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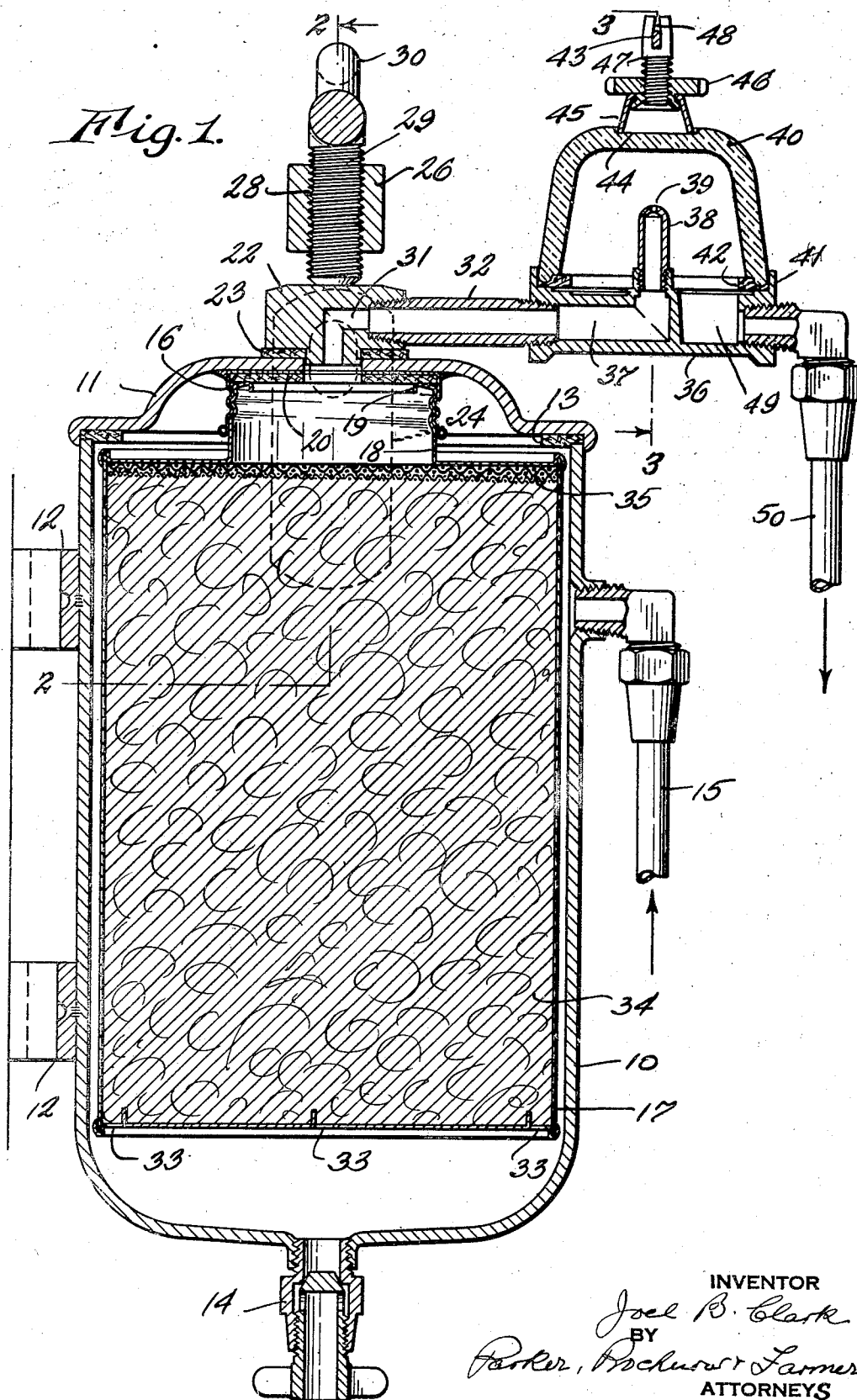
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2,294,330

OIL CONDITIONING DEVICE

Filed Sept. 21, 1937

4 Sheets-Sheet 1



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2,294,330

OIL CONDITIONING DEVICE

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4 Sheets-Sheet 2

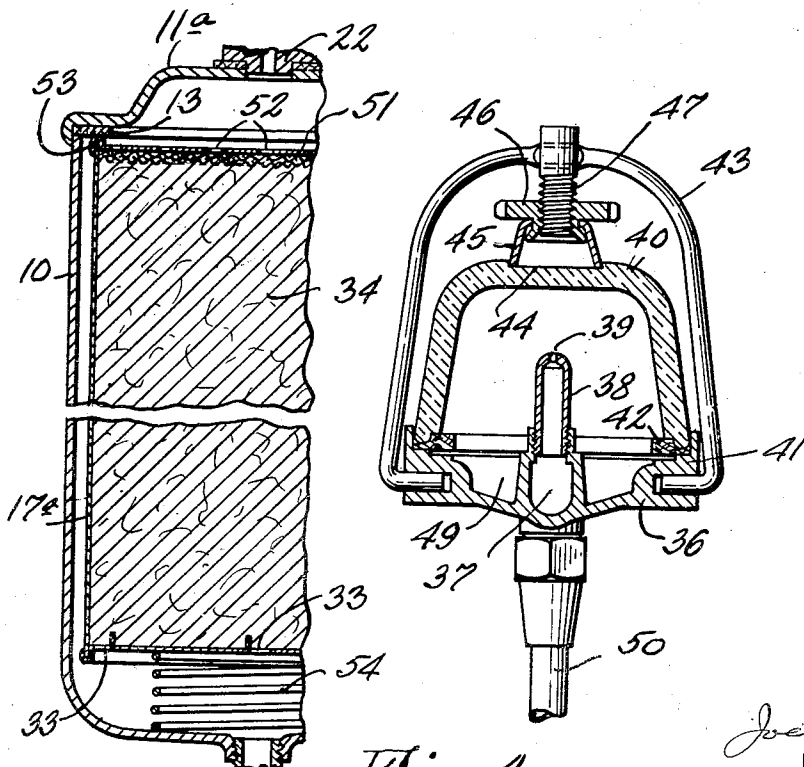
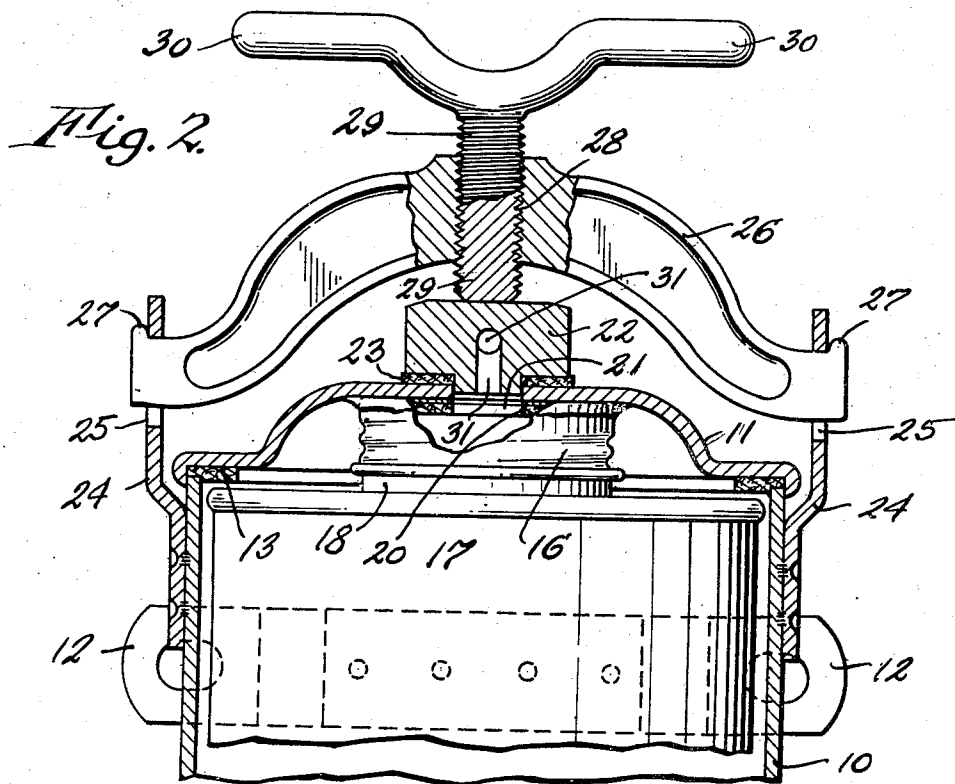


Fig. 4.

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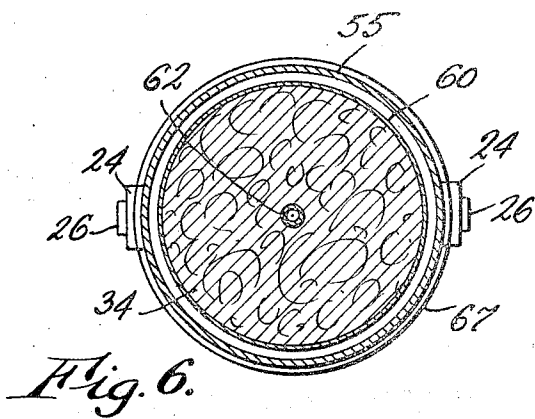
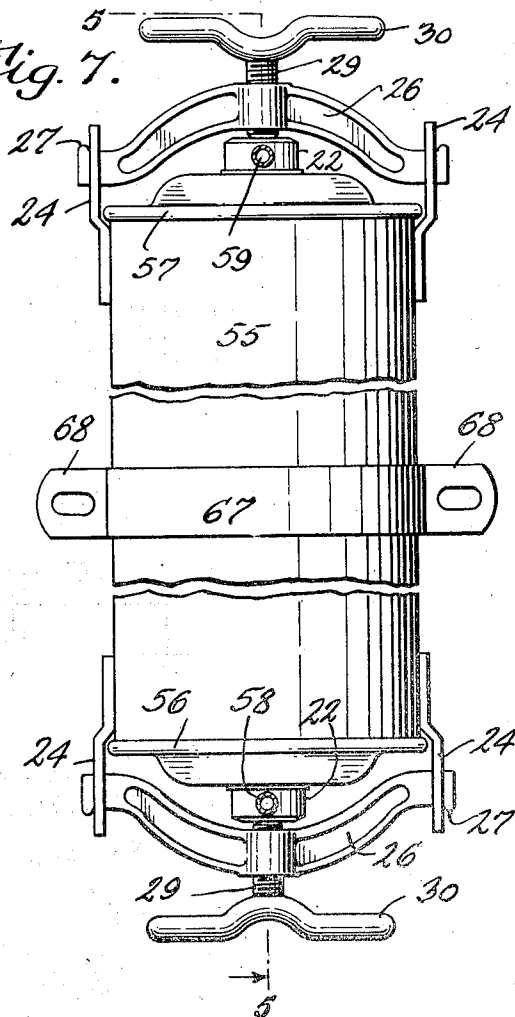
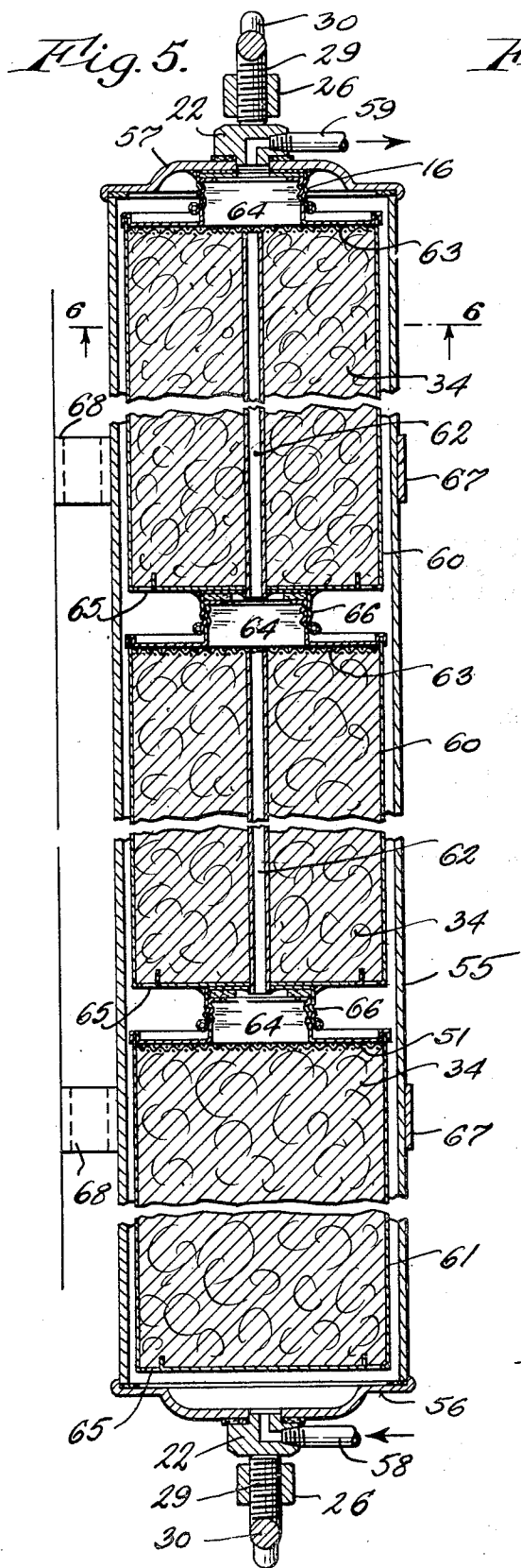
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OIL CONDITIONING DEVICE

Filed Sept. 21, 1937

4 Sheets-Sheet 3



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OIL CONDITIONING DEVICE

Filed Sept. 21, 1937

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Fig. 9.



Fig. 8.

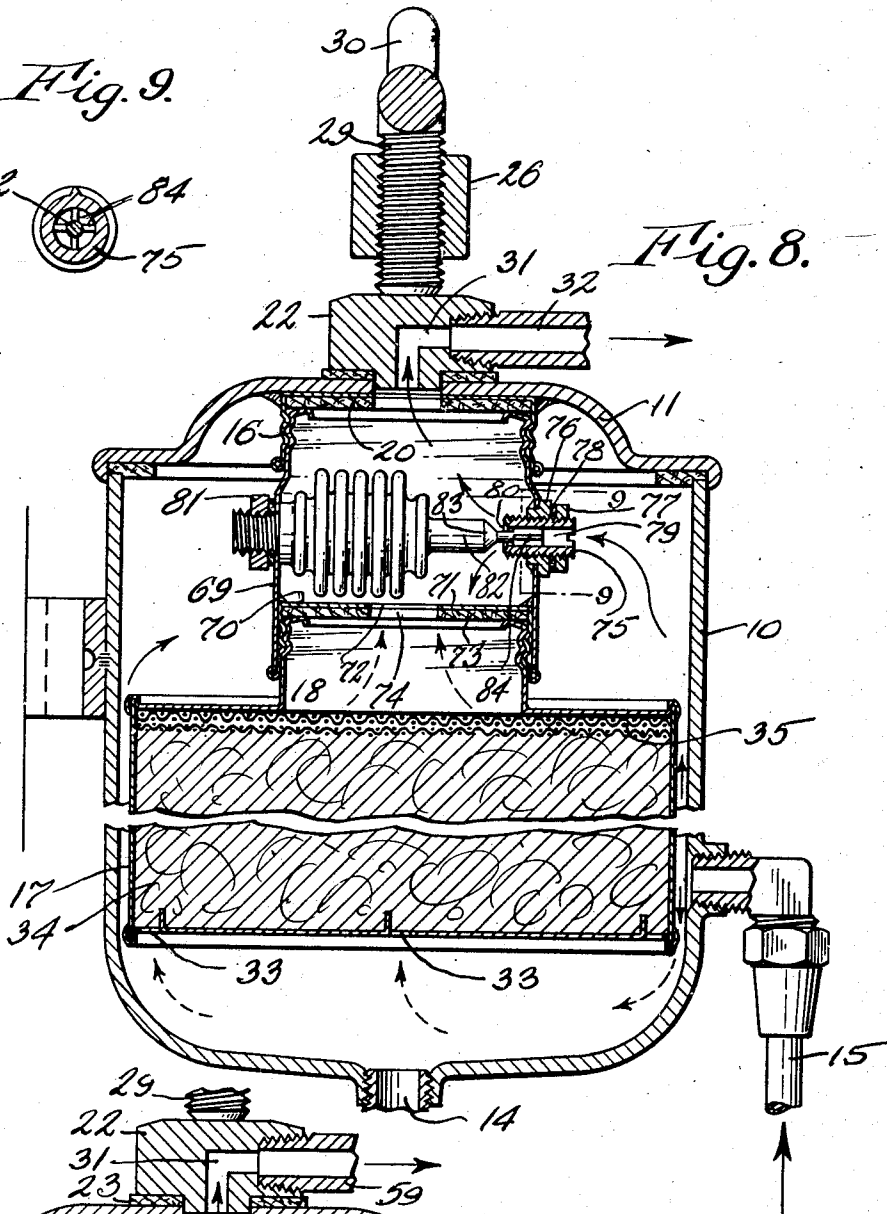
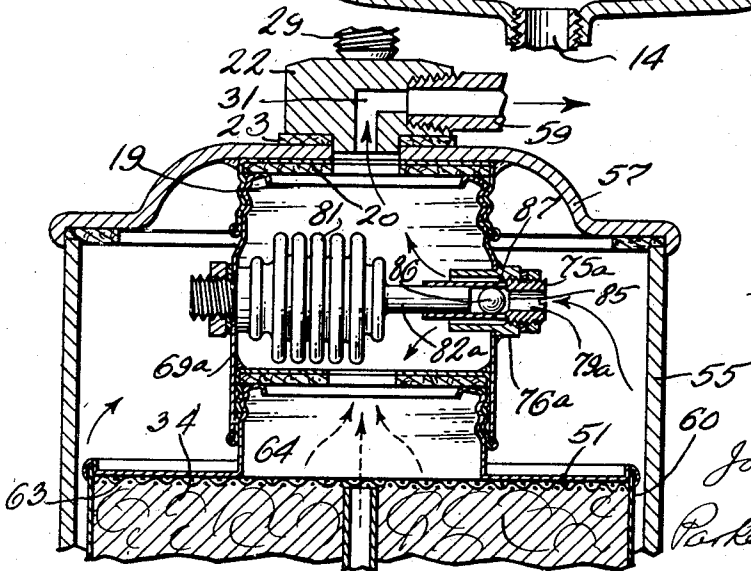


Fig. 10.



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2,294,330

OIL CONDITIONING DEVICE

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Application September 21, 1937, Serial No. 164,940

11 Claims. (Cl. 210—131)

This invention relates to oil conditioning devices such as may be used to advantage, for example, in conditioning the oil of internal combustion engines where the oil is removed from the crank case and circulated under pressure to various parts of the engine and then drained back into the crank case. An oil conditioning device in accordance with this invention may advantageously be included in a branch circulatory path of the oil withdrawn from the crank case before it is delivered to the various parts of the engine to be lubricated. Various filters for removing impurities from oil have been included in such paths of oil, and this invention particularly relates to an improved oil conditioning and impurity removing device which may be utilized in place of the ordinary filters heretofore employed in such systems.

An object of the invention is to provide an improved oil conditioning device for inclusion in the circulating oil system of an internal combustion engine or the like, or where it is desired to treat or condition a circulating body of lubricating oil.

Another object of the invention is to provide an improved oil conditioning device which is relatively compact, efficient, simple and inexpensive, which may be taken apart and a conditioning element or cartridge removed and replaced in a simple, easy and rapid manner, with which danger of leakage in the joints or couplings will be reduced, and with which maximum usefulness of all parts of the filtering media may be obtained.

Another object of the invention is to provide an improved oil conditioning device, with which the circulating oil is conditioned during its circulation, with which stoppage of the circulation such as by plugging of the conditioning means will be immediately apparent, which will indicate whether the conditioning media is exhausted in its conditioning qualities, which will be relatively simple, compact, inexpensive and easily incorporated in existing oil circulatory systems, and with which all of the parts may be readily and easily taken apart for replacement, cleaning and reassembly.

Another object of the invention is to provide an oil conditioning device of maximum capacity with a minimum of resistance to oil flow at all temperatures, and with a minimum of danger from obstruction to all of the flow due to the plugging of the conditioning media, and with which the replacement of part or all of the conditioning media may be accomplished in a simple, rapid and convenient manner.

Another object of the invention is to provide

an improved replacement cartridge for use in such oil conditioning devices, which will be relatively simple, efficient, compact and inexpensive.

Other objects and advantages will be apparent from the following description of some embodiments of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a sectional elevation through an oil conditioning device constructed in accordance with this invention and illustrating a simple embodiment thereof;

Fig. 2 is a sectional elevation through a portion of the same, the section being taken approximately along the line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation of another part of the same, the section being taken approximately along the line 3—3 of Fig. 1;

Fig. 4 is a sectional elevation, on a reduced scale, of a slight modification of the same;

Fig. 5 is a sectional elevation through an oil conditioning device also constructed in accordance with the invention, and illustrating the connection of a plurality of conditioning units together to provide a plurality of separate paths of equal resistance to the oil flow, and also indicating the use of standard containers for obtaining conditioning capacity of any desired size, the section being taken approximately along the line 5—5 of Fig. 7;

Fig. 6 is a sectional plan of the same, the section being taken approximately along the line 6—6 of Fig. 5;

Fig. 7 is a side elevation of the same;

Fig. 8 is a sectional elevation through a conditioning device having incorporated therewith a thermostatically controlled bypass;

Fig. 9 is a sectional elevation through the bypass valve of Fig. 8, the section being taken approximately along the line 9—9 of Fig. 8; and

Fig. 10 is a sectional elevation similar to Fig. 8 but illustrating a slight modification of the thermostatically controlled bypass shown in Fig. 8.

In the embodiment of the invention illustrated in Figs. 1 to 3, the improved oil conditioning device includes a tubular casing 10 of any suitable material, such as sheet metal, which is provided with a removable cover or end wall 11. This casing 10 is supported, preferably in an upright position, by any suitable means such as by brackets 12 connected to the body of the casing 10 as usual in oil filters for internal combustion en-

gines. An annular sealing gasket 13 is interposed between the removable cover 11 and the open end of the tubular casing 10 so as to seal the joint between the same when the cover or removable end wall 11 is pressed against the open end of the casing 10. The cover 11 is preferably flanged adjacent its periphery so as to telescope slightly with the open end of the container and thus resist lateral displacement of the cover 11 on the open end of the container. The bottom end of the casing 10 is provided with a drain plug 14 of any suitable construction, by which sludge or other heavy solids which may collect in the bottom of the casing 10 may be withdrawn at intervals.

An oil inlet conduit or pipe 15 opens into the interior of the casing, preferably through the side wall of the body of the casing. The inner face of the cover or removable end wall 11 is provided with a tubular threaded extension or flange 16. A container or cartridge 17 is disposed loosely within the casing 10, and at its upper end it carries a threaded tubular neck or encircling flange 18 which telescopes with the tubular extension 16 of the cover 11 and is threaded thereto, so that the container 17 may be removably coupled to the cover or removable end wall 11 of the casing. The projecting or free end or edge of the neck 18 is flanged laterally as at 19 so as to engage against a gasket 20 provided on the inner face of the cover 11, and thus effect a sealing, abutting engagement between the end of the neck of the container and the cover 11.

The cover 11 is also provided with an aperture 21 within the area bordered by the tubular extension 16, and this opening 21 is normally closed by a block or member 22 which bridges the opening 21 so as to abut against the outer face of the cover 11 beyond the limits of the opening 21. An annular gasket 23 is interposed between the block or element 22 and outer face of the cover 11 so as to seal the contact therebetween. Preferably the block or member 22 has a boss fitting within the opening 21, so as to prevent lateral displacement of the member 22 on the cover 11 when confined thereon. The casing 10 is provided at diametrically opposite sides thereof, and closely adjacent its open end, with a pair of strap like ears 24, which extend outwardly beyond the open end of the casing 10. These ears 24 may be secured to the casing body in any suitable manner, such as by spot welding the same to the casing, as shown clearly in Fig. 2, and the free ends of the ears 24 are provided with apertures 25. Preferably these apertures are surrounded by metal around their entire periphery, in contrast with slots, so that metal will extend along both sides of the apertures 25 and connect the extreme end portion of the strap with the body of the strap on both sides of the aperture.

A bridge member or bar 26 extends between the ears 24 and through the apertures 25 thereof, the extreme ends being provided with flanges 27 which hook through the apertures 25 against the outer faces thereof at the upper edges of the apertures. The bar 26 is provided between its ends with a threaded passage 28, and a stud 29 is threaded through the passage 28, so that by rotating the stud 29 it may be threaded through the bar or bridge member 26 to any desired extent and in either direction. Preferably the outer end of the stud 29 has wing arms 30, by which it may be rotated to adjust it to different extents through the bar or bridge member 26. The inner end of the stud 29 abuts against the

outer face of the block or member 22, so as to force it against the outer face of the cover 11 and confine it thereon, and also through the pressure thus created on the cover 11 force or confine it tightly upon the open end of the casing 10, as shown clearly in Figs. 1 and 2. By rotating the stud 29, any desired pressure may be placed on the block 22 and the cover 11 to confine them in positions.

The block 22 is provided with an L-shaped or angular passage 31, one arm of which extends downwardly through the inner face of the block 22 so as to open into the opening 21 of the cover 11, and thence through an opening in the gasket 20 into the tubular extension 16 and the neck 18 of the container 17. The other or outer arm of the passage 31 opens laterally through a side face of the block 22, and a pipe or conduit 32 is screwed into this outwardly opening end of the passage 31, which with the passage 31 serves as an oil outlet conduit for the casing.

The container 17 may be made of any suitable material, but is preferably a sheet metal container, and at the end opposite the neck 18 it is provided with any desired number of apertures 33. Preferably a plurality of small apertures are provided at intervals around the end of the container, so that oil from the casing 10 may enter the container 17 at a plurality of points at that end of the container. The container 17 is otherwise imperforate and is substantially filled with a fibrous, oil conditioning media 34, such as loose, soft fibrous cotton waste. This waste may be ordinary, untreated, soft fibre, cotton waste or it may be soaked or impregnated with an oil conditioning liquid. Such oil conditioning liquids are available in the open market, and any of them may be used, or the cotton waste may be unimpregnated or unsaturated.

These oil conditioning liquids or agents are absorbed by the cotton waste and held by capillary attraction. The circulating oil as it passes through the impregnated waste takes up some of the capillary held liquid or agent and carries it to different parts being lubricated and to crank case or reservoir, where it causes disintegration of any accumulation of sludge so that the carbon, metal or other insoluble, but finely divided, particles are released and either settle to the bottom of the crank case or reservoir, where they can be easily drained off, or are carried in suspension by the circulating oil to the container 17 where they are removed and held by the cotton or fibre waste in the container. The impregnating agent in the waste 34 appears to prevent cohesion of the removed solids and hence retards obstruction to flow of oil through the cotton or fibrous waste. By using soft fibre waste, the capacity of the mass to hold impregnating liquids and to remove solids seems to be materially better than with hard fibres.

The waste is preferably packed in the container sufficiently compressed to prevent any of the oil from passing through the container from end to end without passing through a substantial body of the waste. Within the container 17 at the end having the neck 18, I provide screening means which may and preferably does comprise a plurality of sheets of woven wire, mesh screening or fabric 35 disposed face to face and abutting against that end of the container, so as to bridge the opening enclosed by the neck or flange 18. The screen is confined against that end of the container and across the opening bordered or enclosed by the flange 18, by the cotton waste or

other conditioning media 34. Preferably, the screen sheet or layer against which the conditioning media directly abuts is of relatively fine mesh, so that the fibers of the media 34 will not project through the mesh to any substantial extent, and the other layer or layers of screening abutting the end wall of the container may advantageously be of larger mesh to reduce the resistance to oil flow therethrough.

The oil entering the container 17 at the bottom thereof through the openings 33 will pass upwardly through the mass of cotton waste 34 to the screening 35, and thence pass through and along the screening to the container opening enclosed by the flange or neck 18. The oil, therefore, may pass through the mass 34 throughout its entire width, with equal resistance in all parts of the mass 34, and then when it reaches the end abutting the screening 35, the oil will travel along the screening with a minimum of resistance to the opening enclosed by the neck 18, and thence it will pass outwardly through the opening 21, passage 31, and pipe 32.

From the pipe 32 the oil may be returned to the main body of oil in the engine or supplied to other machinery to be lubricated, but I prefer to include in series with this pipe 32 a device for indicating the operativeness of the conditioning mass 34. Inasmuch as the mass 34 removes a considerable quantity of solid particles and sludge from the circulating oil, the interstices between the fibers gradually become plugged to some extent, and if the mass 34 should be so plugged as to seriously limit the flow of oil therethrough, this fact should be made apparent without the necessity of opening the container. It is important therefore to have means by which one may readily ascertain, such as by inspection, that the conditioning mass 34 is functioning to remove impurities and also that it is offering no substantial obstruction to oil flow therethrough. Accordingly the pipe 32 is connected to a housing 36. This housing is provided in its bottom part with a passage 37 into which the pipe 32 is connected, and passage 37 terminates within the housing in a nozzle 38 having a discharge orifice 39 at its free end.

The nozzle 38 discharges the oil from the pipe 32 upwardly into the interior of the housing and against a dome 40 which forms part of the enclosure of the housing. This dome 40 may be of glass or other transparent material and is preferably cup-like and disposed in an inverted position with its open end downwardly and received within an encircling flange 41 provided on the base of the housing. A suitable annular gasket 42 is disposed between the open edge of the dome 40 and the base of the housing at the flange 41, so as to seal the connection between the dome and the remainder of the housing. A ball 43 is hinged to the base of the housing 36 and swings over the dome 40, as shown in Fig. 3. The top of the dome 40 is provided with a slight recess 44, and a confining sleeve 45 abuts against the dome 40 within the recess 44.

The sleeve 45 is rotatably mounted on the hub of a hand wheel or button 46 which is threaded on a stud 47 that is secured on the ball 43 directly over the top of the dome. By turning the button 46 in one direction it will be moved substantially towards the dome 40, and through the sleeve 45 carried thereby it will force the dome 40 firmly against the base of the housing. By rotating the button 46 in the other direction it will release the dome 40. The

ball 43 may then be swung laterally to clear the dome 40 and release it for cleaning and replacement. The stud 47 may be secured to the ball 43 in any desired manner, but advantageously the ball 43 passes through a slot 48 in the outer end of the stud 47 and the arms on opposite sides of the slot, at the open end of the slot, are then sprung towards one another to lock the bar 43 within the slot.

The base of the housing 36 is provided with a chamber 49 opening upwardly towards the dome 40, which serves to collect the oil discharged upwardly into the dome from the nozzle 38 and draining therefrom. An outlet pipe 50 is connected to the base of the housing 36 so as to open into the chamber 49, as shown in Fig. 1, and this serves to remove the oil from the housing 36 as rapidly as it collects in the chamber 49 so that the upper portion of the chamber formed by the dome 40 will not be filled with oil. The nozzle 38 discharges the oil against the top of the dome and a portion of this oil then runs down as a thin film over the side wall of the dome into the collecting chamber 49 in the base of the housing. Inasmuch as the dome 40 is transparent at least on opposite side walls thereof, sufficient light will pass through the dome to indicate the color of the film of oil on the inside of the dome wall when viewed from the outside of the dome, and by observing the color of the oil in such film one may ascertain that the oil passing through the conditioning mass 34 has had at least some of its impurities removed before it reaches the housing 36.

The flow of film over the transparent walls of the dome 40 indicates by its rapidity of flow whether or not there is any serious obstruction to oil flow in the container 17, and if any substantial diminution in the flow is observed in the dome 40, one should immediately replace the container 17 with a fresh container. Likewise, if the color of the oil film in the dome 40 indicates any blackness, such as caused by carbon particles suspended therein, this is an indication that the conditioning mass 34 is not removing the impurities satisfactorily and a new container 17 should be substituted. The pipe 50 is of course connected to the lubricating system at the intake side of the oil pump, and pipe 15 is connected to the system at the delivery side of the oil pump which removes the oil from the storage container such as the crank case, for delivery to the various parts of the machinery or engine to be lubricated.

In Fig. 4 a slight modification is illustrated in which the tubular flange 16 on the inner face of the cover is eliminated, and the small neck 18 of the container 17 is also eliminated. Instead, the top end wall 51 of the container 17a will be an ordinary plate having one or more apertures 52 therein, and the flange 53 formed by clamping the periphery of the end wall 51 over the side wall of the container 17a acts as the peripheral flange of the neck, which abuts endwise against the same gasket 13 that also serves to seal the cover 11a against the open end of the casing 10, and also encloses the end zone including the apertures 52. A coil spring 54 is interposed between the bottom of the casing 10 and the bottom end wall of the container 17a, and holds the container 17a normally sealed against the gasket 13. It will be noted that the pressure of oil in the casing 10 as it is forced through the container tends to increase the pressure of the flange 53 against the gasket 13, and thus increase

the sealing action thereon, and hence the spring 54 is necessary only to confine the container 17a in position against the gasket 13. The cover 11a is similar to the cover 11 except for the elimination of the tubular extension 16, and the conduit connection through the block or member 22 is the same as in Figs. 1 to 3. The cover 11a is also confined on the casing 10 in the same manner.

In Figs. 5, 6 and 7 I have illustrated another modification of the invention which may be advantageously used when a larger capacity for oil treatment is desired. In this embodiment of the invention, the casing 55 is cylindrical, open at both ends, and the ends are normally closed by removable end walls or covers 56 and 57 which are similar to the covers 11 and 11a of Figs. 1 to 4. The wall or cover 56 which forms the bottom of the casing 55 is similar to the cover 11a of Fig. 4, in that it does not have the tubular extension 16 of Figs. 1 to 3. The oil is supplied to the casing 55 in this example through the bottom cover 56 thereof, by means of an oil inlet pipe 58 which is connected to a block or member 22 which is similar to the block 22 of Figs. 1 to 4. The cover or wall 57 on the other end of the casing 55 is similar to the cover 11 of Figs. 1 to 3 and has a tubular, threaded, inwardly projecting extension 16. The member 22 and an outlet pipe 59 for removing oil from the casing are the same as member 22 and pipe 32 of Figs. 1 and 2. Both covers 56 and 57 are confined releasably on the ends of the casing 55 in the same manner as explained in connection with the cover 11 in Figs. 1 and 2, and therefore such corresponding parts of this confining means in Figs. 5 to 7 are designated by the same reference characters and will not be again described.

Within the casing 55 I dispose a plurality of oil conditioning containers 60 and 61 which are generally similar to the conditioning container 17 of Figs. 1 and 2. The container 61 may be identical with the container 17 shown in Figs. 1 and 2, and the containers 60 are generally similar to container 17, but with certain differences which will now be explained. Each container 60 has a tube 62 extending through and secured at one end to its bottom wall and approximately abutting at its other end against the screening means 35 which is similar to the screening means 35 of Figs. 1 and 2. Each tube 62 is imperforate from end to end but open at both ends, and may be soldered or welded to the bottom of the container in any suitable manner. Each of these containers 60 and 61 is provided with a tubular threaded neck or flange 64 at its upper end, similar to the neck 18 of container 17 of Figs. 1 and 2, by which it is supported and by which the oil passing through that container is removed. Each container 60 and 61 at its bottom end is provided with a plurality of apertures 65 the same as the apertures 33 in Figs. 1 and 2, by which oil from the casing 55 may enter any or each container or oil conditioning element.

Each of the containers 60 is also provided on its bottom wall with a depending tubular flange or extension 66 which is similar to or identical with the tubular flange 16 of the covers 11 and 57, and the tube 62 of each container 60 opens downwardly into this tubular extension 66 on the bottom of that container. Each of these depending tubular extensions 66 is provided with threads, the same as the extension 16 in Fig. 1, so that by screwing the necks 64 into extensions 66 of the abutting container, it is possible to cou-

ple the containers together in end to end relation, as shown clearly in Fig. 5. The necks 64 of each of the units 60 is similar to the neck 18 of the container 17 of Figs. 1 and 2, and at its free or outer end it seats against gaskets in the extensions 16 or 66 so as to seal each unit at its neck 64 to the unit against which the neck abuts or to the cover 57. Thus, all of the containers 60 and 61 are carried by the cover 57 and may be removed with the cover 57 as a single unit, yet the containers 60 and 61 may be separated from one another by unscrewing each container from the one to which it is coupled or the first one in the group from the cover 57.

The casing 55 may be secured in operative position, usually in an upright position, in any suitable manner such as by straps 67 which are secured to the casing 55 and have flanged, apertured ends 68 by which the unit may be supported, as usual in oil filters. Each of the containers 60 and 61 will, of course, be filled with the same oil conditioning media 34 as the container 17 in Figs. 1 and 2.

The operation of the device shown in Figs. 1 to 3 would appear to be obvious from the foregoing description, but will be briefly summarized. The pipe 15 is connected to the oil pump (not shown) from which it receives part of the oil removed from the crank case or other reservoir, and the pipe 50 is connected to another part of the oil system. When the oil pump is running it delivers oil under pressure through the pipe 15 to the interior of the casing 10, and the oil passes to the bottom of the casing 10 and enters the container 17 through the openings 33 in the bottom end wall thereof. The oil passes upwardly through the container 17, and in doing so it comes in intimate contact with the fibres of the conditioning media 34, such as the cotton waste, and as the oil passes through this mass, solids such as carbon particles, or metal, etc. are removed and then the oil collects in the screening means 35 and passes to the outlet formed by the neck 18.

It will be understood that when the mass 34 is treated with an impregnating agent which has the property of disintegrating the sludge in a crank case or reservoir, or circulating in the oil which agents are available in the open market, the oil will be conditioned further through its contact with the impregnating agent carried by the cotton waste, and the oil so conditioned as it collects in the neck 18 will pass out through the member 22 and pipe 32, from which it is discharged through the passage 37, nozzle 38 and orifice 39 as a stream against the inner face of the top of the dome 40. The oil thus spreads and flows down the wall of the dome and by reason of the fact that the entire dome 40 is not filled with oil but only its wall covered with a thin film, it is possible by reason of the transparency of the dome 40 to observe the color of the oil film and know by its color whether or not the conditioning mass 34 in the container 17 is functioning to remove impurities from the oil. If no oil is being discharged from the jet 38 or if the amount discharged is substantially below normal, then it indicates a stoppage in the mass 34 and a new container 17 should be substituted in the casing 10. The oil running down over the wall of the dome 40 collects in the bottom chamber 49, and then flows through pipe 50 back to the circulatory system.

To replace a container 17 whenever the conditioning mass 34 thereof has been substantially exhausted or has become plugged for any reason,

one merely rotates the stud 29 to release the bridge bar 26, whereupon the bridge bar may be removed. This releases the member 22 which is removed and this in turn releases the cover 11 which may then be removed, carrying with it the container 17. The container 17 is merely unscrewed from the tubular extension 16 and a new or fresh container 17 reconnected to the cover 11 by screwing it to the tubular extension 16 until the upper flanged end 18 of its neck 18 seats against the gasket 20. The cover 11 is then replaced on the casing 10 with the container 17 within the casing, the block or member 22 replaced, the bridge bar 26 again disposed between the lugs or ears 24, and by rotating the stud 29 the parts are again clamped in operative closed positions.

The dome 40 may be removed for cleaning by merely unscrewing the button 46 to release the dome, whereupon the ball 43 may be swung over to one side of the dome, and the dome thus released may be removed for cleaning or replacement. In the embodiment of the invention shown in Fig. 4, the container 17a is not physically coupled to the cover 11a, but the flange 53 of the container 17a seats against the gasket 13 of the cover and is normally held thereagainst by the spring 54. In this example, the container 17a would be placed in the casing 10 and then the cover 11a applied in the usual manner.

In the example of the invention shown in Figs. 5 to 7, the operation is similar to that described for Figs. 1 to 3 except that the oil entering the bottom of the casing 55 passes along the sides of the containers 60 and 61 and a portion of it enters the container 61 through the opening 65 in the bottom thereof, and other portions enter the containers 60 through the openings 65 in the bottom ends thereof. The oil that enters the lower container 61 passes upwardly therethrough where it is conditioned and collected in the neck 64 which is coupled to the underside of the container 60 just above it. It will be understood that there are no openings 65 in the portion of the bottom wall of any container 60 which is bounded by its tubular extension 66. Thus the oil collecting in the neck 64 of the container 61 will pass upwardly through the tube 62 of the container 60 to which container 61 is coupled, thence up through the tube 62 of the next container 60 coupled thereto, and so on until it reaches the top cover 57 from which it is removed by the pipe 59.

The oil which enters each container 60 through the openings in the bottom thereof will pass through the cotton waste or other treating media 34 of that container and will collect in its neck 64 in the top thereof, from which it will pass through the tube 62 of the next container 60 coupled thereto where it joins the oil passing therethrough from the other containers below it. Thus the oil entering the casing 55 will have a plurality of paths of equal resistance available, each separate path being through one of the containers and after passing through any one of the containers it is conducted immediately to the cover 57 and then removed through the pipe 59.

I may connect any number of these containers 60 and 61 together, there being only one container 61 normally utilized for each casing 55. In case one of the containers should become plugged for any reason, the oil can still pass through the other containers without causing stoppage of the flow of lubricating oil to the parts to be lubricated. In order to remove or replace

any of the containers when occasion becomes necessary, either or both of the covers 56 and 57 may be removed, and the containers separated from one another by unscrewing, and other containers coupled together in the same manner and reinserted in the casing. It will be noted that it is possible to remove any one of the containers without removing the others if desired.

In all of these embodiments of the invention it will be noted that as the oil is conducted through the casing, a substantial area is exposed for cooling by radiation and conduction through the wall of the casing, which materially aids in keeping the lubricating oil at a moderate temperature during use in summertime.

It is known that various lubricating oils have a tendency to thicken when cold and this thickening is quite noticeable in extremely cold climates or during very cold weather. The thickening of oil in the conditioning device offers considerable resistance to flow, and it heretofore has been difficult to heat the thickened oil in a cold conditioning device sufficiently to initiate free flow thereof through the conditioning device. In Figs. 8 to 10 I have illustrated this invention as including therein, means for overcoming this difficulty due to the thickening of oil when cold.

Referring first to Fig. 8, the conditioning device is identical with that shown in Figs. 1 to 3, except that a bypass adaptor is interposed between the tubular, threaded projection 16 on the cover 11 and the tubular neck 18 of the container 17. The parts in Fig. 8 which correspond to identical parts in Figs. 1 to 3 are designated by the same reference characters. This tubular adaptor includes a tubular casing or shell 69, the upper end of which is externally threaded in the same manner that the neck 18 is threaded, so that it can be screwed into the tubular projector 16 in the same manner that the neck 18 would screw therein. This upper end of the adaptor 69 is seated and sealed against the gasket 20 in the same manner as the neck 18 seats thereagainst. This adaptor shell 69 is open at both ends so that its upper end which is attached to the cover 11 is in communication with the passage 31 in the member 22.

The lower end of the shell 69 is provided with internal screw threads corresponding to those of the extension 16 of the cover 11, and the neck 18 of the container 17 is threaded into this lower end of the shell 69. Preferably, the threads are provided in the lower end of the shell 69 by securing telescopically within the lower end of the shell 69, a cup shaped member 70 which has its side wall threaded internally to receive the neck 18 of the container in threaded relation. This member 70 also has an end wall 71 provided with an aperture 72, and a gasket 73 seats against this wall 71 in the same manner that the gasket 20 is seated at the end of the extension 16 nearest the cover 11. The gasket 73 also has an opening 74, so that oil from the container 17 may flow upwardly through the adaptor shell 69 and out through the passage 31.

A bypass sleeve 75 is secured in the shell 69 between the neck 18 of the container and the extension 16 of the cover 11, so as to provide a passage through the side wall of the shell 69. This sleeve 75 may conveniently be threaded through a bushing 76 that is secured in and extends transversely through the side wall of the shell 69. The sleeve 75 is adjustable, such as by threading it through the bushing 76, and a lock nut 77 is threaded on the outer end of the sleeve to com-

press a gasket or washer 78 against the outer face of the bushing 76 and secure the sleeve in different adjusted positions. The sleeve has a bore or passage 79 from end to end therethrough, and at its inner end, that is, the end within the shell 69, it is provided with a frusto-conical seat 80. A thermostatic element 81 is mounted within the shell 69 on the side wall thereof, and this element has a rod or stem 82 extending from its free end into the passage 79 of the sleeve 75. The end of the rod 82 which is within the passage 79 is fluted endwise, so as to be slidably supported by the sleeve and yet pass oil therealong through the passage. The rod 82 is provided with a frusto-conical shoulder 83 which moves toward and from the seat 80. The rod 82 from the shoulder 83 to its free end is reduced substantially in cross section, and this reduced section has vanes or fins 84, Fig. 9, which run in a direction lengthwise of the reduced section, so as to slidably engage the bore of the sleeve 75 and yet provide the flutes that allow passage of oil along the bore of the sleeve 75.

In this type of device, the inlet pipe 15 is preferably connected to the casing 10 near the lower end thereof, so that hot oil delivered by the pump through the pipe 15 will pass along the interior of the casing 10 for a substantial or the major portion of the length of the container 17, in order to reach the passage 79 in the sleeve 75, and the oil can then pass through this sleeve 75 into the shell 69 and out through the opening 31. Thus we have a bypass around the container 17 for the oil delivered by the pipe 15, and the oil as delivered to casing 10 can pass directly through the container 17. As the oil warms up, however, it causes the thermostatic device 81 to expand and carry the shoulder 83 towards the seat 80 and restrict this flow of oil. When the temperature of the oil is up to a desired temperature, the device 81 will shift the shoulder 83 firmly against the seat 80 and obstruct all flow of oil through this by-pass sleeve 75, whereupon all of the oil passing through the casing 10 will have to pass through the container 17 and be conditioned.

As soon as the temperature falls sufficiently, however, the contraction of the thermal device 81 will open the bypass and allow rapid flow of hot oil through the casing 10, until the temperature of the oil in the casing 10 is again up to the desired temperature. The movement of warm or hot oil along the sides of the container 17 will heat the same and thus by conduction heat the conditioning mass and the cooled and thick oil within the container 17, so that this oil in container 17 will be made more fluid and thus free to flow. Hence, when an engine is cold and just starting up, the flow of the oil, as it becomes heated, will quickly heat the container 17 and free the sluggish thick oil therein, and thus place the conditioning device in effective operation promptly, even in cold weather. By adjusting the sleeve 75 further into or out of the adaptor shell, the temperature at which the bypass will be closed may be varied, because this adjustment varies the extent that the thermal device must expand to close the valve or carry its shoulder 83 against its seat 80 and the element 81 will expand to an extent dependent upon its temperature.

The thermal device 81 may be of any desired construction, such as any of the various bimetallic thermal elements commonly employed for

controlling various devices, but I have found to be very effective, a bellows type of thermal element such as that shown. This element is of bellows-like construction and contains a substance which causes it to expand endwise when heated and to contract when cooled. These bellows type thermal elements are available in the open market, making further description unnecessary, but are disclosed, for example, in U. S. Patents Nos. 1,813,168 and 1,999,732. By having the free end of the rod 82 of this bellows device slidably guided in the sleeve at all times, there can be no material buckling of this bellows type of thermal device after it has forced the shoulder 83 into closed or seated position on the seat 80 and a further rise in temperature occurs.

In Fig. 10 the same type of adaptor is applied to the type of device shown in Fig. 5, it being understood that the shell 69a of this adaptor is interposed between the top container 60 and the cover 57. The thermally controlled bypass in this adaptor shell 69a may be the same as shown in Fig. 8, but, by way of example, I have illustrated another type of valve controlled by the thermal device 81. In this embodiment of the invention, the adjustable sleeve 75a is threaded through a bushing 76a in the side wall of the casing of the adaptor shell 69a, and the free end of the rod 82a is cylindrical throughout its length and slides in a cylindrical passage in the inner end of the bore 79a of the sleeve 75a. The bore 79a however has a frusto-conical seat in the nature of a shoulder 85, and a ball 86 is disposed in the inner end of the bore so as to roll along the same toward and from the seat 85. The rod 82a prevents the escape of the ball from the inner end of the bore 79a.

The portion of the sleeve 75a within the chamber provided in the adaptor shell 69a is provided with apertures 87 adjacent, but inwardly from, the seat 85 so that as soon as the ball 86 is released by the rod 82a, it will be forced by the oil pressure away from its seat, and oil may then flow through the bore 79a, past the seat 85, then out of the sleeve through openings 87, and thence through the chamber of the adaptor to the outlet passage 31. The sliding engagement of the rod 82a in the inner end of the sleeve 75a restricts any material buckling of the thermal bellows-like element 81, and guides it in a manner to force the ball 86 into closed position on its seat 85 after a desired temperature has been reached. Further pressure on the thermal device 81 on the ball 86 following a further rise in the temperature of the oil will have no effect on the valve except to hold it closed with greater pressure. By adjusting the sleeve 75a through the wall of the adaptor, the temperature at which the bypass will close, and prevent the flow of oil through the sleeve may be varied, because this adjustment varies the extent that the thermal device 81 would have to expand in order to effect a closing of the valve.

It will be understood that either type of bypass valve may be employed with either type of conditioning apparatus. It will also be understood that various changes in the details, materials and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

I claim:

1. An oil conditioner comprising a container

having an imperforate end wall with a tubular neck extending outwardly and endwise from said wall, and of substantially lesser cross sectional area than the cross sectional area of said end wall, a pair of woven wire screens disposed face to face with one another in said container flat against the entire face area of said end wall, the outermost of said screens being of relatively coarse mesh and the other of said screens being of finer mesh, loose fibrous oil conditioning media substantially filling said container and abutting said screens and having an opening for the entrance of oil adjacent the end opposite said neck and means for circulating oil through said container in a direction from the end opposite said neck to said neck.

2. A cartridge for an oil conditioning device comprising a container having an imperforate end wall with an opening of substantial lesser face area than of said end wall, enclosed by a tubular flange projecting endwise and outwardly therefrom, screening means within said container and abutting flat against substantially the entire area of said end wall and bridging the opening bordered by said flange, and a loose fibrous oil conditioning mass confined in said container against said screening means, said container being apertured adjacent its end opposite that having the flange, said screening means comprising a plurality of layers of woven screen fabric disposed face to face with one another in superposed relation.

3. An oil conditioning device comprising a tubular casing, a plurality of containers within said casing and spaced at least partially from the walls of said casing, each of said containers being substantially closed but apertured adjacent one end thereof, and at its opposite end having an opening enclosed by a tubular projecting flange, screening means disposed in each container against the end having said tubular flange and bridging said opening bordered by said flange, a fibrous oil conditioning mass confined in each container against the screening means, said containers being disposed in similar positions but end to end in a row in said casing, with the flanged ends of the containers between any two containers in a row abutting against the apertured end of the next adjacent container in the row, each of said containers which abuts at its said apertured end against an adjacent container, having an open ended tube passing from end to end therethrough from the apertured end thereof to said screening means, opening through said apertured end into the space enclosed by the abutting flange of the next adjacent container, and also having its apertures in its apertured end disposed exteriorly of the area abutting the next adjacent container, means for removably connecting the free flanged end of the container at one end of the row to a wall of said casing, an outlet conduit opening through said casing wall into said connecting means, and an oil inlet means connected to another part of said casing for supplying oil under pressure to the interior of said casing, which oil divides and different portions pass through the conditioning mass in different containers, and then directly and by said tubes to the outlet conduit opening, whereby said containers are in effect connected to provide separate optional paths for the travel of the oil through the casing.

4. An oil conditioning device comprising a casing having a removable cover, a plurality of containers disposed end to end with one another to

form a row in said casing, each of said containers having at its upper end an opening enclosed by a tubular flange projecting from that end of the container, the top container of the row having its flange abutting and sealed against the inner face of the cover, and each of the other containers in the row having its flange abutting and sealed against the bottom end of the container next above it, the bottom end portion of each container being apertured exteriorly of the abutting area of the flange of any next lower container, each container having therein a woven screen extending across the opening enclosed by its said tubular flange, a fibrous oil conditioning mass within the container and abutting the screen, an oil inlet conduit opening into said casing below said cover, and an oil outlet conduit opening through said cover into the top container within the area enclosed by the flange of the top container, each of said containers above the bottom one having a tube opening through the bottom and into the area enclosed by the abutting flange of the next lower container and extending upwardly at least approximately to said screen in that container, whereby oil admitted to said casing may pass through any one of said containers and after passing through any of said containers below the top container may pass upwardly through the tubes directly to the outlet conduit without passing through the conditioning media in those upper containers.

5. An oil conditioning device comprising a casing with an oil inlet and an oil outlet, a container in said casing having inlet and outlet openings, an oil conditioning mass therein through which oil must pass between said openings, said container having its outlet removably communicating with said casing outlet by a closed passage, a conduit opening at one end into the interior of said casing at a point remote from said casing inlet opening and at its other end into said oil outlet, for providing a by-pass for oil between said casing inlet and outlet past a substantial surface area of said container, and an automatic device having a thermal element disposed in the path of travel of both by-passed oil and oil passing through said mass in said container and a valve element controlling said conduit and operated by the thermal device, for closing said by-pass when the temperature of the oil passing through said casing exceeds a selected temperature, and for opening said by-pass when the temperature of oil meeting said element is below said selected temperature.

6. An oil conditioning device comprising a casing, a container having therein an oil conditioning mass removably disposed in said casing, said casing having a tubular flange projecting from an end wall thereof and an opening through said end wall in the space bounded by said flange, means connected to that end wall for removing oil from said casing through said opening and the space bounded by said flange, a tubular conduit telescopically and releasably connected to said flange to form an extension thereof and open at both ends, said container having an open end bordered by a tubular flange telescopically and releasably connected to the free end of said tubular conduit, said container having therein a fibrous mass of oil conditioning media and being apertured adjacent the end farthest from its end having the flange, an oil inlet opening into said casing exteriorly of the flange thereon, said conduit having an opening in its side wall thereof affording communication from said casing direct-

ly into said conduit and thence to said outlet, and thermostatic means disposed within said conduit and operable to close said passage in the wall of the conduit when the temperature in the conduit exceeds a predetermined temperature, and operable to open said passage when the temperature in said conduit falls below said predetermined temperature, whereby said thermally controlled passage in the conduit by-passes oil through said casing around said container until the temperature of the oil rises to a predetermined value, and then closes said passage to force all of the oil through said container for conditioning.

7. An oil conditioning device comprising a casing having a chamber therein, a pair of containers disposed end to end in said chamber, and each containing a filtering medium, the end face of one container which is adjacent the other container having an opening, and said other container having a similar opening at the end remote from the adjacent ends of said containers, said other container having a passage therethrough and open at one end into the opening of that container, and passing through an imperforate wall in the opposite end thereof, which is adjacent said one container, adjacent ends of said containers having sealed communication with one another between said opening in said one container with the adjacent end of said tube, means associated with said casing for establishing a closed communication from the exterior thereof to said opening in said other container, said casing also having a passage therethrough into said chamber separate from said closed communication, each container being apertured at a distance from its outlet whereby a liquid may be circulated through said chamber and the filtering medium of either container.

8. An oil conditioning device comprising a casing having an inlet at one point and an outlet at another point, a container within said casing and having therein an oil conditioning medium and inlet and outlet openings, a conduit connecting the outlet of said container to the outlet of said casing and having therein a thermally responsive element, a by-pass from said conduit to the chamber of said casing and controlled by said thermally responsive element, and opened by said element when the temperature of the oil passing said element is below a predetermined temperature and closed when above a predetermined temperature, the inlet connection to said casing being disposed a substantial distance from the bypass and at least partially past said container so that oil entering the casing through said inlet must either pass through the container or travel along the container in heat exchanging relation thereto for a substantial distance to reach the bypass.

9. An oil conditioning device comprising a casing having a chamber with an inlet and an out-

let, a filter cartridge within said chamber and having an inlet and an outlet, a conduit connecting the outlet of said cartridge to the outlet of said chamber, the inlet of said cartridge opening into said chamber, a controlled bypass between the interior of said conduit and said chamber and having therein a valve operable when open to connect the chamber of the casing directly to the interior of said conduit, and a thermally responsive element connected to and operating said valve, disposed in a position to be responsive to the temperature of the oil reaching said conduit, and operable, when the temperature of the oil in said conduit at said element is below a predetermined temperature, to open said bypass, and when the temperature of oil at said element is above a predetermined temperature to close the bypass, the inlet to said casing being disposed a substantial distance from the opening of said bypass into said chamber so that the oil passing through said chamber and said bypass must pass in heat exchanging relation to said cartridge.

10. An oil conditioning device comprising a casing, filtering means within said casing, means for conducting oil through said casing and filtering means therein, and means responsive to the temperature of the oil leaving said casing for bypassing the oil through said casing and past, but in heat exchanging relation to, said filtering means whenever the temperature of the oil leaving said casing is below a selected temperature.

11. A filtering device comprising a casing formed of separable sections and having a chamber, an inlet opening and an outlet passage opening into said chamber, a container removably disposed in said chamber and having an outlet passage communicating directly with and forming an extension of said casing passage when said container is confined within said chamber, said container having therein a loose fibrous filtering medium, and an apertured wall for confining said medium within said container and through the apertured portion of which the fluid being filtered passes, a plurality of superposed layers of woven wire screen disposed flat against one another and said apertured wall at said apertured portion and also along the adjoining portion, for forming a multi-layer screen and preventing movement of said medium through said wall and facilitating fluid flow along said adjoining wall portion to the apertured portion, said container having an opening into said chamber at a substantial distance from said apertured wall, whereby fluid entering said chamber must enter said container and pass through said filtering medium and said extension passage to reach said casing outlet, and minimum possible resistance to escape of fluid from said filtering medium will be obtained.

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