

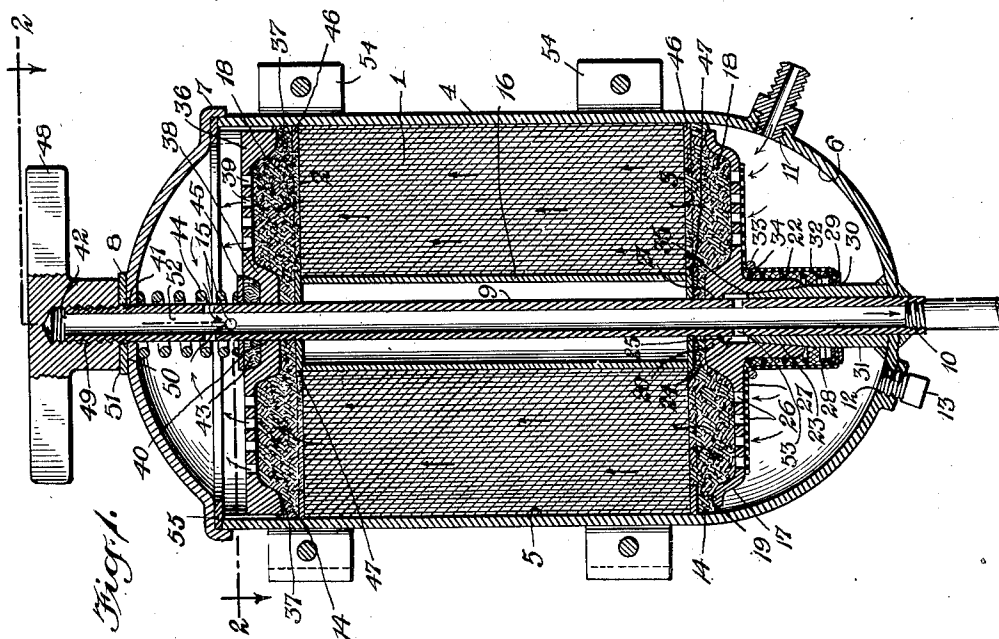
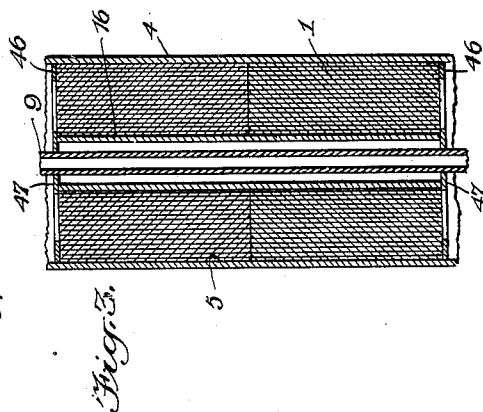
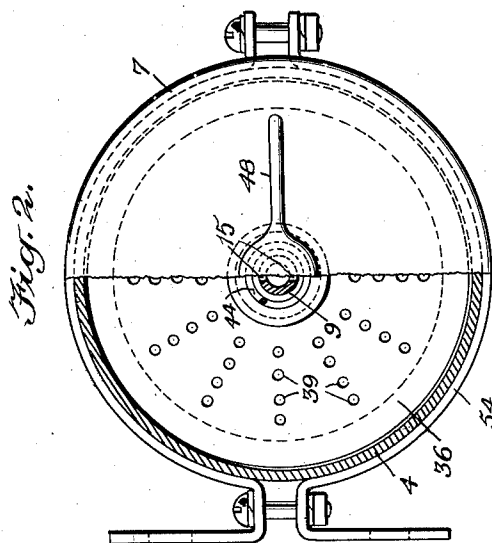
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R. A. WEIDENBACKER

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OIL FILTER

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WITNESSES  
*James H. Taylor*

INVENTOR  
*Russell A. Weidenbacker*  
BY  
*Mum, Anderson & Liddy*  
ATTORNEYS

## UNITED STATES PATENT OFFICE

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## OIL FILTER

Russell A. Weidenbacker, Haverford, Pa.

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8 Claims. (Cl. 210—112)

This invention relates to improvements in oil filters, and particularly to a construction of the type adapted for use in circulating oil systems.

5 An object of the invention is to provide a filter capable of continuously filtering and clarifying the oil so as to restore its natural color.

Another object of the invention is to provide a filtering structure having a low cost replacement filtering medium.

10 An additional object is to provide a filtering structure having as a filtering medium one or more rolls of paper or cellulose material presenting thin sheets edgewise to the flowing oil.

15 An additional and further object is to provide a construction which can be quickly serviced and which when in operation presents an automatic regulation of the internal oil pressure without interruption of the continuous flow of oil.

20 According to one form which the invention may assume, the filter may comprise a casing containing a single roll of toilet tissue, paper or cellulose or a single roll of tissue paper or cellulose towels arranged endwise between foraminous compressible packings supported at one end and yieldingly clamped upon the other end and disposed endwise in this manner between the inlet and outlet openings of the filter so that the oil normally flowing from inlet opening to outlet opening will pass through the roll in a direction substantially at right angles to the ends of the roll and having means arranged whereby the oil pressure upon the filter roll is maintained nearly constant while the oil is in circulation.

25 According to another form which the invention may assume, the filter may comprise a casing containing more than one roll of toilet tissue, paper or cellulose or more than one roll of tissue paper or cellulose towels arranged end to end between porous compressible packings, the combination supported at one end and yieldingly clamped upon the opposite end and disposed endwise in this manner between the inlet and outlet openings of the filter so that the oil normally flowing from inlet opening to outlet opening will pass through the rolls in a direction substantially at right angles to the ends of the rolls, and having means arranged whereby the oil pressure upon the filter rolls is maintained nearly constant at all times while the oil is in circulation.

30 The filter rolls may be tightly or loosely constructed of paper or cellulose or of any ingredients from which paper can be made and of any thickness, calendered smooth, rough or wavy and may be impregnated with any chemical compounds or ingredients or chemically treated to

assist in the desired function of separating sludge, grit, dust, abrasives, asphaltines, particles of carbon, impurities and the like, and improve their properties for absorption of water and soluble and insoluble contaminating elements producing oil discoloration and imparting properties capable of neutralizing acids.

Specific examples of this invention will now be described in detail with reference to the accompanying drawing and certain specific disclosure of the invention is made for purpose of explanation, but it will be understood that the details may be modified in various respects without departing from the broad aspect of the invention.

In the accompanying drawing:

Fig. 1 is a vertical longitudinal section of a filter made in accordance with the invention;

Fig. 2 is a partial plan and partial transverse section on the line 2—2 of Fig. 1;

Fig. 3 is a small scale fragmentary section of the casing only illustrating how two cartridges are placed in a filter casing end to end.

Referring now to the drawing by numerals, . indicates a replaceable filtering medium or cylindrical cartridge which is arranged longitudinally in respect to its upper end 2 and its lower end 3 in a drawn steel casing 4 having a cylindrical cavity 5, a semi-spherical chamber 6 at the bottom, a removable dome-shaped cover 7 at the top, a leak-proof seal or gasket 55 arranged between the cover 7 and the casing 4, a central tubular column forming an oil outlet tube or pipe 9 disposed longitudinally of the casing 4 and extending from one end of the casing to the other, the lower end of the tube projecting through the central opening provided in the bottom of the spherical chamber 6 terminating in an outlet connection 10 a short distance below the bottom 6 of the casing 4 and extending upwardly from this point through the central opening provided in the removable cover 7 terminating a suitable distance beyond or above the cover 7, an oil inlet opening 11 arranged on the side of the casing 4 near the top of the semi-spherical chamber 6, a drain opening 12 provided with a removable plug 13 arranged at the lowest level in the bottom of chamber 6.

The cartridge 1 being longitudinally arranged within the cavity 5 of the casing 4 is disposed endwise between compressible cylindrical felt packing rings or washers 14 provided to bear against the ends 2 and 3 and lies substantially in the normal direction of oil flow between inlet opening 11 and outlet opening 15 provided near

the upper end of the oil return pipe 9. The rings or washers 14 may be of felt but are preferably made from a mixture of cotton and mineral wools, cellulose, or other like synthetic fibrous materials providing a combination having both alkaline and acid reactions. Mineral wools and similar synthetic fibrous materials have a slight alkaline reaction which tends to neutralize the acids in the oil. Cotton is susceptible to attack by sulphurous and sulphuric acids and these acids are partially removed from the oil by being expended in their attack upon the cotton. The compressible washers 14, in addition to the work they perform in filtering and ridding the oil of acids and the like, also serve the purpose of oil seals by blocking the flow of oil through the filter in paths other than through the cartridge element 1 as hereinafter described.

The cartridge 1 as illustrated consists of paper, tissue or the like wound into a roll upon a central tube or core 16, and this tube has the same longitudinal dimensions as the cartridge and is usually made of cardboard, but any kind of material would be satisfactory.

The cartridge element is supported from below by a perforated circular plate or head 17 arranged in the bottom of the cavity 5 but near the top of the semi-spherical chamber 6 having a diameter somewhat less than the diameter of the cavity 5. The plate is formed as shown with an annular recess 18 between its circumference and its center so as to leave a flange 19 at the periphery and a boss 20 in the center. An opening 21 is provided in the center of the boss 20 so that the plate may be arranged snugly about the central oil return pipe 9. Extending downwardly from the underside of the plate 17 is a cylindrical boss 22 formed with a tapered or conical opening 23 concentric with the central opening 21 and merging into a recess 24 which terminates at a point 25 at the bottom of the center opening 23. Secured to the bottom of the plate 17 and covering the perforations 26 is a wire mesh cloth 27 formed into a cylindrical strainer or bag 28 at its center surrounding the boss 22 and provided with a close fitting ferrule 29 upon its bottom opening 30 which is arranged about a tube 31 closely fitting the central oil return pipe 9. The mesh bag 28 is expanded and kept from collapsing by a coiled spring 32 arranged within the strainer and surrounding the boss 22. The lower end of the spring abuts against the ferrule 29 while a draw wire 33 tightly necks the strainer around the boss 22 at a point 34, as shown, forming an abutment for the other end of the spring 32 so that the expansion of the spring has no tendency to pull the screen from the plate 17.

The tube 31 is provided with a tapered or conical upper end or head 35 which registers snugly in the tapered or conical opening 23 provided in the boss 22, forming a support for the plate 17 within the casing 4. The lower portion of the tube 31 is formed as a straight tube so as to be in contact with the close fitting ferrule 29 at all times in order that there will be no passage of oil into the interior of the strainer at this point. The lower end of the tube 31 is attached to the bottom of the semi-spherical chamber 6 in an oil tight manner preferably by welding.

Interposed between the lower end 3 of the cartridge element 1 and the top face of the supporting plate 17 is arranged one of the compressible washers 14 previously referred to. This

is a circular mass of dense, soft absorbent filtering material and it is arranged to fit snugly in the cavity 5 and in a like manner about the tubular column 9. Arranged upon the top end 2 of the cartridge element 1 is a perforated plate or head 36 loosely fitting the cavity 5 and similar to plate 17 in the respect that it is also formed with a recess 18 and has a circumferential flange 37, a centrally located boss 38 and perforations 39. Centrally within the boss 38 is an opening 40 through which the tubular centrally located column or oil return pipe 9 extends upwardly and centrally thereof out through an opening 41 in the removable cover 7 terminating at a point 42 above the cover 7. The boss 38 is recessed from above to accommodate a suitable packing washer or ring 43 of felt, cork or the like, arranged to fit closely around the oil return pipe 9.

Interposed between the upper end of the cartridge element 1 and the underside of the plate 36 and filling all of the space formed by the recess 18 is arranged another of the compressible washers or masses of dense soft absorbent filtering material 14 arranged to fit snugly the bore of the casing 5 and to fit in a like manner about the tubular column 9. A coiled compression spring 44 is arranged about the outlet tube 9 to bear between a metal washer 45 located about the tube 9 and resting upon the packing ring 43 and the underside of the casing cover 7 which serves as an abutment for the spring. The spring is of sufficient strength to hold the heads 17 and 36 firmly against the top and bottom faces of the filter element 1 and under this compression the packing above the flange 19 and below the flange 37 is pushed out firmly and circumferentially against the surface of the cavity 5 or bore of casing 4. As will be noted, flat annular metal or composition rings 46 closely fitting the bore of the casing 4 are provided to rest upon each end of the cartridge separating the packing washers 14 at each end from the cartridge. It will also be noted that smaller flat annular metal or composition rings 47 fitting over the central tube 9 are provided to bear upon each end of the cartridge tube 16 separating the packing washers 14 at these points from the cartridge 1.

By the arrangement shown the packing washers 14 are clamped or compressed under the compression of spring 44 between the flanges 19 and 37 and the opposing annular rings 46 at the peripheries of the packings 14, and between the centrally located bosses 20 and 38 and the opposing annular rings 47, forming in the latter case a secure joint against the passage of oil around the central tube 9, and over the ends of the cartridge tube 16 and in the former case a secure joint for the same purpose around between the periphery of the cartridge 1 at each end and the bore of the casing 4. A wing nut 48 or suitable acorn nut or the like engages the threaded portion 49 supplied upon the end 42 of the tube 9 as indicated, thereby holding the described parts securely together, yet allowing them to be readily taken apart. It will be noted that a suitable gasket 8 is provided between the flat surface 50 arranged upon the top of cover 7 and the face or surface 51 of the wing nut.

As will be noted from Fig. 1, a number of apertures 15 are provided in the central tubular column 9 above the perforated plate 36 affording communication between the cavity 5 and the interior 52 of the column 9. A number of apertures 53 are likewise provided in the lower end

of the tubular column affording communication between the recess 24 within the boss 22 and the interior 52 of the column. The apertures 15 form the normal oil return means while apertures 53 provide the by-pass means serving to maintain a uniform pressure within the casing 4. When the pressure in the semi-spherical chamber 6 at the bottom of the casing 4 exceeds that which is exerted by the pressure of the spring 44 holding the surface of the conical opening or chamber 23 firmly in contact with the corresponding conical head 35 formed on the upper end of the tube 31, the plate 17 will be forced upward breaking the lock between the described conical surfaces, thereby admitting the entrance of oil passing through the screen 28 and flowing upward into the recess 24 and then into the interior 52 of the central column by way of the apertures 53 and then back to the source of supply.

After the parts are assembled as illustrated with the wing nut 48 turned down tightly and the filter is vertically disposed by means of suitable brackets 54, an oil inlet connection is made at 11 and an oil return connection is made at 10, and the filter is then ready for operation. The oil after leaving the engine is discharged into the chamber 6 which it quickly fills and then passes through the wire cloth 27 screening out all grit and the like and then flows upwardly and through the perforations 26 into the filtering mass 14 which apart from its sealing functions is capable of neutralizing acids, etc. in addition to filtering and passes vertically upward through hundreds of vertical layers of paper forming an edge type filtering medium entrapping all small particles, carbon, etc. and absorbing water, etc. emerging from the top 2 of the cartridge 1 to pass through the final layer or mass of filtering material 14 and then out through the perforations 39 into the cavity above the cartridge 1 and then through orifices 15 into the interior 52 of the central column and downward to discharge opening 10 to repeat the cycle.

If it is desired to restrict the amount of oil entering the filter, thereby keeping the operation of the by-pass valve down to a minimum, a metering fitting as shown in Fig. 1 having a restricted orifice is inserted in the inlet opening and the oil inlet connection is made to this. Fig. 3 illustrates how more than one cartridge is used in a filter to increase the capacity and shows two cartridges placed end to end longitudinally of the filter.

I claim:

1. An oil filter comprising a casing having an inlet in the bottom, an oil outflow pipe extending entirely through said casing from top to bottom, means at the top of said pipe for sealing the same, said pipe having an aperture therein within the casing and near the top of the casing, a coiled filtering element arranged substantially centrally within said casing whereby upper and lower cavities will be presented, the lower one for the entering oil and sludge and the upper one for the filtered oil, said aperture in said pipe registering with said upper cavity, a filtering pad at the top and bottom of said filtering element, a foraminous member at the top and a foraminous member at the bottom of said casing acting on said pads for holding the same and the filtering element in functioning position, and spring means for maintaining tension between said filtering element and said foraminous members.

2. An oil filter of the character described as in claim 1, in which the coiled filtering element is

composed of a plurality of rolls of paper arranged in tandem for filtering the oil arranged end to end and having their centrally positioned passageways extending longitudinally thereof and surrounding the oil outflow pipe.

3. An oil filter of the character described as in claim 1, in which the coiled filtering element is composed of a roll of standard toilet tissue paper for filtering the oil.

4. An oil filter including a casing having an inlet opening, means forming an outlet passageway extending through each end of the casing provided with openings therein near each end, said passageway terminating in a discharge point at one end and in a closure at the opposite end, a cartridge filtering means surrounding said outlet passageway excepting for a short space at the top of the casing and for a space at the bottom thereof, said filtering means comprising a plurality of cylindrical layers of material having substantially the characteristic of paper vertically disposed within said casing, annular filtering means of porous, absorbent, compressible material arranged upon the ends of said cartridge extending outwardly from around said outlet passageway adjacent the inner wall of the casing, circular plates arranged along said outlet passageway adjacent said annular filtering means at each end, the lower of said plates serving as a support for all said filtering means and the upper of said plates having means for yieldingly clamping them together so as to confine the flow of oil under normal pressure from inlet opening to outlet pipe to the path through said filtering elements, said yielding means comprising a compression spring surrounding said outlet pipe, a compressible packing arranged about said outlet pipe and disposed in a centrally located recess in the top face of said upper plate so as to form an oil tight seal about the top of said outlet pipe, one end of said spring being positioned to bear against said compressible packing, the other end of said spring bearing against the underside of the top of the casing which serves as an abutment therefor.

5. An oil filter including a casing having an inlet opening at the bottom and means forming an outlet pipe extending longitudinally and centrally thereof and outwardly through the lower end of the casing terminating in a discharge point, said outlet pipe having openings near each end within said casing, a coiled cartridge filtering element surrounding said outlet pipe for most of its length within the casing excepting for a short distance at each end thereof and comprising a plurality of turns about said outlet pipe of a material closely resembling paper, filtering pads of porous material arranged upon the ends of said cartridge extending from around said outlet pipe outwardly adjacent the inner wall of the casing, an upper and a lower circular head arranged along said outlet pipe near the respective ends of said cartridge for supporting the cartridge at one end and yieldingly clamping it at the other between said porous pads, thereby confining the flow of oil under normal pressure from inlet opening to outlet pipe to passage through said filtering elements, said by-pass structure including a tube secured to said casing surrounding said outlet pipe near its lower end, said tube being tapered at its upper end, and a boss extending from said lower head formed with a conical opening merging into an annular recess surrounding the lower opening in said outlet pipe, said conical open-

ing being adapted to receive the tapering upper end of said tube.

6. A filter comprising a casing having a removable cover, an inlet opening and a cavity for the passage therethrough of an oil to be filtered, a cartridge formed with a central passageway having substantially the characteristics of a roll of toilet paper vertically disposed therein so that said central passageway extends longitudinally of the casing, an oil return pipe extending upwardly through said passageway and centrally thereof and downwardly out through the sludge chamber in the bottom terminating in a discharge end thereof, said casing being oil tight excepting for the flow of oil through said inlet opening and return pipe, an oil filtering pad surrounding said oil return pipe at the bottom, an oil filtering pad surrounding said return pipe at the top, a plate surrounding said return pipe below said lower pad, and a spring acting on the upper plate for yieldingly compressing said filtering pads and said cartridge.

7. A device for separating foreign matter from and absorbing the discoloration of lubricating oil including in combination a casing having a cavity with inlet and outlet means for the flow therethrough of an oil to be filtered, a filtering cartridge comprising a plurality of cylindrical layers of paper vertically disposed in the path of said flow from inlet to outlet means and surrounding said outlet means and arranged between annular masses of porous compressible filtering material, said annular masses being in turn interposed between apertured heads at each end of said cartridge, one of said heads being movably supported from below and covered on its bottom face by a wire mesh screen through which the oil must pass in flowing from inlet means to outlet means, the

other of said heads being yieldably pressed downward from above, both of said heads having means for compressing said annular masses of filtering material against the ends of said cartridge so that the oil can not escape upwardly around said cartridge but is forced through it.

8. An oil filter of the character described comprising a casing having a semi-spherical bottom forming a sludge chamber, a dome-shaped detachable cover, a fastening device securing said cover to said casing so that the casing will be oil tight, an outlet pipe extending centrally and longitudinally of the casing formed with apertures near the top, said pipe extending upwardly and out through an opening in the cover and downwardly and out through the bottom of said casing and secured thereto so that the casing will be oil tight, a roll of paper having a central passageway for filtering the oil disposed in said casing substantially filling it circumferentially and having its centrally positioned passageway extending longitudinally thereof upwardly to near the top and downwardly adjacent said sludge chamber, an annular compressible mat of filtering material arranged upon the top face of said roll of paper extending outwardly firmly adjacent the wall of said casing and inwardly firmly surrounding said outlet pipe, a second similar filtering mat arranged upon the bottom face of said roll of paper extending outwardly firmly adjacent the wall of said cavity and inwardly firmly surrounding said outlet pipe, a supporting structure for said mats and roll of paper disposed in the bottom of said casing, and a filter screen secured upon the bottom face of said supporting structure for straining the oil passing upwardly there-through.

RUSSELL A. WEIDENBACKER.