Nov. 6, 1945. F. B. HARVUOT 2,388,636

LUBRICANT CONDITIONER

Filed Nov. 7, 1940 6 Sheets-Sheet 1

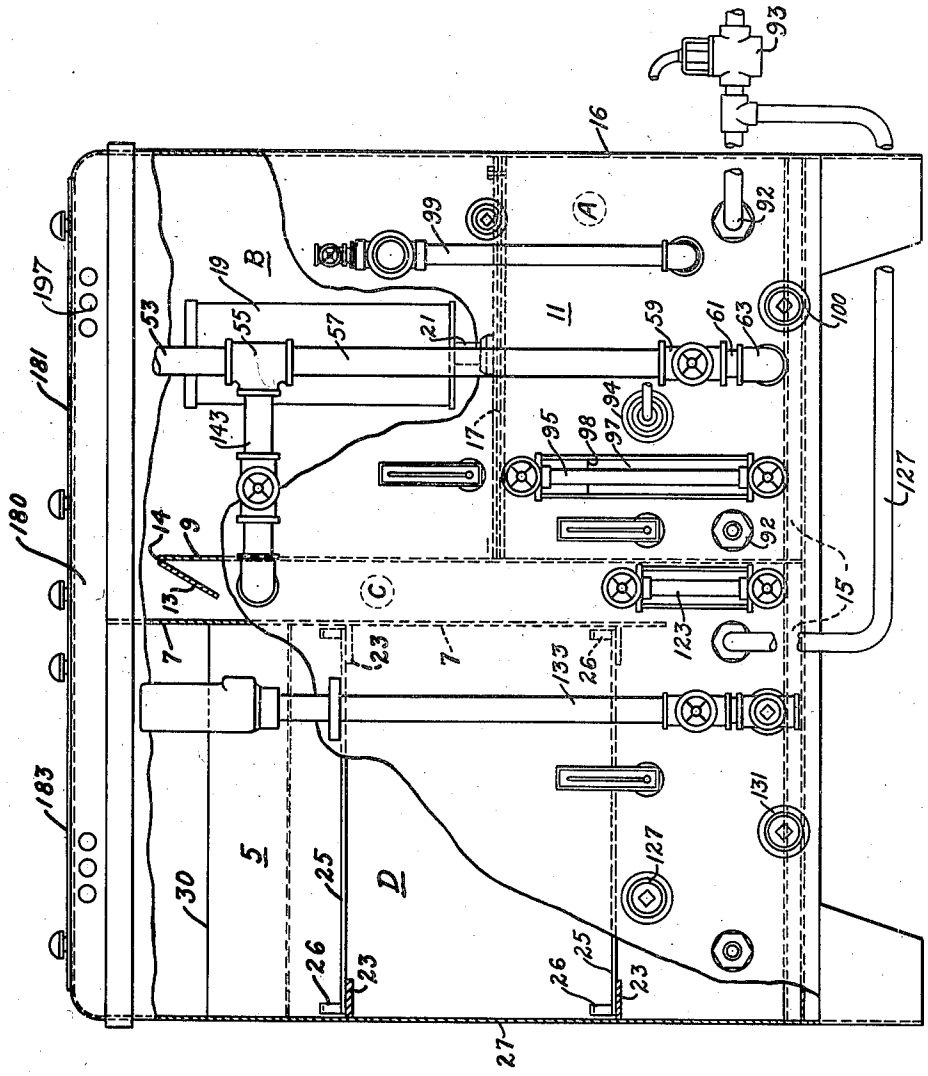


Fig. 1

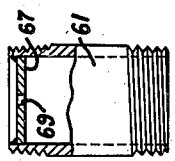


Fig. 10

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LUBRICANT CONDITIONER

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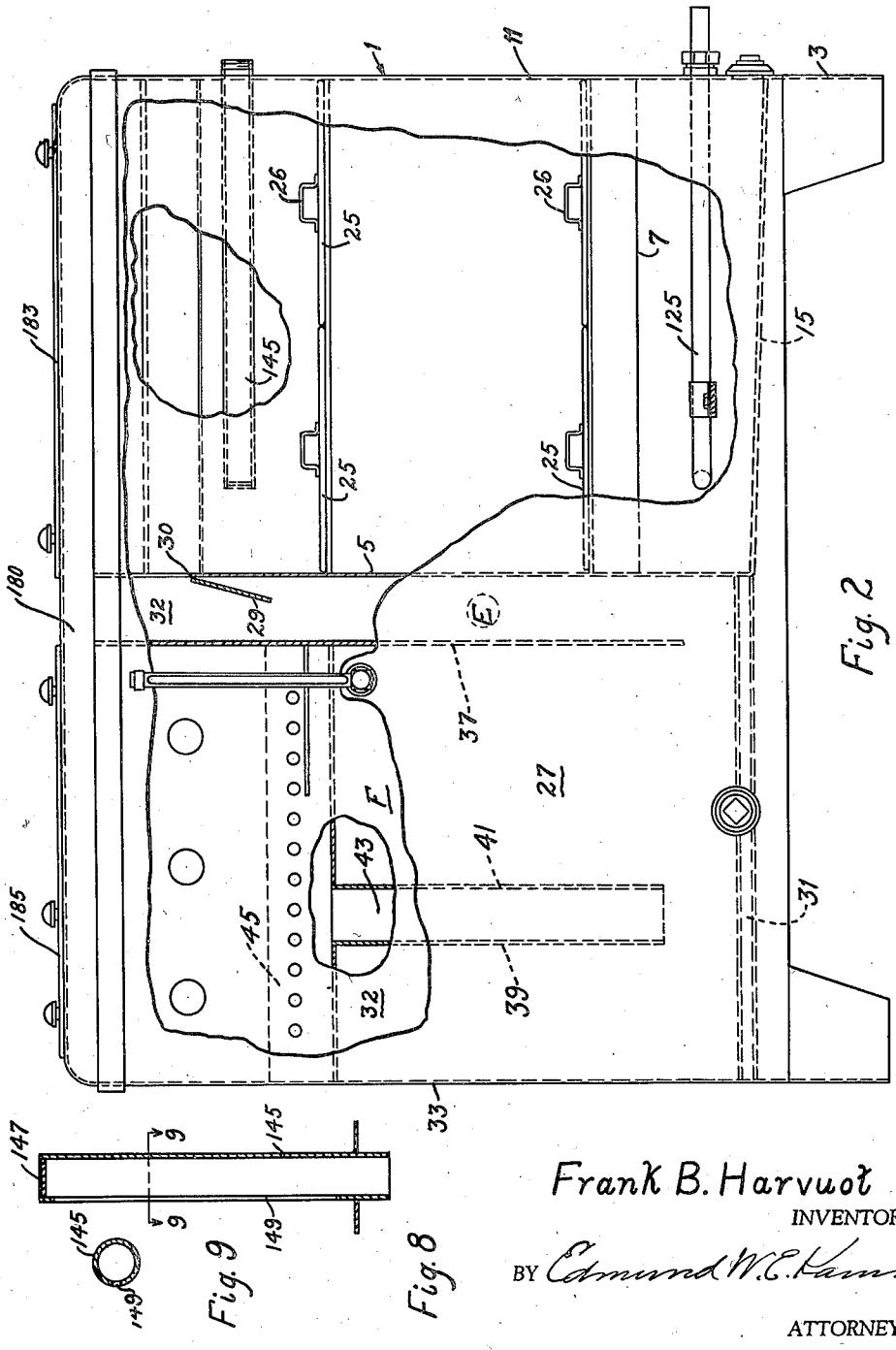


Fig. 2

Fig. 9

Fig. 8

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LUBRICANT CONDITIONER

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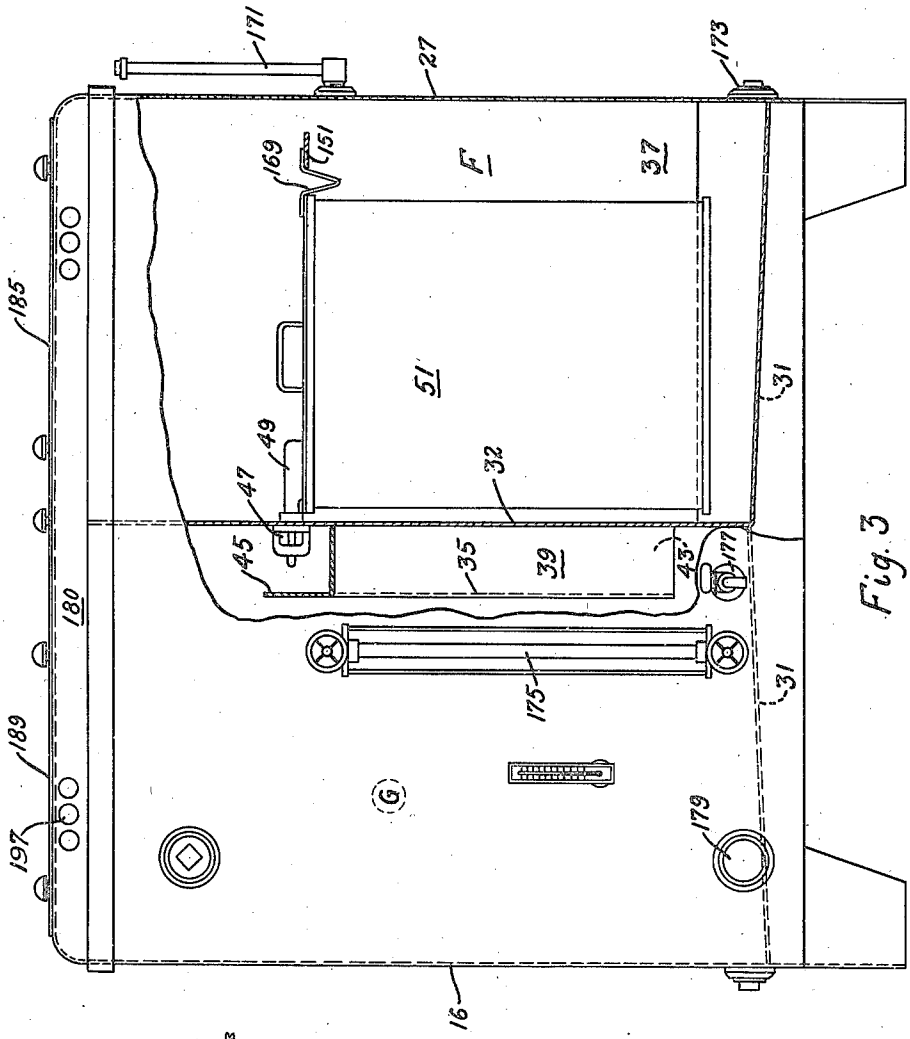


Fig. 3

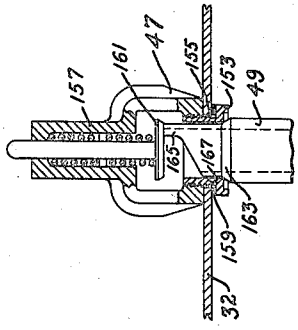


Fig. 14

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LUBRICANT CONDITIONER

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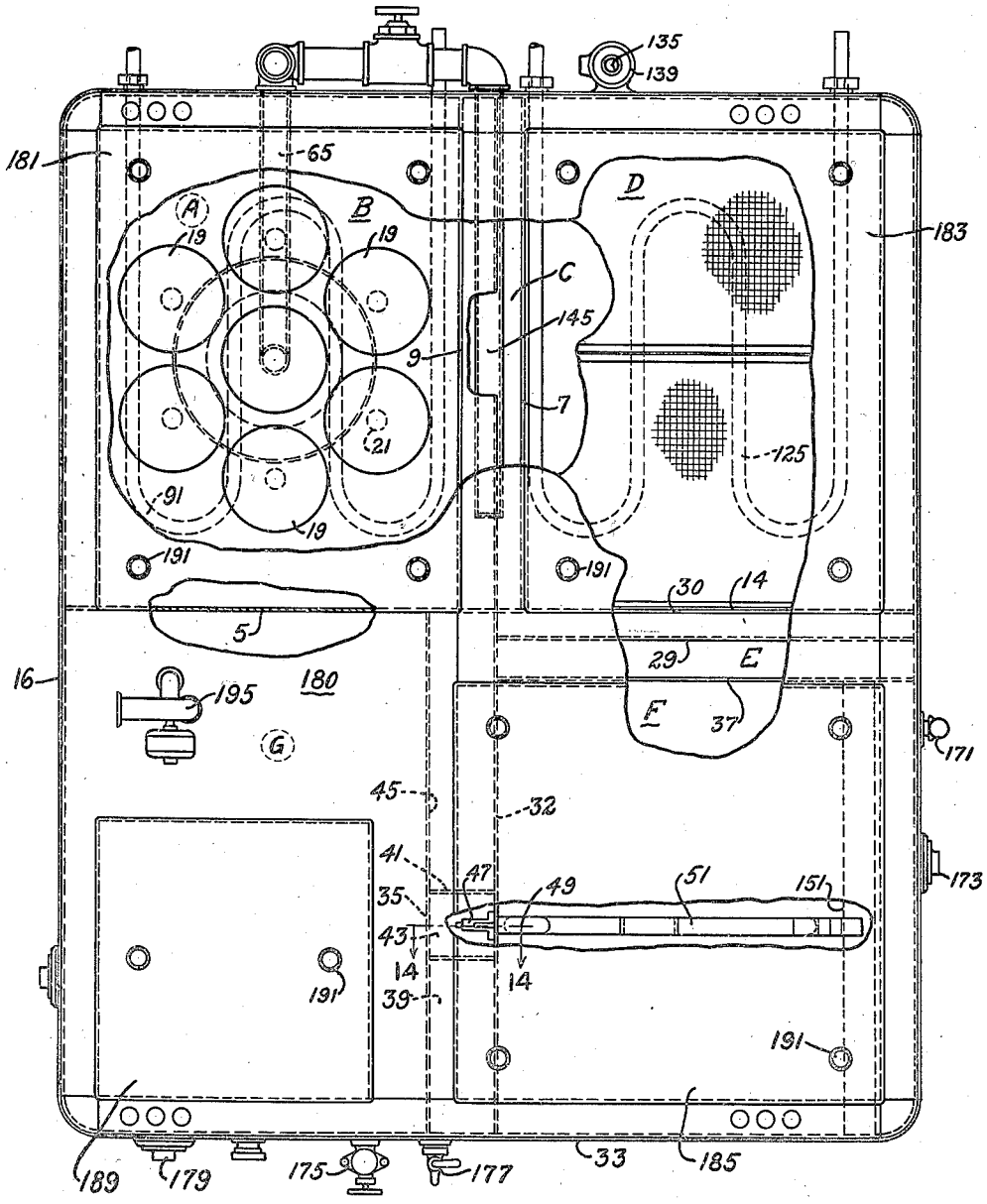


Fig. 4

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LUBRICANT CONDITIONER

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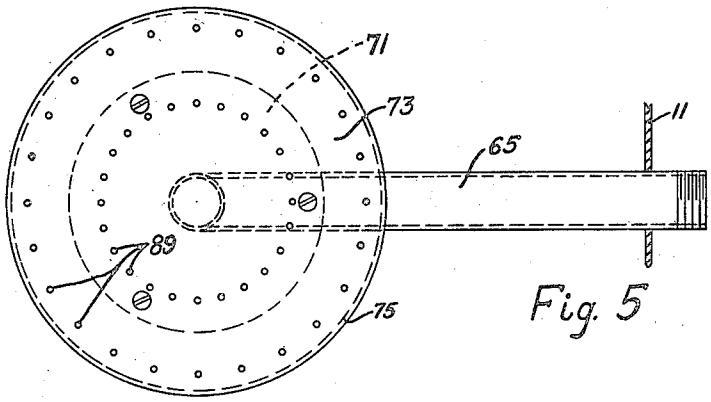


Fig. 5

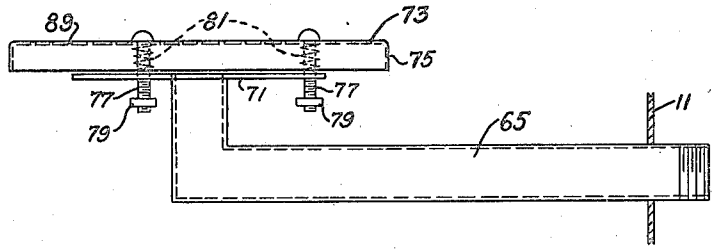
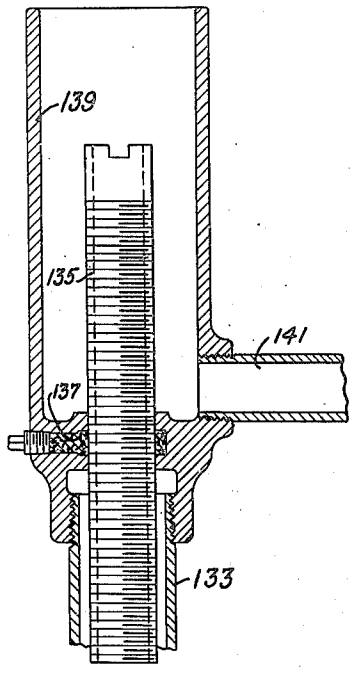


Fig. 6

Fig. 7



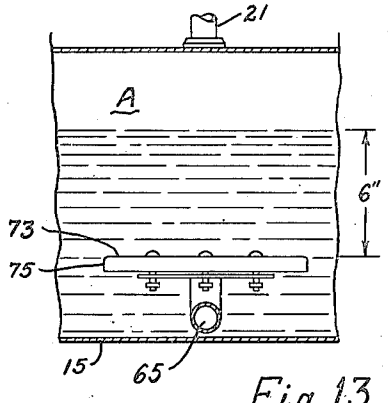


Fig. 13

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LUBRICANT CONDITIONER

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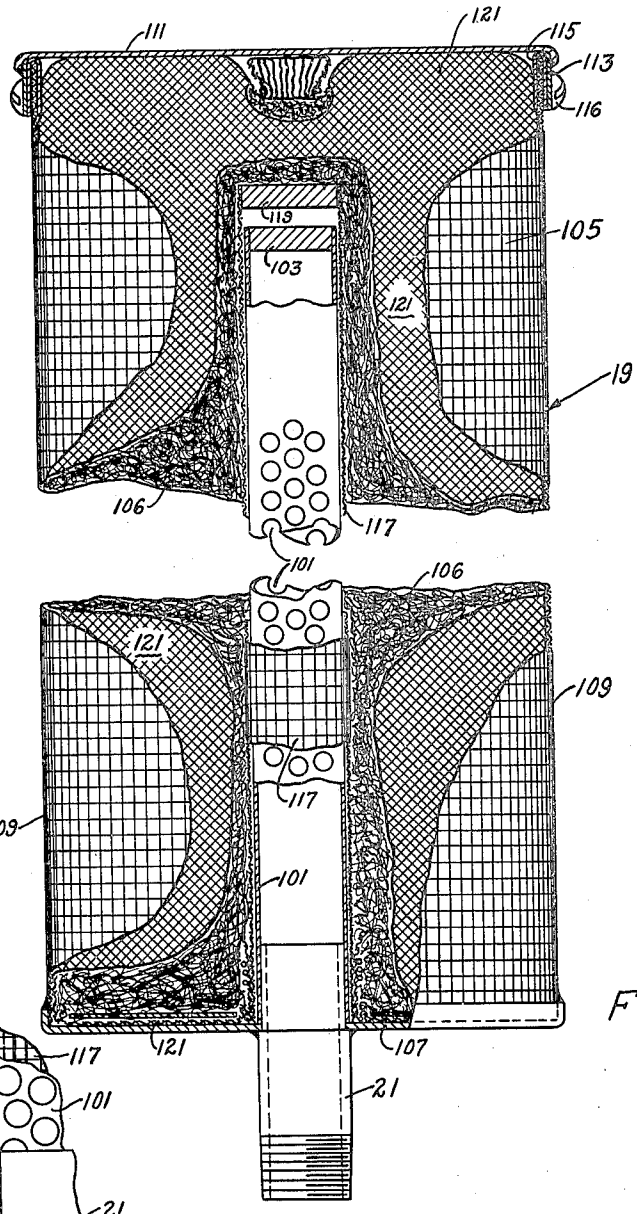


Fig. 11

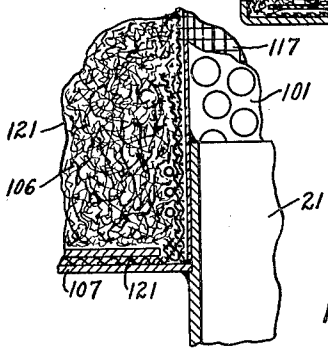


Fig. 12

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Patented Nov. 6, 1945

2,388,636

UNITED STATES PATENT OFFICE

2,388,636

LUBRICANT CONDITIONER

Frank B. Harvuot, Fort Wayne, Ind., assignor to S. F. Bowser & Company, Incorporated, Fort Wayne, Ind, a corporation of Indiana

Application Novembr 7, 1940, Serial No. 364,686

10 Claims. (Cl. 210—49)

This invention relates to a device for maintaining lubricating oil which flows in a circulatory system clean and in good lubricating condition. More specifically, it relates to a device which has provisions for continuously washing a portion of the circulating oil with water to reduce the acid content of the oil, for dehydrating the washed oil and for filtering all of the oil passing through the device.

It is an object of the invention to provide a lubricant conditioner which will remove acid from lubricant flowing in a circulatory system.

It is a further object of the invention to provide a conditioner which will remove water from the circulating lubricant.

Still another object of the invention is to provide a new and novel device for dehydrating oils and similar liquids.

It is still another object of the invention to produce a new and novel system for treating a portion of the oil flowing in a circulatory system to remove impurities, without impeding the operation of the system.

It is yet another object of the invention to provide an oil washing device for securing intimate contact between the oil and the washing fluid.

Still another object of the invention is the provision of means for securing intimate contact between the oil and the washing fluid and for thereafter removing any of the washing fluid which may become entrained in the oil.

Yet another object of the invention is to provide dehydrating units which are readily replaceable in the system.

A further object of the invention is to provide an oil washing device wherein the oil is compelled to traverse a path of predetermined distance through the wash fluid.

It is another object of the invention to provide means for heating the lubricant to render the washing and precipitating operations more efficient.

It is still another object of the invention to provide means for precipitating water from the lubricant.

A further object of the invention is to provide a cartridge type of dehydrator.

Another object of the invention is to provide a novel spreader device which separates the lubricant into small particles and dispenses them into the wash fluid.

Yet another object of the invention is the provision of means for discharging the filtered lubricant into the storage compartment without agitation so as to prevent air from being included with it.

Another object of the invention is to provide means for ventilating the casing so as to prevent corrosion thereof by condensate which forms on the interior parts exposed to air and gases.

These and other objects of the invention will become apparent from a study of the following specification and the drawings which are attached thereto and made a part thereof and in which:

Figure 1 is an end elevation of the entire structure showing the various fittings and having portions of the end wall broken away to show the internal construction.

Figure 2 is a side elevation of the structure viewed from the left of Figure 1 and having parts broken away to show the internal construction and with the filter elements removed.

Figure 3 is an elevation of the end opposite to that of Figure 1 with part of the outer wall broken away to show the filter and clean oil compartments.

Figure 4 is a plan view of the device in which the lower end is the end shown in Figure 3, and wherein portions of the covers are broken away to show the internal construction.

Figure 5 is a plan view of the spreader device which forms the oil into small droplets.

Figure 6 is an elevation of the device of Figure 5.

Figure 7 is a vertical section showing, in detail, the level regulator for the washing fluid.

Figure 8 is a sectional view of the oil inlet pipe.

Figure 9 is a section taken on the line 9—9 of Figure 8.

Figure 10 is a view, partially broken away, showing the orifice for controlling the admission of oil to the washing compartment.

Figure 11 is an elevation with parts broken away of a dehydrator element.

Figure 12 is a sectional view, partially broken away, of the dehydrator element structure at the point of inlet thereto.

Figure 13 is a sectional view showing the washing compartment with the spreader in place.

Figure 14 is a sectional view taken on the line 14—14 of Figure 4 showing the filter outlet structure.

Referring to Figures 1 to 4, the numeral 1 indicates generally an open topped tank of rectangular shape which is provided with legs 3 at its four lower corners.

Fixed in the tank at about the middle is an upright, transverse wall 5 which sealingly engages the bottom and side walls of the tank.

That portion of the tank disposed between wall 5 and the end wall 11 is further divided by two vertical partitions 7 and 9 which sealingly engage the said walls.

Partition 9 extends from the bottom 15, which it sealingly engages, to a point preferably about three inches from the top edge of the tank where it is provided with a downwardly depending lip 13 which, with the partition, forms a weir 14.

As shown in Figure 1, a horizontal deck 17 is sealingly but removably attached to the partition 9, walls 5 and 11 and the side wall 16 to form with bottom 15 a compartment A which is termed the washing compartment. The compartment B above the deck 17 is termed the dehydration compartment because it contains a plurality of dehydrator units 19 which are connected to outlet pipes 21 fixed in deck 17 and forming channels of communication between the compartments A and B.

The partition 7 extends from the top edge of the tank down to a level some eight or ten inches from the bottom 15, this distance being variable because of the slope of the bottom, and forms with partition 9 a passage C which connects compartment B with the precipitation compartment D.

In this compartment a series of supports 23 are fixed to the walls and partitions and serve to support flat screens 25. The latter are held in position by their weight and are provided with handles 26 so that they may be lifted out of the compartment for cleaning, etc.

The wall 5 is of less height between the left side wall 27 and partition 7 than it is between this partition and the side wall 16, and reaches to a level about nine inches below the edges of the tank where it is provided with a depending lip 29 to form a weir 30 (see Figure 2).

The remainder of the bottom of the tank will be designated by numeral 31 for the sake of clarity, and it will be seen from Figures 2 and 3 that this portion 31 of the bottom slopes downwardly and outwardly from about the longitudinal center of the tank.

A central vertical partition 32 sealingly engages the wall 5 and the end wall 33 of the tank as will be seen in Figure 4, and extends parallel with partitions 7 and 9 but on the opposite side of wall 5 from said partitions. It extends from the bottom to a level even with the tops of the tank sides.

A T-shaped wall 35 extends parallel with partition 32, and the extremities of the horizontal portion of 35, numbered 45, sealingly engage the wall 5 and end wall 33 respectively, and its depending or vertical portion terminates at a level some four and one-half inches above the bottom 31.

A transverse partition 37 extends parallel to wall 5 and sealingly engages the side 27 of the tank and the partition 32 just described. It extends upwardly to a level flush with the sides of the tank and downwardly to a level some three or four inches from the bottom 31. This distance will vary because of the slope of the bottom.

In Figures 2 and 3 will be seen angle plates 39 and 41 which are disposed between, and which sealingly engage the partitions 32, 35 and 45. The depending portions of the angle plates form with the partitions a downwardly extending conduit 43 while the horizontal portions of the angle plates form a horizontal trough 45 which is closed at its ends by walls 5 and 33 but which communicates at its intermediate portion with the conduit 43.

The partition 32 is provided with a plurality of fittings 47 which are adapted to receive the discharge pipes 49 of filters 51 as will be described.

It will be seen from an inspection of Figures 2 and 4 that the walls 5 and 27 and partitions 32 and 37 form a passageway E which connects the precipitation chamber D with the filtration chamber F by way of the weir 30 described above.

The filtration chamber F communicates with the treated oil compartment G by way of the fittings 47, trough 45 and the conduit 43. This compartment is defined by the walls 5, 16, 33 and partition 32.

Referring now to Figures 1, 4, 5, 6 and 13, the washing compartment A is connected with an inlet pipe 53 by way of a T 55, a pipe 57, a valve 59, a regulating nipple 61, the L 63 and pipe 65.

The regulating nipple which is clearly shown in Figure 10 comprises an ordinary pipe nipple having a disc 67 sealingly fitted therein as by welding. The disc is provided with a hole 69 which is of a diameter sufficient to permit passage of about one-fourth of the entire flow coming to the unit through the washing compartment diameter.

Referring now to Figures 5 and 6 it will be seen that the pipe 65 is L-shaped and is welded or otherwise fixed in the tank end 11. Welded or otherwise fixed to the upturned end of pipe 65 and flush with the end thereof is a horizontal plate or collar 71.

A spreader 73 which comprises a circular plate having a downwardly directed flange 75, is mounted by means of screws 77 on the collar 71. The screws pass freely through holes in the spreader and enter tapped holes in the collar. Nuts 79 are fixed to the screws to prevent their complete withdrawal from the collar.

Springs 81 are disposed, one around each screw and between the collar and the spreader plate, so as to hold the latter against the heads of the screws.

Diffuser orifices 89 are formed in the circular plate portion of the spreader and the number and size of the holes, as well as the diameter of the head, vary with the capacity of the machine as shown by the following table which contains the values arrived at by actual test and experiment.

Machine capacity	Spreader capacity	Diameter spreader	Number holes	Diameter holes
G. P. H.	*G. P. H.*	*Inches*		*Inch*
90	22.5	12	24	1/16
270	67.5	12	72	1/16
540	135.0	12	64	3/32
1080	270.0	20	128	3/32

It will be recalled that the orifice 69 in the nipple 61 divides the flow so that only about one-quarter of it will pass through the spreader head. The diffusion orifices are of sizes small enough so that the oil will form in droplets at the orifice outlets and will detach themselves therefrom and float upwardly through the wash fluid as separate globules as distinguished from a stream.

The flange 75 on the spreader head is about one inch deep and should lubricant be supplied to the head faster than it can pass through the orifices, it will simply fill the head and flow out from under the rim thereof. No harm results

from this and the only result is that such overflow of lubricant is not completely washed for the reason that it is not broken up to secure an intimate contact with the wash fluid.

The washing compartment is provided with a steam coil 91 which serves to heat the water in this compartment. An automatic valve 93 controlled by a thermostat 94 inserted in the water bath controls the admission of steam to the coil and serves to maintain the temperature of the water at about 140 degrees Fahrenheit, at which temperature the surface tension of the oil is reduced to a point where it can be efficiently washed with water. Numerals 92 indicate the connections between the valve 93 and the steam coil.

A gauge glass 95 is provided in this compartment and is provided with an indicator 97 which bears a mark 98 at the level at which water should be carried in the compartment. This level is preferably about six inches above the outlet from the spreader 73 described above.

A drain outlet 100 is provided at the lower edge of bottom 15 for drawing off the wash water when it is desired to change it, and a water inlet pipe 99 provided with a shut-off valve and a flow indicator is connected to the compartment for supplying fresh water to the compartment.

As described above, a plurality of pipe nipples 21 are set in the deck 17. Each nipple has fixed to it a perforated tube 101 which is sealed at its upper end by a plug 103.

The dehydrator unit 19 which is preferably cylindrically shaped is fixed to the tube 101 and comprises a circular bottom head 107, a rigid cylinder 109 of rather coarse, stiff screen and a cap 111 having a depending flange 113.

The top edge of the screen cylinder 109 is preferably provided with a ferrule 115 which facilitates the insertion of a cartridge and which maintains the shape of the screen at the upper, open end. The cap 111 is held in place over the end of the screen by means of screws 116 which enter threaded openings in the ferrule.

The dehydrator cartridge comprises a screen wire inner tube 117 which is provided with a plug 119 at its upper end.

Firmly tied or otherwise fixed to the lower end of the tube is a cloth bag 121 which is packed with a water absorbent material, preferably defiberized cellulose. This is preferably mixed with a fibrous material such as long fibre cotton which serves to hold the cellulose together as an integral mass. It is also desirable to mix with the above constituents, certain wiry materials which render the mixture resilient so that it will not become a slushy, shapeless mass when it is saturated with oil or water. The materials which applicant prefers to use for this purpose are curled horsehair and Mexican sisal.

Preferably, the above mentioned constituents are approximately proportioned by weight as follows:

	Per cent
Defiberized cellulose	50
Mexican sisal	25
Long fibre cotton	15
Carded wool	5
Curly horsehair	5

These constituents, designated as a mass by numeral 106, are thoroughly mixed in any suitable manner and are then packed into the cloth bag 121, mentioned above, which is then tied at the top to form a cartridge. The cartridge may then be inserted in the container 105 where it is held by the lid.

The cartridge is forced against the bottom of the cylinder with considerable force so that there will be little likelihood of by-passing of the liquid around the dehydrator cartridge.

The flow through the cartridge is, of course, through nipple 21, tubes 101, 117, through the bag filling 106, bag 121 and screen cylinder 109 into the compartment B. The weir 14 is higher than the top of the dehydrator so that the latter is at all times submerged in oil.

Water is carried at a level, in compartment D, about two inches below the lower end of partition 7. The water level will be indicated by a gauge glass 123.

A steam coil 125 is mounted in this compartment below the usual water level and is adapted to heat the water. This coil is connected to the valve 93 by pipe 127 and is controlled thereby to hold the temperature in the precipitation compartment to approximately 140 degrees Fahrenheit, which is suitable for effecting the precipitation of moisture from the oil.

A cleaning plug 131 is also provided at the bottom of this compartment.

The precipitation compartment D is provided with an automatic water discharge to prevent the level of water from rising in the compartment beyond a predetermined level (Figures 1 and 7). This device comprises a pipe 133 which communicates with the compartment near its bottom and hence below the water level; hence a column of water will rise in this pipe and in the adjustable tube 135 (Figure 7) which is fitted into the pipe, a distance corresponding to the pressure exerted by the combined head of oil and water in the compartment.

By adjusting tube 135 in the stuffing box 137, the amount of water in the compartment can be varied because as the tube 135 is lowered it will require less pressure to force water to spill over into the cup 139 so that it will pass to the drain 141. Water will accordingly be displaced by oil until the columns are again balanced. Addition of water to the body in the compartment will cause water to be passed to the waste water discharge. Obviously, since water is heavier than oil the top of tube 135 will have to be lower than weir 30.

Referring to Figures 1, 2, 4, 8 and 9, it will be seen that a pipe 143 is connected with T 55 and serves to divert the greater portion of the flow, about seventy-five percent, into the channel C. Pipe 143 is connected with a pipe 145 which is provided with a plug 147 at its end and with a downwardly opening slot 149 which extends substantially the entire length of the pipe (see Figures 2 and 8). By reason of this construction the oil is diverted downwardly in channel C toward compartment D so that it will not unduly disturb the liquid which is flowing over the weir 14.

In the filtration compartment F, a support 151 is fixed to the walls 33 and 37. The fittings 47 heretofore mentioned each comprise a valve seat member 153 which passes through a hole 155 in the partition 32 and enters a valve body 157 which is disposed in the trough 45 (see Figures 3, 4 and 14). A gasket 159 is provided under the head of the valve seat to seal the joint. A poppet type valve 161 is mounted in the body and is spring urged toward the seat member.

Each filter element 51 is provided with fitting 49 which comprises a conical sealing surface 163

which is adapted to engage the seat 153 at the end opposite to that engaged by valve 161. A projection 165 formed on the fitting 49 is adapted to displace the valve 161 from seat 153 when said projection is inserted in the passage 167 of the seat member. The projection is cut away so that liquid may flow out into trough 45. When the filter element 51 is removed the valve 161 automatically closes the passage 167 so that there will be no mixing of filtered and unfiltered oil. The filter element 51 is also provided with a bracket 169 which is adapted to rest upon the support 151. The filter element is thus supported by the nozzle or projection 165 at one side and by the bracket 169 at its other side and is in communication with the trough 45.

The filter element shown comprises a hollow screen wire frame over which is stretched a removable bag made of moleskin or other filtering cloth.

A sight gauge 171 is connected in the filter compartment and a clean-out plug 173 is provided near the bottom.

A sight glass 175 and a draw-off cock 177 are provided in the clean oil compartment. The clean oil outlet 179 is disposed at the bottom of this compartment.

Suitable thermometers may be installed in the various compartments if desired.

The tank is provided with a top 180 having a number of removable covers 181, 183, 185 and 189 which cover the compartments B and C, D, F and G respectively. Suitable knobs 191 are provided so that the covers may be easily removed.

If desired, an exhaust fan 195 may be provided on the top 180, as shown in Figure 4, to prevent the collection of vapors on the parts exposed to air and which might be corroded. Air inlet openings 197, which preferably have screens set in them, permit the entry of air from outside of the device.

Operation

In circulating lubricating systems, the gallons circulated in a minute are known so that when the conditioner is installed the orifice 69 in the control nipple is made of a diameter to permit the passage of about twenty-five percent of the total flow. The remainder of the flow passes through pipes 143 and 145 into channel C.

The oil passing through the control nipple enters pipe 65 and the spreader 73. The latter is submerged in a body of water and, consequently, there will be a differential pressure exerted on the orifices in the spreader which will force the oil through them in the form of small droplets which rise through and come into intimate contact with the wash water, whereby water soluble acids are taken out of the oil.

Should the flow of oil through the control nipple exceed the flow through the spreader orifices, the excess will simply build up within the spreader and eventually escape from under the rim thereof.

In order that the pressure may be equalized over all of the spreader orifices, the adjusting screws 77 will be actuated to level the spreader once the tank has been adjusted to level the weirs 14 and 30.

The droplets rise through the wash fluid and eventually merge in the body of oil which floats on the water under deck 17 and pass up through nipples 21 and through the dehydrator elements 19 wherein any water, which may be intermingled with the oil, is removed. The oil level rises until it passes over the weir 14 whence it runs down through passage C.

While passing through channel C the oil is mixed with the oil issuing from the pipe 145, and this mixture passes between the body of water at the bottom of the channel and the partition 7 into the precipitation compartment D where it moves slowly up through the screens 25. The screens assist any water particles which may be in the oil to coalesce into larger droplets which eventually drip from the screen and merge with the body of water at the bottom of the compartment.

The water level in this compartment is maintained constant by the withdrawal of water through the automatic draw-off mechanism as it accumulates.

In both compartments A and D, the temperatures are regulated to about 140 degrees Fahrenheit to secure the best action, both in breaking up the oil and in precipitating the water.

Since the weir 14 is higher than the weir 30, there will be a constant head of oil tending to cause the oil to move through channel C and compartment D over weir 30 into channel E, where it passes under partition 37 and into the filtration compartment F. The weir 30 is higher than the level of the filter outlet fittings 47, 49 so that the filters 51 and their outlets will be submerged and, consequently, there will be ample pressure available to force the oil through the filtering surfaces and into the trough 45 which collects the filtered oil into down pipe 43 through which it passes in a quiescent manner to avoid aeration, into compartment G. The circulating pump will withdraw the treated oil from this compartment and pass it through the lubricating circuit.

It is obvious that various changes may be made in the form, structure and arrangement of parts without departing from the spirit of the invention. Accordingly, applicant does not desire to be limited to the specific embodiment disclosed herein primarily for purposes of illustration; but instead, he desires protection falling fairly within the scope of the appended claims.

What I claim to be new and desire to protect by Letters Patent of the United States is:

1. In a lubricant conditioner, the combination of a flow line for said lubricant, a compartment containing wash fluid of higher specific gravity than said lubricant, an oil separating device comprising an inverted container having a flat top wall and a downturned rim, a plurality of small, diffusion orifices in said top wall for forming droplets of lubricant, submerged in said wash fluid, said flow line being disposed to open into said container from below so that a body of lubricant will collect in said container adjacent said orifices, means for limiting the rate of flow of lubricant to the container to at least the rate of flow of lubricant from said container, and means for levelling said container.

2. In a lubricant conditioning apparatus, the combination of a lubricant washing compartment, a moisture precipitating compartment, a lubricant supply line connected with both compartments and means for proportioning the flow of lubricant into streams flowing one to each of said respective compartments.

3. In a lubricant conditioning apparatus, the combination of a lubricant washing compartment, a moisture precipitating compartment, a lubricant supply line connected with both compartments and flow restricting means adapted to proportion

the flow to said precipitation and washing compartments in the ratio of about four to one.

4. In a lubricant conditioner, the combination of a wash compartment having a washed lubricant collecting section and a dehydration compartment, means for connecting said collecting section with said dehydrating compartment, a dehydrating device comprising water absorbent material associated with said connecting means to receive and dehydrate the lubricant passing from said collecting section and to discharge it into said dehydration compartment.

5. In a lubricant conditioner comprising a water washing and dehydrating section and a water precipitation compartment, a passage for washed lubricant connecting said section and compartment, a flow line for said lubricant including means for directing part of said lubricant into said section and thence into said passage and the remainder directly into said passage, said precipitation compartment having a large cross-sectional area, and precipitation promoting means comprising heating means and precipitation screens disposed in said compartment.

6. In a lubricant conditioner comprising a casing having a plurality of compartments, including compartments containing water, removable covers closing said casing, said compartments being open topped and inter-communicating within said casing and covers, an exhaust fan for withdrawing vapors from said casing and openings in said casing above said compartments for admitting atmospheric air.

7. In a lubricant conditioner, the combination of a flow line for said lubricant, a compartment containing wash fluid of higher specific gravity than said lubricant, an oil separating device comprising an inverted container having a flat top wall and a downturned rim, a plurality of small diffusion orifices in said top wall, submerged in said wash fluid, said flow line being disposed to open into said container from below, means for levelling said container comprising yieldable means tending to lift said container, and adjustable length support means counteracting said yieldable means at at least three points.

8. In a lubricant conditioner, the combination of a flow line for lubricant, a compartment containing wash fluid, means in said compartment adapted to receive lubricant from said flow line, to divide said lubricant into small particles and to discharge said particles into said wash fluid, said compartment comprising a lubricant collecting section and dehydrating means connected to receive said washed lubricant from said collecting section, and a compartment for receiving oil discharged from said dehydrating means, said dehydrating means comprising a body of highly water absorbent difiberized cellulose.

9. In a lubricant conditioner, the combination of a flow line for lubricant, a compartment containing wash fluid, means in said compartment adapted to receive lubricant from said flow line, to divide said lubricant into small particles and to discharge said particles into said wash fluid, said compartment comprising a lubricant collecting section and dehydrating means connected to receive said washed lubricant from said collecting section, and a compartment for receiving oil discharged from said dehydrating means, said dehydrating means comprising a densely packed body of highly water absorbent defiberized cellulose mixed with supporting and binding fibers.

10. In a lubricant conditioning apparatus, the combination of a lubricant washing compartment, a moisture precipitating compartment, a lubricant supply line connected with both compartments, means for proportioning the flow of lubricant into streams flowing one to each of said respective compartments, and means for combining both streams in advance of the precipitation compartment.

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