

March 13, 1934.

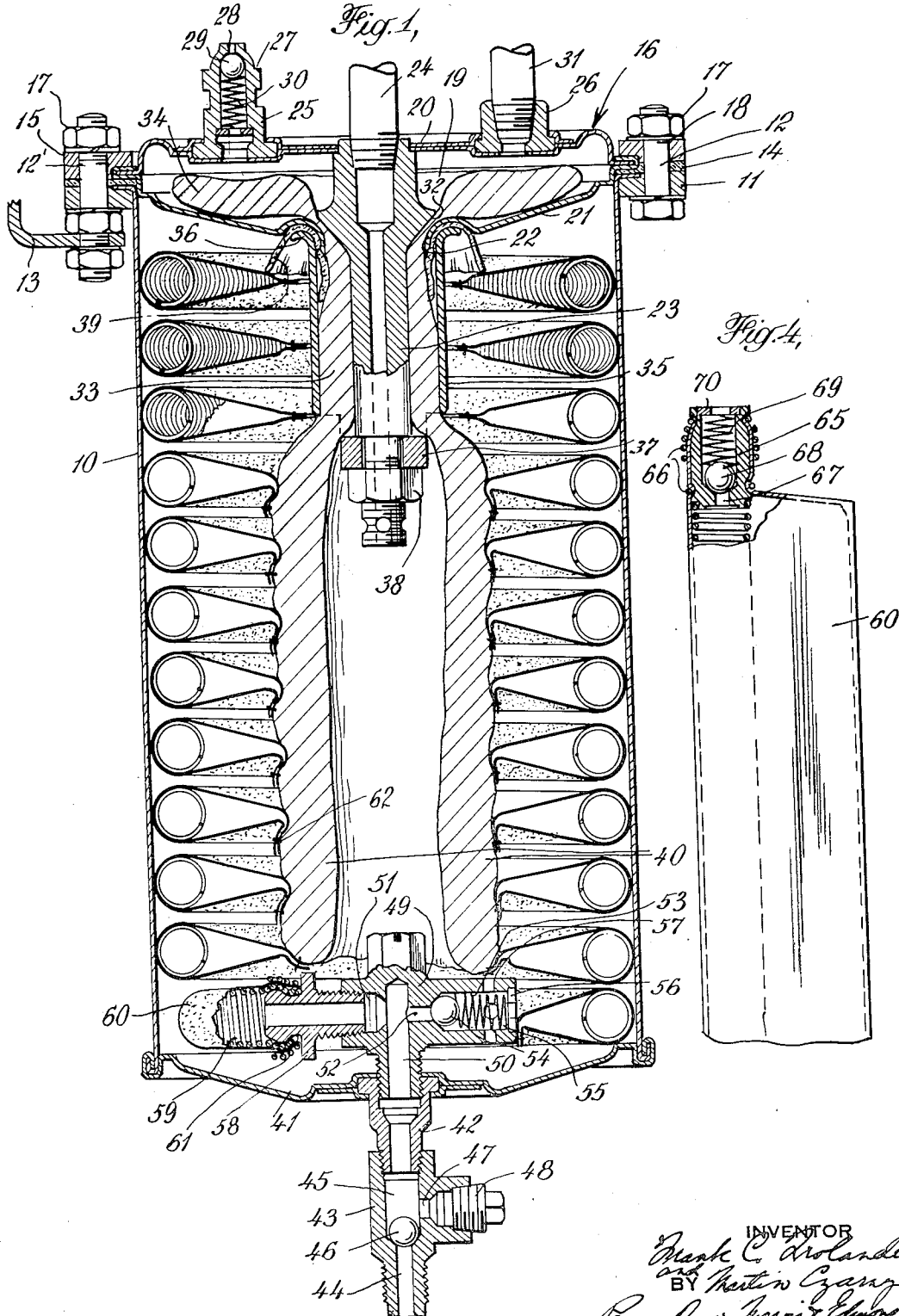
F. C. FROLANDER ET AL

1,950,487

OIL FILTERING AND RECTIFYING DEVICE

Filed March 17, 1931

2 Sheets-Sheet 1



March 13, 1934.

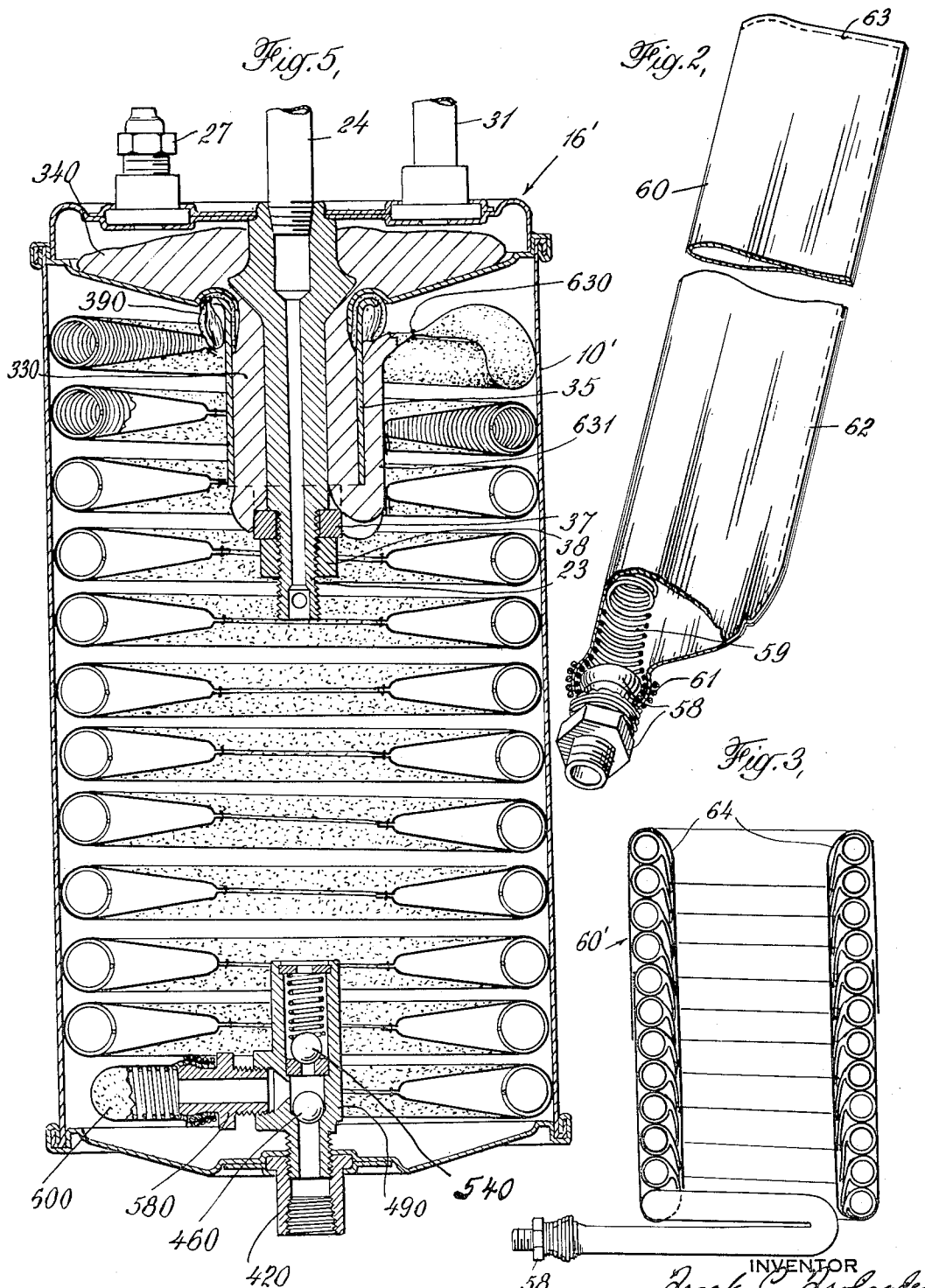
F. C. FROLANDER ET AL

1,950,487

OIL FILTERING AND RECTIFYING DEVICE

Filed March 17, 1931

2 Sheets-Sheet 2



INVENTOR
Frank C. Frolander
BY Martin Gamm
Penne, Slaw, Herwig & Edmund
ATTORNEYS

UNITED STATES PATENT OFFICE

1,950,487

OIL FILTERING AND RECTIFYING DEVICE

Frank C. Frolander, Elizabeth, and Martin Czarny, Roselle, N. J., assignors to Capillizer Holding Corporation, New York, N. Y., a corporation of New York

Application March 17, 1931, Serial No. 523,246

8 Claims. (Cl. 196—16)

This invention relates to apparatus for filtering and rectifying oil containing both solid and liquid impurities. The invention has particular reference to apparatus of the type described for rectifying the used lubricating oil of an internal combustion engine in which the solid particles, such as carbon flakes, grit, etc. and liquid diluents and impurities, such as gasoline and water, are deposited during operation of the engine.

In our prior Patent No. 1,717,096, issued June 11, 1929, and in our co-pending application Serial No. 319,129, filed November 13, 1928, there is described methods and apparatus for rectifying used lubricating oil by taking advantage of the superior capillary activities of the liquid diluents, such as gasoline and water, as compared to oil, in order to separate them from the oil.

The abstracted liquid diluents are evaporated in the presence of air to carburet the gasoline and in the preferred arrangement this combustible mixture is introduced into the engine for consumption along with the engine fuel. The apparatus for performing these various steps includes a container for receiving used lubricating oil from the crank case of the engine, a wick inserted in the container for abstracting the liquid diluents from the oil therein by capillary action, an evaporator associated with the wick for vaporizing the gasoline and water and preferably a suction pipe leading from the evaporator to the engine intake for conveying the vaporized gasoline and water mixture into the engine for combustion, whereby not only the full lubricating qualities of the oil are restored, but the gasoline recovered therefrom is utilized as fuel to increase the economy of the operation of the engine. The small amount of water abstracted from the oil by the device and introduced into the engine along with the gasoline in the form of vapor does not detract from the operation of the engine but, in fact, improves its operation in accordance with the well known phenomenon that internal combustion engines seem to operate better in moist air, such as during damp weather.

A filter bag is also employed for removing the solid particles from the oil by filtration, and in the arrangement disclosed in our aforementioned copending application, this filter bag is employed as an auxiliary capillary device for augmenting the abstraction of the liquid diluents from the oil, these diluents being transferred to the wick and thereafter vaporized in the manner described. Also in the arrangement of our copending application, the wick abstracts a regulated quantity of light oil from the crank case oil, and

this light oil is introduced into the combustion space of the engine for lubricating the pistons and valves. The suction connection to the evaporator portion of the wick aids the capillary action thereof by removing the abstracted diluents immediately and thus leaving space in the evaporator for more diluents, and the suction at one end of the wick increases the pressure drop therethrough to hasten the flow of the diluents through the wick.

These methods and apparatus for rectifying lubricating oil described in our aforementioned patent and copending application, have proven to be very effective and eminently satisfactory, and the present application is especially concerned with improvements on the apparatus of this prior patent and application, which renders this apparatus even more effective for the purposes described.

The present invention is particularly concerned with a novel filtering unit for the oil, this unit having an extremely large filtering surface and is consequently usable for a long time, and is preferably arranged to contain the solid material which it abstracts from the oil within its interior so that this solid material may be removed as a mass with the filter bag without soiling the remaining parts of the apparatus, this used filter bag then being discarded and replaced with another unused one, though in some instances, it may be found desirable to replace the entire rectifying unit with a new one. As in the apparatus disclosed in our aforementioned copending application, this new filter bag also acts as a capillary device to augment the action of the wick in abstracting the liquid diluents from the oil, and light oil also if desired, but because of its greatly increased surface in contact with the oil and its peculiar construction and arrangement, this new filter bag also has an increased effectiveness as a capillary device for abstracting the liquid diluents.

A preferred arrangement of the invention, accordingly, consists of a container for receiving used lubricating oil from the crank case of an internal combustion engine, for example, this oil being forced by a pump into the interior of the novel filter bag, which comprises an elongated tube of filtering material, such as cloth, this tube being of relatively great length and coiled in spiral shape within the relatively small confines of the container, and is sealed at one end and connected at the other end to the oil intake of the container so that all of the oil received in the container first passes through the filter coil which filters out the solid impurities from the oil and

retains these impurities within its interior. The oil filters through the walls of the bag and flows out through the oil outlet of the container. Extending as a separate unit within the annulus formed by the coiled filter bag, is a wick, preferably engaging the inner surface of filter bag coil, this wick being adapted to abstract from the filtered oil such liquid diluents as gasoline, water and the like which cannot be filtered out of the oil mechanically. The coiled filter bag also acts as a wick of great length for abstracting a certain additional quantity of the liquid diluents from the oil, and by virtue of the contact between the filter bag coil and the wick, such diluents abstracted by the coil are transferred to the wick and pass through the latter out of the container to the evaporator. Air is applied to this evaporator for vaporizing the gasoline and water abstracted by the wick and preferably a suction tube connects the evaporator to the intake manifold, carburetor, air cleaner or other connection associated with the intake of the engine for transferring the vaporized diluents into the engine to be burned along with the fuel, this suction connection aiding the capillary action of the diluents in the wick in the manner described above.

In a modified arrangement the wick and the filter bag constitute a single element, differing in this respect from the aforementioned arrangement, in which the filter bag and wick are separate elements. The free end of the filter bag serves as the wick in the modified arrangement and extends into the evaporator instead of the separate wick, the filter coil thus being a combined wick and filter of great length.

The filter bag coil and the wick may either be permanently sealed in their container or the container may be made openable for permitting removal of the filter bag and replacement thereof with a new one after it is filled with solid material abstracted from the oil. In the latter arrangement, that is for use in the openable container, the filter coil is a separate unit and is preferably arranged in the form of a cartridge insertable in the container after the used cartridge has been removed. This filter cartridge resembles a coil spring and is preferably held in shape by clips, while the intake end of the filter bag hangs free so as to be detachably connectible to the intake of the container. The intake of the container preferably includes a normally closed spring valve which is unseated by any abnormal oil pressure in the container, such as occurs when the filter bag becomes too clogged with solid material to permit the oil to pass through its walls. In this event, the oil is by-passed around the filter bag through this valve and is supplied directly to the engine bearings, crank case, or the like, so that there is no decrease in the oil supply regardless of the clogging of the filter. When the combined filter bag and wick arrangement described is employed, the sealed container will be found more satisfactory, as the filter bag is not separable from the wick, although with this arrangement the combined wick and filter bag unit may be supplied as the cartridge, and then the openable container may be employed. It will be seen that the new apparatus of this invention is extremely simple in construction and operation, contains no moving parts to get out of order, needs no attention other than replacement of the filter unit when it becomes clogged after long use, and provides for economical operation of an internal combustion engine, as it maintains the lubricating qualities of the oil by abstracting the solid and

liquid impurities therefrom and utilizes the abstracted liquid impurities by burning them in the engine, whereby fuel consumption is decreased and better engine operation is assured. The engine oil, accordingly, need not be replaced from time to time, but it is only necessary to replenish it periodically with small quantities of new oil to maintain the level of the oil in the engine crank-case.

For a better understanding of this invention, reference is made to the accompanying drawings, in which,

Figure 1 is an axial section through the new oil filtering and rectifying apparatus of this invention;

Figure 2 is a perspective view of the elongated tubular filter bag of this invention;

Figure 3 illustrates the manner of arranging the filter bag in a coil secured in shape by clips to form a replacement cartridge;

Figure 4 illustrates a fragment of the filter bag with the by-pass valve inserted through the wall thereof; and

Figure 5 is an axial section through a modified form of the apparatus of this invention, in which the filter bag and the wick constitute a single element.

Referring particularly to Figure 1 of the drawings, numeral 10 designates a cylindrical container, open at the top end and closed at the bottom end. The open top end of the container is fitted with a flange ring 11, secured thereto by solder, welding or the like, and is provided with spaced holes for the reception of bolts 12. Certain of these bolts 12 serve to secure the container 10 to a bracket or brackets 13, by means of which the container 10 is mounted upon the dash, engine, or other support beneath the hood of an automobile, for example, the present invention being of particular utility for rectifying the lubricating oil of an internal combustion engine employed for driving an automobile, aeroplane, motor boat, railway vehicle, and the like, and the container 10 is adapted to be inserted in the lubricating oil circulating system thereof.

The bolts 12 also pass through a gasket 14 and a companion flange 15 which carries the head 16 of the container. When the nuts 17 are screwed down tightly on the bolts 12 over lock-washers 18 the gasket 14 seals the joint between the container 10 and head 16 to render it leak-proof against the escape of oil under reasonable pressures. Also, simply by removing nuts 17, the head 16 may be removed to gain access to the interior of container 10, the purpose of making this container openable in this manner being explained later.

The head 16 of this container constitutes a suction and evaporator chamber 19 formed between the cap 20 and the inner web 21. The outer edges of the sheet metal cap and web are crimped together and may be secured to clamping ring 15 by soldering, welding, or the like, so that the evaporating and suction head having the chamber 19 is removed from the container 10 when the ring 15 is lifted off.

The web 21 of the evaporating and suction chamber 19 is provided with a central opening, the edge of which is turned downwardly to form a flange 22. Sealed through the cap 20 by solder or the like is an oil outlet tube 23, communicating with the interior of the container 10. The outlet of this tube 23, which projects through cap 20, is threaded for the reception of the end of the oil return pipe 24, leading to the engine bearings,

crank-case, or the like, and through which the rectified oil is discharged from container 10.

Also sealed through the cap 20 of the vaporizer and suction head 16 are two nipples 25 and 26. The outer end of nipple 25 is threaded for the reception of the air valve body 27, having a small air vent 28 at its outer end, which is normally closed by ball valve 29 maintained in closed portions of spring 30. Connected to the threaded outer end of nipple 26 is suction pipe 31, leading to the intake manifold, carburetor, air cleaner or other connection associated with the intake of the engine for creating a suction in the chamber 19 and conveying vaporized diluents therefrom in the manner to be described later, this vaporization being accompanied by the inlet of air by valve 29, which is unseated by the suction in chamber 19. This arrangement is substantially identical to that described in our aforementioned copending application to which reference may be had for further details of connections and the like.

Clamped in the annular space formed between a conical flange 32, an oil outlet tube 23, and the inner flange 22 of web 21 is a capillary device 33, such as a wick of absorbent cotton cloth or the like, the upper end of which is splayed to form a large evaporating portion 34 lying in the chamber 19 of head 16. The wick 33 lies in a tube 35 having an outwardly turned flange 36 at its upper end cooperating with the flange 22 of web 21. The tube 35 is held in this position by a clamp 37 slipped over tube 23 and secured in place by a nut 38 screwed up on the lower threaded end of tube 23. A piece of filter cloth 39 is inserted between the coating flanges 22 and 36 and serves both as a washer and a small auxiliary wick contacting with wick 33 at its inner end and arranged so that its outer edge extends into the oil in the container 10. It will be seen that the degree of constriction or choke applied to wick 33 between cone 32 and flange 22 is made variable by adjusting the nut 38, web 21 flexing slightly and tube 23 being drawn downwardly to permit any desired degree of adjustment. The lower ends 40 of the wick 33 extend downwardly toward the bottom 41 of container 10.

Sealed through the bottom 41 of container 10 is a nipple 42, the inner end of which is threaded interiorly and the outer end of which is threaded for the reception of fitting 43 having passage 44 therethrough, which communicates with chamber 45, in which lies a ball 46, which normally closes passage 44. A lateral passage 47 also communicates with chamber 45 and this passage is normally closed by removable pipe plug 48.

The oil supply pipe leading from the oil pump or the like, is adapted to be connected to fitting 43 and it is through this fitting that oil is introduced into container 10. The ball valve 46 seals the intake passage 44 when the oil pump stops, so that the container 10 is kept full of oil for purposes to be explained later. The ball valve 46 also prevents oil from flowing out of container 10 when the oil supply pipe is disconnected from fitting 43, such as when the device is being removed from the oil system for replacement or the like. The pipe plug 48 is provided for the purpose of draining the residual oil in container 10, when desired.

Screwed into the inner end of nipple 42 is fitting 49, having the passage 50 communicating through nipple 42 with the oil intake passage 44. Fitting 49 is provided with two lateral passages 51 and 52, the former being a threaded socket,

and the latter communicating with by-pass valve chamber 53, containing ball valve 54 which is normally biased to close passage 52 by spring 55. The spring 55 is held in place by cap 56 and a plurality of outlets 57 place valve chamber 53 in communication with the interior of container 10.

Removably screwed into socket 51 of fitting 49 is a nipple 58, to the outer end of which is secured the wire spiral 59, over which is slipped the tubular filter bag 60 whose end is secured to nipple 58 by the wire 61, or the like. This filter bag 60 is preferably formed of napped cotton cloth sewn into the shape of a tube of great length. This tubular filter bag 60 is shown in Figure 2, in which it will be seen that the bag 60 is formed simply of a length of the cloth folded lengthwise with the nap inside, and sewn at 62 along the folded over edge, and then across the free end as at 63 to close the bag. The bag so formed is slipped over the elongated wire spiral 59, which is preferably of smaller diameter than the interior of the bag 60, and the open end of the bag is secured by wire 61 to the nipple 58, the corresponding end of spiral 59 being also secured to the nipple 58, at the same time. This spiral 59 holds the bag 60 partially distended, prevents it from collapsing, and also holds it in shape.

The filter bag 60 is then inserted into the container 10 through its open top ends. This is accomplished by screwing nipple 58 tightly into the socket 51 of interior fitting 49, and then coiling the bag 60 within the container 10, as illustrated in Figure 1, the seam 62 of the bag being kept inside. When so arranged the seam of the majority of convolutions of the bag coil engage the lower ends 40 of the wick 33.

It is preferred that the filter bag 60 be supplied in the form of a replacement cartridge, which consists of the filter bag wound into the coil shape and held in this shape by clips 64, as shown in Figure 3, these clips being of metal, cord, or the like. This cartridge is thus a cylindrical unit 60', from which hangs the connection nipple 58 on the free lower end of the bag, which is of sufficient length to permit the nipple 58 to be screwed into the fitting socket 51 before the cartridge is inserted so as to give sufficient hand room to permit this operation. Then the cartridge is slipped into the container 10 and the head 16 replaced thereon in the manner previously described, the wick ends 40 lying within the interior of the bag coil and engaging the inner surface thereof. The spiral 59 may also be wound so that it holds the bag 60 in the coil shape illustrated, so that it need not be coiled by hand into container 10, nor will cartridge 60' then require clips 64.

Assuming that the oil rectifying apparatus of this invention is to be used in an automobile, the bracket 13 is secured to the dash, engine block or other support beneath the hood of the automobile and the container 10 mounted thereon by means of the bolts 12'. The oil supply pipe leading from the oil pump of the engine is connected to fitting 43, the oil outlet pipe 24 of the container is connected to the oil distributing system leading to the bearings, crank-case or other portion of the engine and the suction pipe 31 is connected to the intake manifold, carburetor, air cleaner or other suction connection of the engine, whereby all gases withdrawn through suction pipe 31 are eventually introduced into the combustion space of the engine to be burned. The oil pump forces oil through the intake passage 44, unseats ball valve 46 because of the pressure thereof and the oil flows through nipple 150

42 and passage 50 of the fitting 49 into the filter coil 60. This filter coil 60 is of great length and the oil passes through it and as it does so, it seeps through the walls of the filter bag 60, leaving behind it all solid particles which were introduced in the oil during the operation of the engine. These solid particles include hard and soft carbon flakes resulting from the combustion in the engine, gummy residue caused by cracking of the lubricating oil in the hot engine parts, particles of dirt which entered the engine with the air and even metal filings which were left in the crankcase oil passages or which are ground off because of friction between moving parts of the engine. The hair-like nap in the interior surface of the filter bag 60 mats down and forms a dense filtering surface to which cling the extremely fine carbon particles which would otherwise pass through the meshes of the cloth. The extremely long bag 60, accordingly, provides a filtering surface of great expanse. For example, if the filter bag is twelve feet long and the interior periphery of the bag is say, four inches, the total filtering area is four square feet, this area being confined within the relatively small container 10 and being largely in excess of that required for ordinary filtration, but this excess area greatly increases the life of the filter bag as it may be used for many thousand miles of travel of the automobile before it becomes clogged.

It will be seen that all of the solid material abstracted from the oil by this filter bag 60 is retained within the bag itself so that there is no sludge or dirt in the container. After a long period of use when the pores of the bag become clogged throughout its great length, the head 16 of container 10 may be removed by removing nuts 17 and lifting it off. The filter bag 60 may then be withdrawn and nipple 58 disconnected from the interior fitting 49 and the bag discarded. Then the new unused filter cartridge 60', illustrated in Figure 3, is inserted in the container 10 to replace the discarded cartridge. In order to insert this new cartridge 60', it is simply necessary for the user to grasp the nipple 58 at the end of the free length of the bag, screw this nipple into threaded socket 51 of interior fitting 49, while holding the remainder of the cartridge out of the container 10 to permit hand room for this operation, and then inserting the cartridge 60' in place. Replacement of the head 16 completes the operation of re-cartridging the device.

The means for abstracting the liquid diluents from the filtered oil in container 10 is substantially like that illustrated in our aforementioned copending application and consists principally of the wick 33—40 choked or constricted between shoulder 22 and cone 32 at its upper end and spreading out to form the evaporator 34 lying in chamber 19 of head 16. As explained in our aforementioned patent and copending application, we have found that the capillary activities of liquid diluents such as water and gasoline, are considerably greater than that of the oil. Accordingly, the gasoline and water are abstracted by the wick 33—40 and rise to the evaporating portion 34. Small quantities of light oil also rise in the wick with the gasoline which is a solvent therefor, but we have found that by choking or constricting the wick in the manner described, only the gasoline and water reach the evaporating portion 34. However, it is frequently desirable to introduce light oils into the engine, especially a new engine, in order to lubricate the pistons and the valves. In such a case, nut 38 is loosened

slightly to relieve the choke or constriction so that a small quantity of this light oil reaches the evaporator portion 34 along with the gasoline and water. The suction created in vaporizer chamber 19 causes the unseating of the ball valve 29 to permit the introduction of small quantities of air into the vaporizer chamber 19, which not only vaporizes the water and gasoline as well as any light oil which may have passed through, but also serves to carburet the gasoline and render it combustible. Thus a combustible mixture consisting of gasoline vapor, containing small particles of light oil for lubricating purposes and a small amount of water vapor, is introduced through suction pipe 31 into the engine to aid its operation and at the same time to remove such by-products of the operation of the present apparatus, so that it is an entirely closed system.

The aforementioned operation of the capillary column is substantially as described in our aforementioned copending application, but it was described again here in order to connect the new improvements of this invention with the former apparatus. These new improvements in the wick system includes the cloth gasket 39 which hangs down into the oil in the container and also serves to abstract a certain quantity of gasoline and water from the oil and as the inner end of this gasket 39 lies in contact with the wick 33, the diluents abstracted by the former are transferred directly to the wick.

The filter bag 60, being a continuous piece of fabric of great length within the oil in container 10, also acts as a capillary column and abstracts a large proportion of the liquid diluents from the oil because of the contact between the lower ends 40 of the wick 33 and the interior edges of the convolutions of the filter bag 60 as illustrated in Figure 1, the diluents abstracted from the oil by the filter bag 60 are transferred to the wick 33—40 and thus greatly augment the rectifying action of the apparatus. This combined wick formed by the wick 33—40 and the filter bag 60 and the gasket 39, is such as to effectively abstract all diluents from the oil under any circumstances, even such severe conditions as winter operation of the engine where the choke is used excessively and richer gasoline mixtures are employed in the engine. The large wick area of the device is also sufficient to abstract all the gasoline from the oil of an engine having leaky piston rings such as an old automobile engine in which much gasoline passes the pistons and leaks into the crank-case oil.

The ball valve 46 closes the intake passage 44 when the pump stops operating and so keeps the container 10 full of oil at all times. This is especially effective when the engine is stopped over a considerable period, such as at night, inasmuch as the wick continues to act to abstract the liquid diluents from the oil and distribute them to the evaporating portion 34 so that it frequently contains sufficient gasoline to supply the additional gasoline necessary in starting the engine in the morning, whereby the use of the choke is not necessary. Also, should it ever be desired to remove the apparatus from the oil circulating system, the disconnection of the fitting 43 from the oil supply line will not cause the oil to flow out of the container, as ball valve 40 keeps the passage 44 closed. Whenever it is desired to drain the container 10, it is only necessary to remove pipe plug 48 for this purpose.

In case the user does not re-cartridge the apparatus when the filter 60 becomes clogged the

abnormal oil pressure thus set up causes the by-pass valve 54 to be unseated and the oil flows directly into the container 10 and out of the oil outlet tube 24 to the bearings, crank-case or other portions without stirring up any sediment within the container or filter coil 60, as the sediment is entirely enclosed and contained within the interior of the filter coil 60.

In Figure 5 there is illustrated a modified form of the invention in which the wick and the filter bag are a single unit instead of two separate units, as illustrated in Figure 1. In such an arrangement, in which the filter bag is not a single unit, it may be desirable to seal the container permanently in the manner illustrated, so that when the filter becomes clogged the entire container is removed and discarded and replaced with an unused unit. In this arrangement the head 16' is permanently crimped and soldered to the container 10'. The filter bag 600 is constructed as before except that the closed end thereof is extended beyond the seam 630 and the corresponding extension 631 is split to pass around the lower end of tube 23, clip 37 and nut 38 and is inserted within tube 35 to form the wick 330, the free end of which is splayed to form the evaporating portion 340. Also, instead of placing the ball valve 460 on the outside of the container, it is within the interior fitting 490 so that when the entire container is removed from the oil supply line the oil within the can will not spill out. The by-pass valve 540 is arranged in fitting 490 and the intake end of the bag 600 is connected to the fitting 490 by the nipple 580.

In operation the oil enters the apparatus through fitting 490 and is filtered through the walls of the filter coil 600 in the manner described. Also as described, the filter bag 600 acts as a capillary wick and abstracts the liquid diluents from the oil, these diluents passing lengthwise of the filter bag 600 beyond the end thereof at seam 630 and into the wicks 631 and 330 to be evaporated in the evaporator portion 340 as before. This arrangement provides a single unit which is both a wick and a filter bag. In particular, it provides a wick having great length so that some portion thereof is in contact with all parts of the oil body whereby every vestige of the gasoline, water or other liquid diluents in the oil in the container is abstracted and carried off by evaporation into the engine where it is burned. The gasket 390 also aids the abstraction of the liquid diluents from the oil and, as before, transfers them to the wick 330.

In certain arrangements it may be of advantage to place the by-pass in the filter bag, in which event the fitting 49 or 490 may be dispensed with entirely and the nipple 58 or 580 screwed directly into the oil intake nipple 42 or 420. Such an arrangement is illustrated in Figure 4 in which the closed end of the filter bag 60 is provided with a by-pass valve. The body 65 of this by-pass valve is inserted through an opening in the end of the filter bag and the wires 66 wrapped around the cloth within grooves in the valve body 65 to seal the latter through the bag. The passage 67 through the valve body 65 is normally closed by the ball valve 68 which is held in this position by the coil spring 69 secured in place by a cap 70. When the filter bag 60 becomes clogged so that abnormal pressures are set up the ball valve 68 is unseated and the oil flows directly through the filter coil.

It will be seen that the apparatus of this invention provides important improvements on the

oil rectifying apparatus disclosed in our aforementioned patent and copending application and that the entire new apparatus is extremely simple and effective for the purposes described. It not only provides a filtering unit of great effective area within a small space, but also provides a capillary device of increased effectiveness and efficiency. The oil is pumped through a filter bag of great length arranged in a coil and kept partially distended by a spiral wire so that there can be no resistance to the flow of oil therethrough and the oil filters through the walls of the bag as it passes through the filter bag coil. By introducing the oil into the interior of the bag coil the entire effective area thereof is employed as the oil circulates around the convolutions of the wire spiral and the latter does not close up any of the pores of the bag, which would not be the case if the oil were placed into the tubular filter bag from the outside, although such an arrangement lies within the scope of this invention. Also, in the arrangement shown in Figures 1 and 3, the device may be re-cartridged whenever the filter becomes clogged, simply by inserting a new filtering cartridge and this does not require especial skill as it is only necessary to open the container, remove the clogged filter and replace it with a new one.

While several preferred embodiments of the invention have been illustrated and described herein, it is to be understood that the invention is not limited thereby, but is susceptible of many changes in form, arrangement and use. For example, it might be used with equal facility on other apparatus than on an internal combustion engine, and is capable of use under any conditions, for purifying lubricating oils, whether used or not, which contain foreign liquids having greater capillary activity than the oil itself. It is also to be understood that the term "wick" as used herein comprehends all forms of capillary bodies or devices having connected or continuous pores, passages or the like, in which liquids may elevate themselves by their own capillary activities.

We claim:

1. In oil rectifying apparatus, the combination of a container having an inlet, an elongated tube of filtering material folded within the relatively small confines of the container, connections between the inlet and the tube, and means within the tube for holding it in folded position.

2. In oil rectifying apparatus, the combination of a container having an inlet, an elongated tube of filtering material folded within the relatively small confines of the container, connections between the inlet and the tube, and means within the tube for holding it in folded position.

3. In oil rectifying apparatus, the combination of a container having an inlet, an elongated tube of filtering material coiled within the container, means within the tube for distending the same and holding it in coiled form, and connections between one end of the tube and the inlet of the container.

4. In oil rectifying apparatus, the combination of a container having an inlet, a tube of filtering material coiled helically within the container and connected at one end to the inlet, and means within the tube for holding it in a self-sustaining helical coil.

5. In oil rectifying apparatus, the combination of a container for the oil, a bag of porous filtering material therein for filtering the oil and for abstracting the liquid diluents therefrom, a porous

wick having a portion extending into the oil in the container for abstracting the liquid diluents therefrom, and connections between the wick and the bag for transferring liquid diluents abstracted
5 by the bag to the wick.

6. In oil rectifying apparatus, the combination of a container for the oil, and a filter bag of porous material coiled therein, said bag having a portion
10 extending outside of said container for receiving the liquid diluents abstracted by capillary action from the oil in the container by the bag.

7. In oil rectifying apparatus, the combination of a container for the oil having an inlet, an elongated filter tube of porous material folded
15 within the container, connections between one end of the tube and the inlet of the container, and an extension on the other end of said tube extending outside of said container for receiving the liquid

diluents abstracted by capillary action from the oil in the container by the tube.

8. In oil rectifying apparatus, the combination of a container for the oil, having an inlet and an outlet, an elongated tube of filtering material
80 coiled within the relatively small interior of the container, connections between the tube and the inlet of the container, a wick inserted in the container and having a portion outside of the container for abstracting the liquid diluents from
85 the oil by capillary action, connections between the filter tube and the wick for transferring the liquid diluents abstracted by the tube to the wick, and an evaporator connected to the wick portion outside of the container for vaporizing the liquid
90 diluents received thereby.

FRANK C. FROLANDER.
MARTIN CZARNY.

95

25

100

30

105

35

110

40

115

45

120

50

125

55

130

60

135

65

140

70

145

75

150