

June 26, 1934.

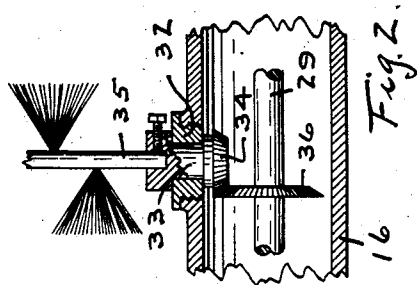
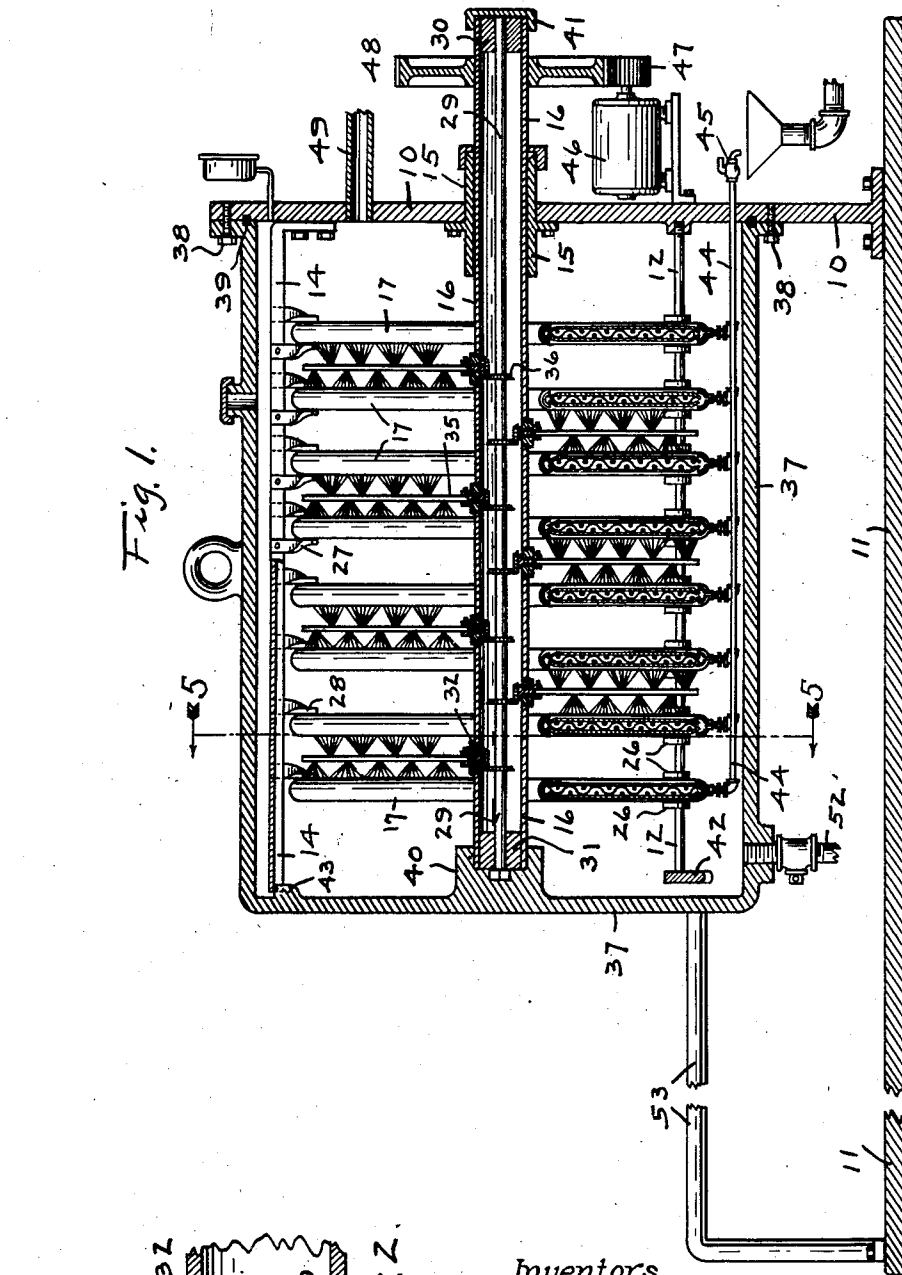
L. C. McNAMARA ET AL

1,964,326

METHOD AND APPARATUS FOR FILTERING USED JOURNAL BOX OIL

Filed Jan. 7, 1933

3 Sheets-Sheet 1



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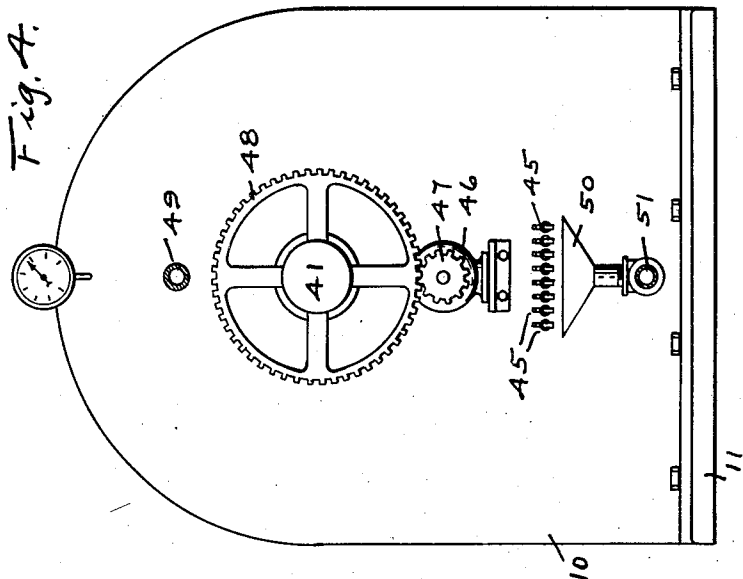
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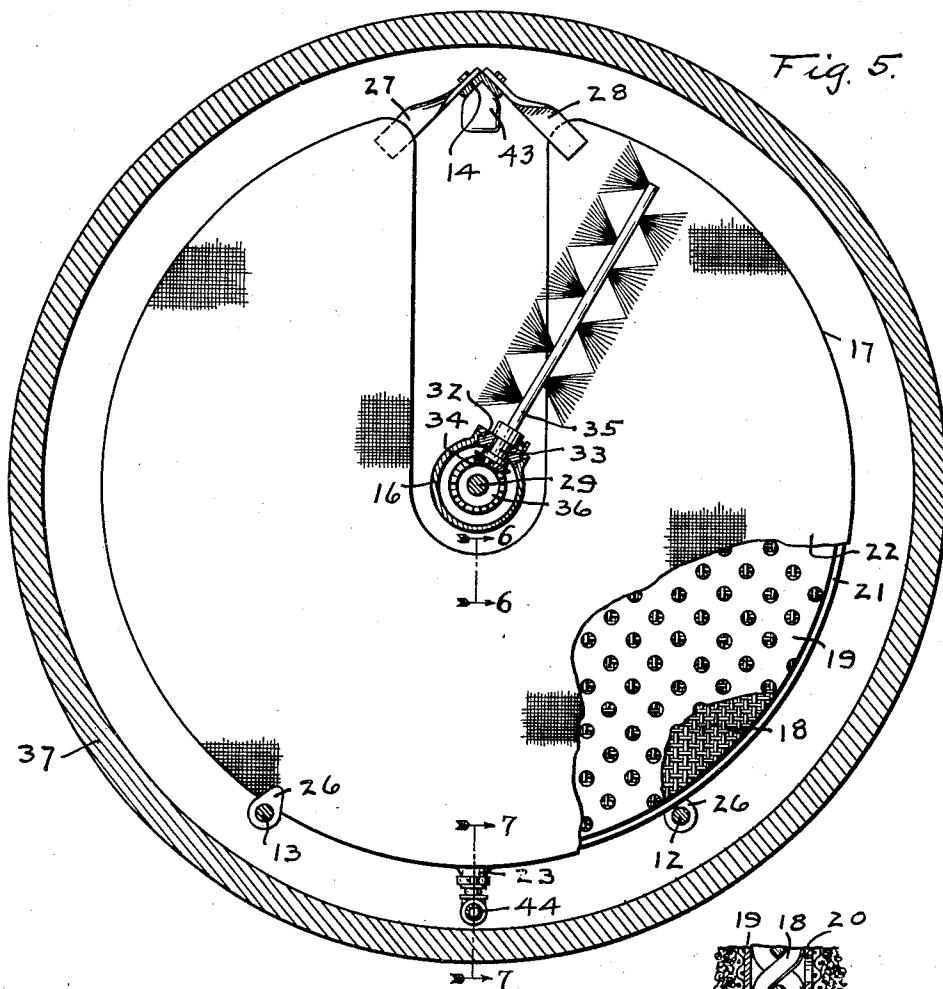


Fig. 5.

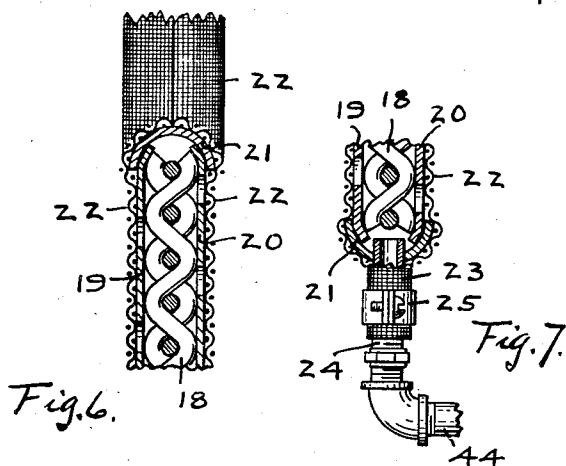


Fig. 6.

Fig. 7.

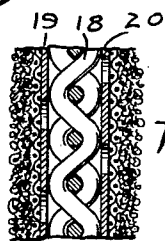


Fig. 8.

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UNITED STATES PATENT OFFICE

1,964,326

METHOD AND APPARATUS FOR FILTERING
USED JOURNAL BOX OIL

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8 Claims. (Cl. 210—182)

This invention relates to the art of filters and particularly to a type of filter adapted to filter oil obtained from used journal box waste and also oil which has been used as a wash oil in cleaning used journal box waste.

The art of recleaning used journal box waste has had quite an extensive growth. The waste referred to herein is that which has been employed in packing journal boxes particularly of the type employed in railway equipment wherein the waste is packed under a journal and feeds oil to the surface of the journal for lubricating purposes. After a period of time this waste reaches a condition under which oil will no longer be fed to the journal and the waste must be removed and other waste installed in its place in order to prevent the failure of lubrication. The waste in a journal box is employed solely for the purpose of feeding oil to the journal surface by capillary attraction. In other words the waste serves as a wick. This waste in many instances consists largely of cotton threads and yarn to which in some cases wool threads or yarn are added to give the mass resiliency in order to maintain the mass of waste in contact with the journal. In other instances wool waste alone is employed. With cotton waste, the major portion of the waste being cotton, and cotton thread and yarn being nothing more than cotton lint twisted together, there is always present in the cotton waste a quantity of such lint which becomes separated from the threads and yarn. With wool waste, the threads or yarn are made from twisted wool fibers inherently short in length, some of which fibers may become separated also from the threads and yarn. Hereinafter, the term "lint" will be employed to include both cotton lint and wool fibers. Heretofore it has been the common accepted belief that the presence of such free lint in the mass of waste has caused failure of lubrication of the journal by reason of the lint becoming matted and preventing the flow of oil therethrough to the journal. Extensive investigation has disclosed that the failure of lubrication is not at all due to the presence of such free lint but that instead, the presence of such lint actually aids in providing more capillaries to feed the oil to the journal. It is well known that felt forms a good wick and is commonly used in connection with the lubrication of bearings in many instances. The lint even if it should felt forms a good wick likewise. What does happen when lubrication fails with the use of waste is that after a period of time comminuted particles of foreign matter such as sand, cinders, brass, Babbitt metal, iron and the like

become mixed with the oil in the journal box in a colloidal state to be suspended accordingly in the oil. This colloidal matter being carried by the oil in suspension chokes the capillaries formed by the waste itself and through the felted lint after a period of time so that oil is fed by the waste in gradually decreasing quantities until such a condition is reached that insufficient oil reaches the journal and the journal begins to run hot.

When the waste reaches this condition wherein the colloidal matter has stopped the capillary action, the waste must be removed and either new waste installed or the old waste cleaned and returned. In the cleaning of the old waste, it has been the common practice to wash this old waste either in a bath of heated lubricating oil wherein the old oil in the waste was likewise heated and became mixed with the wash oil, or heated lubricating oil has been flushed through the old waste. In either event, this wash oil carries out from the mass of waste some of the free lint as well as the colloidal matter in the old oil. It is to be seen that unless this wash oil can be used over and over again, the process of cleaning the used waste becomes rather expensive. Many attempts have been made to renovate this used wash oil to restore it to a condition wherein it may be used over again without carrying more foreign matter back into the waste than it originally contained.

Chemical processes have been employed, such for example as shown and described in the U. S. patent to Grisbaum No. 1,791,473, issued February 3, 1931. Another process employed heretofore has been that of distillation as shown and described in the U. S. patent to Potter et al., No. 1,709,230, issued April 16, 1929. In both instances attempts were made to renovate the oil by disposing of the lint carried by the oil. Filtering mediums heretofore obtainable were entirely incapable of handling this used wash oil with any commercial success so that the chemical and distillation methods were employed.

Our present invention makes use of the discovery that it is the colloidal matter in the used waste oil and not the free lint which has prevented the use of filtering processes. In our present invention, we make use of the free lint and employ it as a filtering and retarding medium to receive the colloidal matter from the oil while the oil is filtered through a second medium through capillary action. Further, colloidal matter in suspension being particles of foreign matter enclosed by oil films, we break down such films by capillary attraction.

It is a primary object of our invention to pro-

vide a filter structure wherein the oil from the used journal box waste and also the dirty wash oil may be filtered directly without the employment of chemicals, and in which relatively large quantities of the oil may be handled in a relatively short period of time so that the oil may be filtered and returned to the wash tanks without undue delay whereby large batches of the used waste may be cleaned without having to shut down frequently and wait for the oil to be cleaned and returned.

A further important object of our invention is to provide such a filtering structure that may be readily cleaned and inspected with a minimum expenditure of labor and with a degree of certainty to insure a clean run of oil. A further advantage of our invention is that the filtering mediums are made up as individual members and that the operation of each of these members may be observed separately by the flow of oil therefrom. A still further advantage of our invention lies in the particular construction which provides for easy replacement of any of the filtering elements and which provides for means for cleaning these elements without their having to be removed from the structure.

These and other objects and advantages will become apparent from the following description of the invention as illustrated by the accompanying drawings, in which

Fig. 1 is a central longitudinal vertical section through a structure embodying our invention;

Fig. 2, a detail on an enlarged scale showing the cleaning brush driving mechanism;

Fig. 3, a fragmentary rear elevation of the structure;

Fig. 4, a front elevation;

Fig. 5, a vertical transverse section on an enlarged scale on the line 5—5 in Fig. 1;

Fig. 6, a detail in vertical section on the line 6—6 in Fig. 5;

Fig. 7, a detail in vertical section on the line 7—7 in Fig. 5, and

Fig. 8, a detail in vertical section through the filtering disc indicating the various filtering media.

Like characters of reference indicate like parts throughout the several views in the drawings.

We form a head 10 here shown as being supported in a vertically disposed position by a base 11 and on the rear side of this head we mount a pair of lower arms 12 and 13 to extend horizontally rearwardly therefrom in substantially parallel and horizontal alignment. An upper spacing arm 14 is also secured to the back face of the head 10 to extend horizontally rearwardly therefrom. All three of these arms are preferably attached to the head in a removable manner. A bearing 15 is provided centrally through the head 10 and through this bearing is revolvably carried a hollow shaft 16.

We provide a plurality of filtering discs 17, here shown as eight in number, the number depending upon the capacity of the filter desired. Each of these filter discs 17 is formed to have a center core 18 serving as a medium to space apart two plates 19 and 20. This central core 18 may be formed in a variety of ways, the essential feature of its construction being that the oil to be filtered may flow freely from top to bottom therethrough as well as laterally in from the outer edges. A convenient way of making such a core is to employ coarsely woven wire fabric or screen, the screen and both plates 19 and 20 separated by the screen being made preferably

out of some metal. Both plates 19 and 20 are provided with a plurality of perforations therethrough so as to permit flow of oil through such perforations into the spacing core. The plates and core are held together in a unitary structure, here shown as by a molding 21 encircling the peripheral edges of the plates and core. This structure so formed is essentially a circular disc and is provided with a cut away portion entering radially from the edge so as to permit the disc to be centrally placed about the shaft 16 with the shaft extending through this cut away portion to have the disc centrally disposed about the shaft. The diameter of the disc is made such that the disc may rest upon the supporting arms 12 and 13, Fig. 5, and thereby be held centrally about the shaft 16 as indicated. Thus it is obvious that by revolving the disc 17 circumferentially about the shaft 16 while the disc is supported on the arms 12 and 13, the cut away portion of the disc may be brought around to approach the horizontal position so that the disc may be withdrawn from about the shaft in a lateral direction instead of having to shift the disc entirely to the end of the shaft.

Each disc 17 is provided with a woven, cotton duck cover 22 which is formed to fit snugly about the disc and to have an extending hose-like portion 23 which may be slipped over a nipple 24 which extends radially through the molding 21 on the side of the disc opposite to the cut away portion. This portion 23 is tightly gripped about the nipple 24 by a clamp 25. The cover 22 is cut in two pieces each to have a peripheral edge extending beyond the edge of the disc and these two edges are sewed together around a major portion of the periphery so that the cover thus formed may be slipped over the disc and the remaining portions of the edges then sewn together after the cover is in place. We find that cotton duck commonly known as canvas may be used successfully throughout a wide range of weights, an eight ounce duck giving good performance. Heavier duck may be employed and will last longer than the lighter duck. The essential characteristic of the cotton material is that it has a rather tight weave and that when in the presence of oil will serve as a wick by providing innumerable capillaries.

The various discs 17 employed are supported by the arms 12 and 13 as above indicated and are spaced apart therealong by means of brackets 26 secured to the arms and extending like fingers up on each side of the respective discs. In order to maintain the discs in vertical positions, we provide the upper arm 14 with pairs of fingers 27, 28 which hang downwardly and extend across the cut away portion of the discs to be in contact with the respective faces of the discs. The discs 17 are thus supported in vertically spaced apart positions.

A shaft 29 extends longitudinally through the shaft 16 and is supported centrally therewithin by bearings, here shown as by the forward bearing 30 and the rear bearing 31, the shaft 29 being free to revolve in these bearings. The shaft 16 is provided with a plurality of bearings 32, Fig. 2, here shown as being screwthreadedly carried by the wall of the shaft. Each bearing 32 is separately assembled before being attached to the shaft 16 to have a stub shaft 33 revolvably carried thereby with a bevel gear 34 on the inner side and a socket in the outer end to receive the end of a brush arm 35. These bearings 32 thus assembled are screwthreadedly engaged in fixed po-

sitions along the shaft 16, the bearings being spaced apart so as to come centrally between the various discs 17. Preferably, to obtain more structural strength, these bearings 32 are placed in staggered arrangement around the circumference of the shaft 16 as indicated in Fig. 1. On the shaft 29 are carried a plurality of beveled gears 36 fixed to the shaft 29 and spaced therealong so as to have a gear 36 in mesh with each gear 34. The brush arms 35 are provided with bristles extending therefrom of sufficient length so as to be in compressive engagement with the faces of adjacent discs.

The entire structure so far described is enclosed within a cylindrical housing 37 which is secured against the rear face of the head 10 by cap screw 38 passing through an annular flange on the housing and screwthreadedly engaging the head. Preferably a gasket 39 is employed to extend circumferentially around the end of the housing 37 to be compressed against the head 10 so as to form an oil tight joint therewith. The housing 37 is provided with a central inwardly extending hub 40 which receives the end of the shaft 16 to support it in a revoluble manner to form a bearing for the shaft and also to receive the end of the shaft 29 which is shaped to enter within a socket inside of this hub so as to prevent rotation of the shaft. The end of the shaft 29 is here shown as being square and as being received in a like shaped socket. A cap 41 is provided to fit over the forward end of the shaft 16 so as to prevent oil leakage therefrom and also to retain the shaft 29 in the position to have its rear end engaged within the socket. To prevent bending of the arms 12 and 13 and also of the arm 14, supports are provided to be carried by the housing 37, a cross bar 42 receiving the rear ends of the arms 12 and 13 to rest against the inner wall of the housing, Fig. 3, and a boss 43 being provided to enter under the rear end of the arm 14. The arms 12 and 13 are here shown as being circular in cross section while the upper arm 14 is shown as being formed from an inverted angle iron, the exact cross sectional shapes of these arms are immaterial.

From each of the nipples 24 on the respective discs 17 leads a pipe line 44 forwardly under the discs within the housing 37 to pass outwardly through the head 10. A valve 45 is provided on each pipe 44 forwardly of the head 10 as a means for cutting off the flow of oil from each pipe as may be desired. Some means is provided for revolving the shaft 16, here shown as an electric motor 46, interconnected with the shaft through the pinion gear 47 and driving gear 48.

In using the structure above described, the oil is heated to above the boiling point of water so as to have a water free oil, the temperature being preferably around 230 to 240 degrees F., but may be lower or higher with the flash point as the upper limit. The oil is carried to within the housing 37 through some suitable means, such as by the pipe 49, and a pressure is maintained on this oil within the housing. This pressure is relatively low, normally being within the range of from five to ten pounds, the maintenance of an exact pressure not being vital particularly if maintained between these limits. Pressures up to twenty-five pounds may be employed without materially hindering the filtering action, but should the pressure become excessive, such as up around one hundred pounds or above, the filtering action is greatly affected and finally stopped altogether within a short time by reason of such

excessive pressure squeezing closed the capillaries in the canvas coverings.

Upon the entrance of the dirty oil within the housing 37, the oil fills in about the various discs 17 and the oil at once starts feeding through the canvas covers 22 on these various discs to cause the oil to flow through the perforations in the plates thereunder, into the central cores 18, from which the oil may drain by gravity out through the nipples 24 and respective pipes 44, through the valves 45 into some collecting trough or funnel 50 from which the filtered oil is carried by a pipe 51 to any suitable storage (not shown). The flow of the oil is observable as it drops from the valves 45 into the funnel 50 and should there be a torn or worn place in any one of the covers 22, such fact becomes apparent at once by reason of dirty oil flowing from the valve 45 which is on that line 44 leading to the particular disc having the defective covering. The valve 45 may accordingly be shut off so that the remaining discs may continue to function without the entire filter having to be shut down and opened for repair.

After a slight initial flow of the oil through the canvas covers 22, the lint carried in suspension by the oil begins to coat over the outer faces of the various covers to form a felt coating. The felt itself then serves as an excellent medium to entrap the greater mass of colloidal matter and hold it adjacent the canvas itself. The cotton canvas possessing excellent wick-like characteristics feeds the oil quickly away from the felt and colloidal matter coating, through the canvas, and the inner plates 19 and 20 to allow this oil to escape into the central core therebetween. This action is clearly shown when the housing 37 is removed and a section is taken through the canvas and the coating by the fact that the side of the coating which contacts with the canvas is in an approximately dry state. The oil will continue to travel through this built up layer and the canvas thereunder for an extended length of time as determined by the quantity of colloidal matter carried by the oil. In time, this colloidal matter will coat over and coke up the capillaries through the layer and entrances to the canvas capillaries until a condition is reached such that the flow of oil is retarded to such an extent as to be practically stopped. Up to this point, the shaft 16 with the radiating brushes extending therefrom has remained stationary, but when the colloidal matter has collected to such an extent as to have practically stopped the flow of oil to within the discs 17, the flow of dirty oil to within the housing 37 is stopped and the oil drained from within the housing 37. Some washing solution in water is then placed within the housing 37 and the shaft 16 is revolved by the motor 46. As this shaft revolves the brushes revolve about their axes as the shaft 16 carries the gears 34 around the stationary gears 36 so that while the brushes 35 are being carried through complete circles of travel around between adjacent discs, the brushes are also revolving axially so as to brush off the adhering residual matter including the felted lint adhering to the covers 22. The presence of the washing solution tends to precipitate the remaining matter so as to cause it to be more easily removed. The exact solution to be employed is immaterial since such materials for this purpose may be any of many washing solutions well known to those skilled in the art. When this residual matter has been removed from the discs, the

washing solution and other matter then contained in it are drained from the housing 37 through some suitable means, herein shown as through the valve controlled drain 52, Fig. 1. Following this draining, the structure is then again ready to receive a new supply of the dirty oil for further filtering action. The flow of oil into the housing 37 may be under pressure itself and may be continuous and so regulated that the oil may flow into the housing as fast as the filtered oil leaves it so that the filtering action may be continuous until residual matter has to be removed.

When any one or more of the covers 22 becomes ineffective by being torn or worn out, the housing 37 may be detached from the head 10 and slipped backwardly therefrom along rails or tracks 53, 54 supported by the base 11 so that the housing 37 may be shifted rearwardly sufficiently so as to give access to all of the discs 17. Any individual disc may then be uncoupled from its discharge line 44, the upper arm 14 detached from the head 10 and the disc revolved about its central axis and then pulled out laterally for recovering without distributing the other discs.

When the cleaning solution is drained from the tank 37 following the brushing of the surfaces of the various discs, the lint and other matter removed from the discs is carried out in the solution and thus removed from within the housing. The slight pressure maintained on the oil during the filtering action seems to aid the capillary flow of the oil through the canvas coverings and is therefore maintained to speed up the filtering process. As above indicated, an excess pressure will cause the colloidal matter to press together the capillaries and thus prevent further flow of oil therethrough. A further use of the pressure is that the normal tendency for reverse flow of the clean oil to the dirty oil due to osmosis is prevented.

In further explanation of the process we employ, attention is directed to the fact that the lint in the oil collects on the outer faces of the canvas coverings. This lint becomes coated with the colloidal matter in the oil so that a concentration of colloidal matter is obtained at the canvas coverings. The colloidal matter comprises the comminuted particles of foreign matter entrapped in films of the oil, the surface tensions of which films resist efforts to dislodge the particles from their supporting oil films. Now as these films are brought and held against the canvas coverings, the capillary attraction induced by the canvas overcomes the surface tension of the films, the films are "sucked" off the particles to flow through the canvas capillaries, and the dry particles are left stranded on the outer faces of the canvas. This action continues leaving a layer of dirt or foreign particles thus divested of their films with capillaries through the layer, lint being intermixed with it. However, as the layer increases in thickness, colloidal matter in the oil then separated from the canvas is thus held away from the more intensive capillary attraction of the canvas, and such matter fills in the capillaries in the formed layer so as to stop the feeding of more colloidal matter to the canvas surface. Then it is that clean oil flows in smaller quantities within the discs, and a putty-like coating is found on the outer sides, dry next to the canvas. The brushing off of this coating is readily accomplished in the presence of the washing solution, the foreign matter in the coating having been changed from a colloidal

suspended state to a mass of oil film free particles readily precipitating in the solution.

While we have herein shown and described a comparatively simple mechanism, such mechanism has very effectively solved a problem which has baffled others working in the same field in obtaining a clean oil from a lint and colloidal matter bearing oil which has passed through waste and has either washed such waste after having been used in a journal box or has been reclaimed from such waste as part of the original waste containing lubricating oil. It is obvious that structural changes may be made in the mechanism which we have herein shown and described without departing from the spirit of the invention and we therefore do not desire to be limited to this precise form beyond the limitations as may be imposed by the following claims.

We claim:

1. In a process for separating from lubricating oil which has been mixed with waste, lint and foreign comminuted matter, some of which at least is in a colloidal state, the combination of those steps which comprise that step of forming a mat from the lint carried by the oil to collect in part said matter, and that step of setting up an intensive capillary attraction on one face of the mat to induce a flow of oil therefrom.
2. In a process for separating from lubricating oil which has been mixed with waste, lint and foreign comminuted matter, some of which at least is in a colloidal state, the combination of those steps which comprise that step of forming a mat from the lint carried by the oil to collect in part said matter, and that step of setting up an intensive capillary attraction on one face of the mat to induce a flow of oil therefrom, and that step of maintaining a slight difference in pressure between the two faces of the mat, the lower pressure being at said one face.
3. A process for separating from lubricating oil which has been removed from journal box waste, lint and other suspended matter, which comprises forming in the presence of the oil a mat from the lint carried by the oil over a mat of similar lint in a more compressed form and having a greater capillary attraction for the oil than the first mat, flowing said lubricating oil against said first mat, and collecting oil drawn by the second mat from the first mat.
4. A process for separating from lubricating oil which has been removed from journal box waste, lint and other suspended matter, which comprises forming in the presence of the oil a mat from the lint carried by the oil over a mat of similar lint in a more compressed form and having a greater capillary attraction for the oil than the first mat, flowing said lubricating oil against said first mat, collecting oil drawn by the second mat from the first mat, said suspended matter being retained in part at least by the first mat, and maintaining a difference in pressure on said two mats to have a slightly higher pressure on the first mat than on the second.
5. A process for separating from lubricating oil which has been mixed with journal box waste, lint and other suspended matter, which comprises heating the oil to above the boiling point of water, flowing the heated oil through a filter mat of tightly compacted lint of the same nature as that appearing in the oil, permitting a mat to be formed over the filter mat from the lint carried by the oil so as to introduce a medium to catch and retain in part said suspended matter and

hold it adjacent said filter mat, drawing the oil from the formed mat by the capillary action of the filter mat, carrying the oil under a slight pressure against said formed mat, and collecting the oil draining from the filter mat.

6. In a method for separating foreign matter in colloidal suspension from lubricating oil which has been mixed with waste, that step which comprises breaking down the oil films about the particles of foreign matter by subjecting the films to the force of a capillary attraction of sufficient strength to pull the oil films from about the particles.

7. In a method for separating lint and foreign matter in colloidal suspension from lubricating oil which has been mixed with waste, those steps which include that step of collecting the lint with foreign matter adhering thereto in the presence of the oil in a relatively thin layer to cause a greater concentration of the colloidal matter in said layer than in the oil, and that step of sub-

jecting the concentrated colloidal matter to a capillary attraction of sufficient force to overcome the surface tension of the oil films enclosing the particles of foreign matter to cause withdrawal of the films therefrom.

8. In a method for separating foreign matter in colloidal suspension from lubricating oil which has been mixed with waste, those steps which include that step of heating the oil to above the boiling point of water to eliminate the moisture and to reduce the viscosity of the oil, that step of subjecting the oil films about the particles of the foreign matter to an external force of adhesion sufficient to overcome the force of cohesion in the oil films, and that step of conducting the oil away from the exposed particles.

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