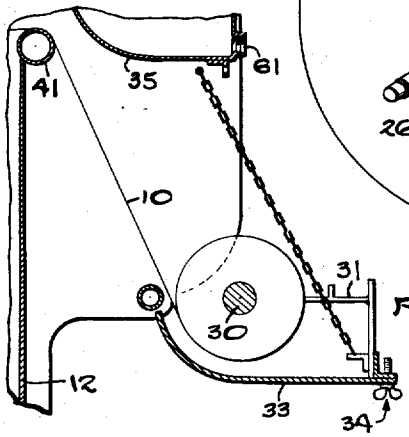


Fig. 6

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24,430

PERFORATED DRUM TYPE LIQUID FILTER

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Original No. 2,752,045, dated June 26, 1956, Serial No. 370,737, July 28, 1953. Application for reissue May 31, 1957, Serial No. 663,574

5 Claims. (Cl. 210—387)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This invention relates to liquid filters of the type in which a flexible filter sheet travels around a rotary perforated drum partially submerged in the liquid to be filtered, the filtrate being removed through the interior of the drum.

The general object is to provide a filter of the above character which is simple and efficient and relatively inexpensive in construction for a given filtering capacity, which operates solely by gravitational flow, and which provides for automatic by-passing of the liquid to the filter outlet in the event that the filter sheet becomes clogged or overloaded.

Another object is to combine the filtrate outlet and the drum seal in a novel manner to provide substantially complete draining of the drum and full utilization of the gravity head in inducing the filtering action.

A further object is to lead the filter sheet to and from the drum in a novel manner to provide vertical over-all compactness of the unit and prevent the filtered material from falling therefrom.

Still another object is to provide, in the event of clogging of the filter sheet, for by-passing of the supplied liquid through an uncovered part of the drum.

The invention also resides in the novel mounting of the filter sheet supply roll to permit ready replacement thereof.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a vertical sectional view of a filter embodying the novel features of the present invention.

Figs. 2, 3, and 4 are fragmentary sectional views taken respectively along the lines 2—2, 3—3, and 4—4 of Fig. 1.

Fig. 5 is a perspective schematic view of the filtering elements.

Fig. 6 is a fragmentary sectional view of a part of Fig. 1 showing the filter medium supply roll in a different position.

The improved filter shown in the drawings for purposes of illustration comprises generally an elongated flexible filter sheet **10** extending partially around a perforated drum **11** rotatably mounted within a tank **12** containing the liquid **13** to be filtered by gravitation through the sheet **10** into the interior of the drum from which the filtrate is drained through an outlet **14** (Fig. 4). The tank is of generally square box-like construction somewhat deeper than the diameter of the drum and preferably is closed by a suitable cover the major part **15** of which is rigid with the upper flanged edge of the tank wall. Herein, a second part **16** of the cover is hinged at **17** to the part **15** and projects outwardly and around one side of the tank as shown in Fig. 1. The fluid **13** to be filtered is delivered into the tank through an inlet **18** and the rate of flow is suitably controlled so as to maintain the liquid at a normal level **19** near the top of the tank.

Herein, the drum **11** comprises a rigid perforated cylinder **20** covered by a suitable screen **21** with its opposite ends seated in the cylindrical rims **22** on two circular disks **23** and **24**. The latter, which constitute ends of the drum, are joined to spokes **25** and rigid with trunnions **26** which project axially and outwardly and are journaled in bearings **27** supported in opposite side walls of the tank. The drum is thus adapted to turn about a horizontal axis so disposed that with the liquid at the level **19** all except a small segment at the top of the drum is submerged.

The disk **24** is solid so as to close one end of the drum. The other end is left open as by forming holes **28** at spaced points around the outer edge portion of the disk **23**.

The filter medium **10** which may be composed of woven fabric or other porous material is wide enough to cover the full perforated length of the drum and is an elongated sheet wound around a supply roll **30**. The latter is preferably disposed outside of the tank and has end trunnions which herein are supported by a bracket **31** pivoted at **32**. The bracket is rigid with a cover **33** whose free edge is adapted to be secured detachably at **34** to a plate **35** which is rigid with the tank and cooperates with the movable part **16** of the cover to form a housing enclosing the supply roll. When the cover **33** is released and swung outwardly and downwardly as shown in Fig. 6, the supply roll is exposed thus affording convenient access for the substitution of a new supply sheet.

The plate **35** overhangs the upper edge of the tank side wall and constitutes an extension of a drain plate **36** which spans opposite sides of the cover part **15** and slopes inwardly and upwardly to a cylindrical rod **37** which is longer than the width of the sheet **10** and, in this instance, is secured as by welding (see Fig. 3) to brackets **38** mounted at the upper edge of the tank.

A similar rod **39** is secured at opposite ends to brackets **40** on the tank and disposed a short distance below the rod **37**. The rod **39** is disposed at substantially the same level as a similar rod **41** welded to the tank edge adjacent the supply roll **30**.

The filter sheet wound around the supply roll is led off from the inner side of the latter and extended upwardly around the guide rod **41**, then horizontally across the tank and around the guide rod **39**. From the latter, the sheet is bent reversely and downwardly around the perforated area of the drum **11**. Near the lever **19**, the sheet leaves the liquid and slants upwardly around the guide rod **37** beyond which the sheet slopes gradually upwardly and outwardly to a take up roll **42** journaled in bearings which are supported on a bar **43** spanning the side walls of a casing defined by the plate **35** and the cover part **16**. The take up roll may be turned by a hand crank **44** or if desired by suitable power actuated mechanism to advance the sheet **10** at the proper rate. During such turning of the take up roll and advance of the sheet, the drum **11** is turned to draw fresh cloth off from the supply roll **30**. In such advance, a loaded part of the sheet is raised out of the liquid toward the guide rod **37** while a corresponding length of clean cloth is immersed in the liquid on the opposite side of the drum. By adjusting the rate of advance of the sheet **10** in accordance with the character of the liquid to be filtered and other factors, the level of the liquid **13** may be maintained substantially constant for a given rate of delivery of the liquid into the inlet **18**.

When the drum constructed and mounted as above

described is submerged in the liquid, the latter will flow through the filter cloth and screen into the interior of the drum where the filtrate accumulates. In accordance with the present invention, provision is made for withdrawing the filtrate from the drum in a novel manner such as to utilize substantially the entire peripheral area of the drum in achieving efficient filtering and also to maintain a maximum rate of flow of the liquid through the filtering medium. This is accomplished by a novel location of the outlet **14** combined with the provision of an enclosure of novel construction around one end of the drum **11** so that the latter is fully drained or nearly so in all of its different angular positions.

To these ends, the outlet **14** through which the filtrate is withdrawn from the tank **12** is disposed at a level close to the bottom of the drum **11**. On the interior of the tank, the outlet and the interior of the drum are enclosed by a chamber **45** which is of circular shape and a diameter substantially equal to the diameter of the drum so as to communicate with the interior of the drum in all angular positions of the latter. The chamber **45** is defined in part by an annular imperforate flange **46** concentric with the drum axis and projecting from the drum end **23** outside of the openings **28** therethrough.

Axially alined with and of the same size as the flange **46** is an annular imperforate frame **47** which preferably is rigid with a wall of the tank and projects from the latter substantially into abutment with the flange **46**. The gap between the rotatable and stationary flanges is closed by a sealing band **48** extending around the exterior of and overlapping the adjacent ends of the flanges. The band may be a strip of flexible material with opposite ends **49** and **50** disposed and held above the normal level **19** of the liquid **13** and drawn together to contract the band to maintain the desired sealing pressure. Herein, contraction of the band is effected by a screw **51** pivotally connected at **52** to the band end **50** with its other end projecting through an outstanding lug **53** on the band end **49**. Beyond the lug, a spring **54** is coiled around the screw **51** and compressed by tightening a nut **55**. The tensioning device thus formed is held against turning with the drum **11** by a pin **56** anchored in the tank wall and projecting into a lug **57** on the band end **50**. As a result, the submerged part of the chamber **45** is sealed effectually against the entry of the unfiltered liquid **13** in all positions of the drum during its slow rotation.

In operation of the filter, the liquid to be filtered is delivered to the tank at a rate correlated with the filtering capacity of the submerged part of the filtering medium **10** so as to maintain the tank filled substantially to the level **19**. At the same time, the take up roll **42** is turned continuously or intermittently to wind up the used part of the filter medium and to turn the drum in the direction indicated by the arrow in Fig. 1 thereby drawing a corresponding amount of the clean sheet off from the supply roll **30**. Since the lowermost part of the drum interior is drained continuously through the chamber **45** and the outlet **14**, the substantial head of the unfiltered liquid operates by gravity to force the liquid through the cloth over substantially the entire submerged area thereof. The filtering action thus proceeds continuously and entirely by gravity thus contributing to the over-all simplicity of the filter construction irrespective of the capacity of the filter.

With the guides **37** and **39** disposed above the top of the drum as described above, it will be observed that the dirty and clean parts of the filter cloth are led onto and off the drum periphery at points **59** and **60** disposed above the normal level **19** of the liquid **13**. Since these points are spaced apart angularly around the drum, the intervening arc of the perforated periphery of the drum is left uncovered and adapted for the free passage of the unfiltered liquid directly into the drum. Such by-passing of the liquid will occur automatically in the event that the liquid **13** rises substantially above the latter if the filter becomes clogged or the unfiltered liquid is supplied at too rapid a rate. Any danger of overflowing the tank or interrupting the flow of fluid through the filtering system is thus avoided.

It will be observed that the used portion of the filter sheet is led off from the drum at a comparatively small angle relative to the horizontal and, after passing around the guide **37**, extends generally horizontally to the take up roll **42**. With this arrangement, the excess liquid dropping from the filter sheet falls onto the drain plate **36** and flows down the plate **35** to a drain outlet **61**. [Any possibility of the filtered material falling back into the liquid body **13** is thus avoided.]

By extending the used portion of the filter sheet upwardly around the outer side and over the top of the guide 37 and then to the take up roll 42 in a generally horizontal direction back toward the supply roll, only the clean side of the sheet comes into actual contact with the guide bar. This eliminates the possibility of rubbing the filtered material off from the sheet or pressing this material into the sheet. Dropping of the material back into the drum or into the liquid is avoided and the filter sheet is readily cleanable for reuse if desired. Any possibility of the filtered material falling back into the liquid body is thus avoided

I claim as my invention:

1. A filter having in combination, a tank adapted to contain a body of liquid to be filtered, a drum having a perforated periphery mounted within said tank to turn about a horizontal axis coincident with the drum axis, parallel [vertically spaced] supply and take up rolls [disposed outwardly beyond the side wall of said tank and] mounted to turn about axes paralleling the drum axis, a pair of guides paralleling the drum axis and mounted above said drum, a flexible filter sheet encircling said supply roll and extending generally horizontally across the top of said tank, around one of said guides, then downwardly around the drum to cover the perforated area thereof, upwardly *and tangentially off from the drum* and around the other of said guides *on the upper side thereof* and finally generally horizontally to said take up roll, *whereby only the clean side of said sheet contacts said other guide* [a member disposed beneath the horizontal run of said sheet to prevent material falling from the sheet from returning to said tank], and means for draining filtrate from the interior of the drum *after gravitation thereof inwardly from said tank through said filter sheet.*

2. A filter having in combination, a tank adapted to contain a body of liquid to be filtered, a drum having *closed ends and* a perforated periphery mounted within said tank to turn about a horizontal axis coincident with the drum axis, parallel supply and take up rolls [disposed outwardly beyond the side wall of said tank and] mounted to turn about horizontal axes paralleling the drum axis and disposed at different levels, a flexible filter sheet encircling said supply roll and extending across the top of said tank, downwardly around the drum to cover the perforated area thereof, and finally *tangentially away from the drum and* to said take up roll, means for guiding the portions of said sheet between said drum and said supply and take up rolls, *including a bar engageable with the clean side of the tangentially extending portion of said sheet,* and means for draining filtrate from the interior of the drum *after gravitation thereof radially of said drum and inwardly through said filter sheet.*

3. A filter having in combination, a tank adapted to contain a body of liquid to be filtered, a drum having a perforated periphery mounted within said tank to turn about a horizontal axis coincident with the drum axis, parallel [vertically spaced] supply and take up rolls [disposed outwardly beyond the side wall of said tank and] mounted to turn about axes paralleling the drum axis, a flexible filter sheet encircling said supply roll and extending across the top of said tank, downwardly around

the drum to cover the perforated area thereof, upwardly and around said take up roll, means for draining filtrate from the interior of the drum, a bracket rotatably supporting said supply roll, and means pivotally supporting said bracket to swing *outwardly and downwardly* [toward and away from the wall of said tank] between an inner operating position and an outer loading position.

4. A filter having, in combination, an endless perforated carrier movable in an endless fixed path around a horizontal axis, said carrier having imperforate bands along opposite side margins, a tank enclosing said carrier and having walls spaced from the sides and ends of the carrier, said tank being adapted to contain a body of liquid to be filtered submerging the lower portion of said carrier, means closing opposite ends of said carrier and providing a passage communicating with the interior of said carrier for withdrawing filtered liquid therefrom, a flexible filter sheet of sufficient width to cover said carrier and overlap said bands, means supporting said sheet and tensioning the same around the lower portion of said carrier between lines of initial contact with the carrier and take-off therefrom, said lines being disposed above said liquid body and opposite sides of said carrier, and a guide paralleling said axis and spaced from said take-

off line along a tangent to the carrier intersecting such line, said sheet extending tangentially away from said carrier at said take-off line and over the top of said guide whereby to maintain the clean side of said sheet in contact with said guide.

5. A filter as defined in claim 4 having take-up means operable to draw said filter sheet around said guide along a path inclined relative to the vertical and with the dirty side of the sheet facing upwardly.

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