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MEANS FOR FILTERING OIL IN THE LUBRICATING
SYSTEM OF AN INTERNAL COMBUSTION ENGINE
Original Filed April 30, 1926

Fig. 1.

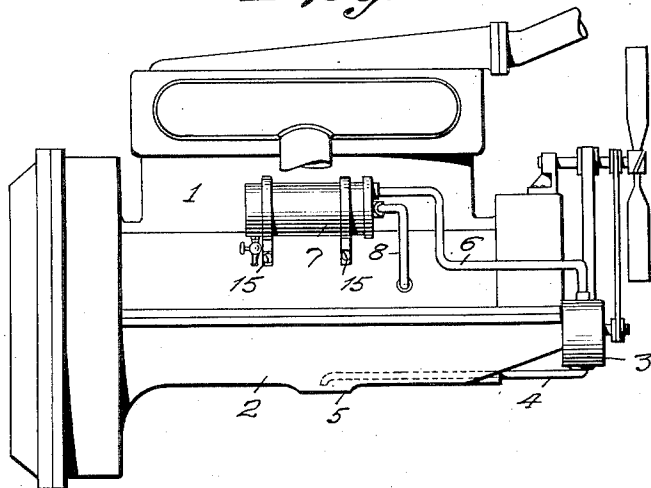


Fig. 2.

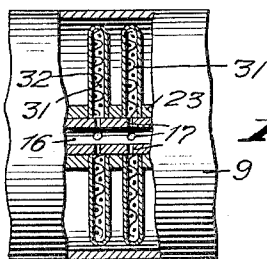
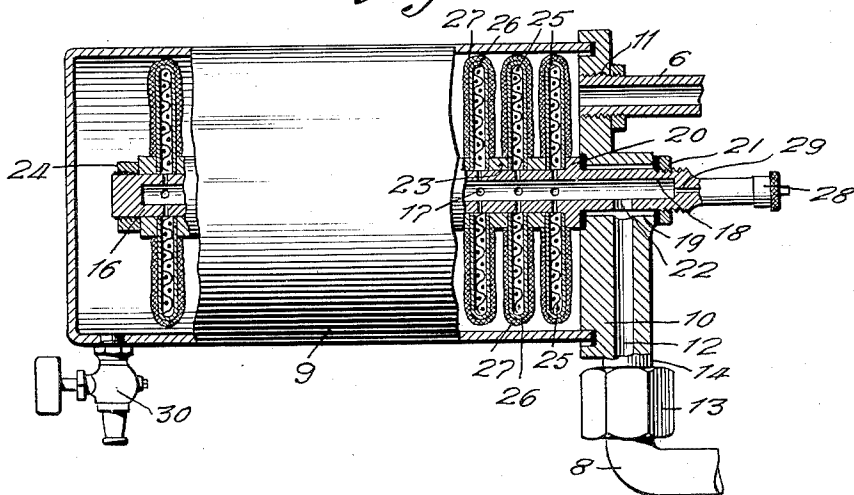


Fig. 3.

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MEANS FOR FILTERING OIL IN THE LUBRICATING SYSTEM OF AN INTERNAL-COMBUSTION ENGINE.

Original application filed April 30, 1926, Serial No. 105,891. Divided and this application filed July 26, 1926. Serial No. 124,805.

The invention relates to a filter for clarifying the oil in lubricating systems of internal combustion engines and is particularly adapted for use in connection with the internal combustion engines of motor vehicles such as automobiles, aeroplanes, motor-boats and the like. The invention has for its object to provide for the removal of all of the suspended deleterious matter from the oil with which the moving parts of the internal combustion engine are lubricated, whereby the oil supplied to such parts will be absolutely clean and free from any matter which would tend to cause erosion of the moving parts. The removal of all of the deleterious matter from the lubricating oil is of the utmost importance in order to insure the efficient operation of the engine as well as the long life of the moving parts thereof, as the presence of such matter in the oil, even through in small quantities, will cause the engine to operate in a less efficient manner, and will eventually result in causing wear of the moving parts, thus necessitating the repairing or replacing of the same.

According to the usual practice the lubricating oil is placed within the crank case of the engine and the lubrication of the engine during its operation is accomplished either by causing the lower end of the connecting rods to dip within the oil and splash it over the moving parts, or by withdrawing the oil from the crank case, by a pump or the like, and delivering it directly to the parts requiring lubrication. After the engine has been operated for a length of time, it will be found that the oil is no longer clear but contains certain deleterious matter which is suspended therein. This deleterious matter may comprise one or more of several substances which have become mixed with the oil during the operation of the engine. The principal substances which are to be found suspended in the oil after it has been operated for some time, are dust, metallic particles and carbon. The dust or dirt usually finds its way into the oil by being drawn into the cylinders along with the air which forms part of the explosive mixture. The presence of metallic particles in the oil is due to the wear of the moving parts, especially if they are not properly lubricated or are not in proper alignment with one another, as in such instances there will be a grinding or cutting

action between the parts which results in the separation of particles of the metal. The carbon which mingles with the oil is due primarily to imperfect combustion of the explosive mixture within the engine cylinders, or to the fact that the gasoline which is used is of a low grade or poor quality. Carbon also results from an inefficient ignition system, as for example when the spark plugs are fouled, and it also results from oil which has become decomposed by being subjected to a high degree of heat. The carbon thus formed not only affects the operation of the engine by reason of its fouling the spark plugs and valves, and forming a coating upon the cylinder walls and piston, but it also affects the operation of the engine by reason of the fact that, owing to the extreme fineness of the particles, it mixes with the oil with which the piston is lubricated and works its way out of the cylinders, between the walls thereof and the pistons, and thus is delivered, along with the oil draining from the cylinders into the body of oil contained within the crank case.

It will thus be seen that within a comparatively short space of time the lubricating oil within the crank case becomes charged with dust, dirt, metallic particles and carbon, to such an extent that it becomes unfit for use and must be removed from the crank case and replaced by clean oil. This necessitates frequent removal of the oil and is a very material factor in the expense of operating the engine. In order to avoid the necessity of renewing the oil it has heretofore been the practice to attempt to remove the deleterious matter from the crank case oil, before it is delivered to the parts requiring lubrication, by causing the oil to pass through a filter member consisting of wire screening. The use of wire screening as a filter member, however, does not fully accomplish the desired object for although it removes from the oil large particles of the dust, dirt and metallic particles suspended therein, it does not remove the smaller particles nor does it remove any of the carbon particles as the latter are so fine that they pass readily through the meshes of wire screening, even though screening of the finest mesh be used for the filter member.

In accordance with my invention, the crank case oil is freed of all of the suspended dele-

terious matter contained therein including the fine particles of carbon, and consequently the oil may be used over and over again and need not be withdrawn from the crank case and replaced by clean oil as must be done in the systems now in use. Even after the engine has been operated for several months, the crank case oil will be found to be clear. It is merely necessary to add oil to the systems from time to time to compensate for the loss of oil due to evaporation, leakage or the like.

This application is a division of my application 105,891, filed April 30, 1926, which application was a continuation of my application Serial No. 393,807, filed June 3, 1920.

In the accompanying drawings, forming part of this specification:

Figure 1 is a side elevation of an internal combustion engine showing my filter installed thereon;

Figure 2 is a vertical longitudinal sectional view of the filter shown in Figure 1; and

Figure 3 is a fragmentary sectional view of a modified form of filter.

Referring to the drawings, 1 represents an internal combustion engine of any suitable type having a crank case 2, which contains the oil for lubricating the coacting moving parts of the engine, either by the "splash" system or by the forced feed system, as above set forth. Mounted upon the engine, or upon the vehicle frame, is a pump 3, of any approved type provided with an intake pipe 4, extending within the crank case 2 and having its open end positioned adjacent the bottom of the crank case, preferably within a depression 5 formed in the bottom wall thereof. The pump is provided with an outflow pipe 6 leading to a filter 7 from which the filtered oil is conducted to the crank case by a pipe 8. The pump 3 may be the usual oil circulating pump of the engine or it may be an added pump.

The filter 7 which may be of any suitable construction is shown for purposes of illustration as comprising a casing 9 provided with a removable cover 10 provided with a threaded opening 11 adapted to receive the threaded end of the pipe 6 and with a passage 12 adapted to communicate with the pipe 8 connected to the cover in any suitable manner, as by a coupling 13 screwed upon the end of the pipe 8 and upon a nipple 14 formed on the cover. The filter is preferably carried by the engine, being secured in position by means of straps 15, as shown in Figure 1. Positioned within the casing 9 and extending axially with respect thereto throughout substantially its length, is a tubular member 16 having a closed inner end and provided with perforations 17 in its wall communicating with the bore 18. The other end of the tubular member extends through

an opening 19 formed in the cover 10 and is provided with a shoulder 20 adapted to engage the inner wall of the cover. Adjacent its extreme outer end the tubular member is provided with a thread adapted to receive a nut 21 which engages the cover 10 and, together with the shoulder 20, serves to support the tubular member upon the cover. An opening 22 formed in the wall of the tubular member registers with the inner end of the passage 12 whereby the bore 18 of the tube is in communication with the pipe 8 which leads from the filter to the crank case.

Mounted upon the tubular member 16 are a plurality of annular filter elements spaced from one another by annular spacing members 23, preferably formed of felt or the like, the filter elements and spacing members being securely held in assembled position upon the tubular member by means of a nut 24 threaded upon the inner end thereof. As shown in Figure 2 each filter element consists of an annular member 25 formed of coarse wire netting, reticulated metal, or the like, enclosed by fine wire screening or filter fabric 26 whereby the filter elements are provided with chambers which communicate with the perforations 17 in the tubular member 16.

The exposed surface of the wire screening 26 of each of the filter elements are provided with a coating 27 shown of exaggerated thickness in Figure 2, having the property of preventing the passage therethrough of the fine particles of carbon and other foreign matter which may be suspended within the oil to be filtered, while permitting the clear filtered oil to pass therethrough. This coating consists of a slime bed formed of an insoluble substance and the impurities filtered out of the oil. The insoluble substance may be kieselguhr, fuller's earth, charcoal, carbonate of lime, asbestos in flake or fibre form, wood pulp, or any other suitable substance which will serve to combine with the suspended deleterious matter in the oil to form a slime bed.

The insoluble substance may be deposited upon the wire screening in any suitable way. For example, it may be mixed with a vehicle consisting of a liquid or viscous substance and the mixture applied to the screening whereby the insoluble substance will adhere thereto, or if desired, the substance, either by itself or mixed with a liquid or viscous substance, may be placed directly within the crank case or within the filter casing, and as the oil to be filtered is caused to circulate the insoluble substance will be carried thereby into engagement with the screening and deposited thereupon. Moreover the insoluble substance may be applied to the screening either before or after its being formed into filter elements. The insoluble substance, when deposited upon the screening, serves to collect the finely divided suspended parti-

cles from the oil to form therewith a slime bed which effectually prevents the passage of any suspended impurities but permits the passage of the clear filtered oil.

5 As shown in Figure 2, a valve 28 of the type used in connection with automobile tires and the like is mounted upon the outer end of the tubular member 16 and communicates with the bore 18 by means of a passage 29. Upon
10 connecting this valve with a suitable air pump, such as the air pump usually carried by motor vehicles, air may be blown into the bore 18 of the tubular member 16 and through the several filter elements, in the reverse direction from the flow of oil through the filter,
15 and this air will tend to remove the slime bed from the filter elements when cleaning of the same is necessary or desirable. The air thus forced into the filter casing escapes through
20 a suitable normally closed petcock 30 communicating with the interior of the filter casing.

During the operation of the engine, the pump 3 will withdraw oil from the crank case
25 2 through the pipe 4 and force it through the pipe 6 into the casing 9 of the filter 7, and into engagement with the several filter elements mounted upon the tubular member 16. The deleterious matter which may be
30 suspended in the oil, including the extremely fine carbon particles, cannot pass through the slime bed 27 and will therefore be extracted from the oil, and the clear oil, free from all impurities, will be
35 forced through the slime bed 27 and wire screening 26 into the chambers within the filter elements, from which it passes through the perforations 17 in the tubular member 16 into the bore 18 thereof. From
40 the bore 18 the clear oil flows through the opening 22 and passage 12 into the pipe 8 which conducts it back to the crank case 2.

Referring to Figure 3, there is shown a filter, the filter elements of which differ
45 slightly in construction from the ones shown in Figure 2. In the modified form each filter element consists of an annular member 31 formed of wire netting reticulated metal or the like enclosed by a close-woven cloth fabric
50 32 such as duck, canvas, chain-cloth or the like, having an extremely fine mesh which will serve to collect the finest particles suspended in the oil to be filtered. In use, at the commencement of the filtering operation a portion
55 of the fine suspended particles will pass through the fabric 32, but within a short time the impurities collected thereon will serve to prevent the passage therethrough of any of the fine particles with the result that only
60 the clear oil freed from all suspended matter will pass through the fabric.

It is of course understood that a coating or slime bed, as above described, may be formed in any suitable manner upon the non-metallic fabric 32 if desired, although I have

found that such fabric without the coating will operate in a satisfactory manner. The fabric may be provided with strands of wire to increase its strength if desired.

While I have described my filtrate as being
70 clear or free from visible solids, it will be understood that the primary purpose of the invention is to remove solid particles of a size which would cause a break in the oil film between the bearings or would cause
75 abrasion of the moving parts, and that solid particles of a microscopic size or of smaller size than the normal thickness of the oil film between the bearings may be permitted to remain in the oil without departing from the
80 purpose or spirit of my invention.

Although the passage of the filtered oil through the fabric of each filter element is retarded by the slime bed and the impurities which are collected thereby, the required flow
85 of filtered oil through the filter is obtained by reason of the extensive filtering surface which is provided with the combined filtering surfaces of the several filter elements 25 or 31 and as the oil is under pressure this is
90 also true of the filter construction shown in Figure 3.

Filters for filtering used crank case oil and removing the fine carbon sediment, dust and the like have been known heretofore, in which,
95 however, the size of the filter necessary to filter the engine oil with sufficient rapidity to keep it clear, was much too large to be carried as an accessory on an automobile. Filters have also been known which were
100 designed to be carried on the automobile engine, but in which the effective filtering area if of sufficiently fine mesh to accomplish filtration, was much too small to filter the
105 crank case oil at a sufficiently rapid rate to effect any substantial clarification of the oil, and where in these latter filters, screens or coarse mesh material is used through which the oil may flow without retardation, no useful result is accomplished. It will be readily
110 apparent that a filter of the hitherto known type if able to filter the contents of a normal crank case once every hour of engine operation must be as large or larger than the automobile engine itself and if the filter were
115 made of sufficiently small size to be carried on the engine, it could filter only a few ounces of oil per day and would be ineffective for my purpose. The two types of filters heretofore known are equally ineffective, the former
120 because of its prohibitive size and the latter because the filtration of a few ounces of the oil in the crank case will never clarify the entire contents or remove the impurities as rapidly as they are added by the operation
125 of the engine.

My invention which provides a large filtering area, large enough to filter the entire contents of the crank case once in every hour of engine operation, or more often and remove
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the impurities at a more rapid rate than they are formed, and yet enclosed in a casing of sufficiently small size to be carried on the engine provides a novel solution to both these problems and the adapting of the size of the casing to the size of the engine and the filter area to both the permissible size of the casing and the contents of the crank case, and the pump pressure so as to provide a definite rate of filtration as compared to the engine operation is a new idea in regard to filters, and the provision of means, such as the tire valve 28, whereby the solids can be periodically removed from the filter elements by the use of the the air hose or pump which every service station and automobile provides, extends the effective life of the filter.

It is of course understood that I do not limit my invention to the specific embodiment shown, but that I intend to cover the same broadly within the scope of the appended claims in whatever form its principle may be employed.

What I claim as my invention is:

1. A pressure filter for use in the lubricating system of an automotive internal combustion engine, comprising a casing capable of being received and supported beneath the hood of the engine, a filter element therein designed to repeatedly filter the predetermined normal oil content of the system within a given time and to remove the deleterious solids from said oil, and means to dislodge the solid particles accumulated on said filter surface without opening the filter casing comprising an air pressure valve connected to the filtrate outlet tube and adapted for connection with a tire valve connection.

2. A pressure filter for use in the lubricating system of an automotive internal combustion engine, comprising a casing capable of being received and supported beneath the hood of the engine, a filter element therein designed to repeatedly filter the normal predetermined oil content of the system within a

given time, said filter element being of sufficient density to remove the deleterious solids from the oil passing therethrough, an inlet to said casing, a drainage member extending through said filter element and through the wall of said casing for conducting the filtered oil therefrom, a tire valve communicating with the drainage member outside of said casing, means in said tire valve to permit the flow of air in reverse direction through said drainage tube and filter surface, and to prevent the escape of oil from said drainage member through said tire valve.

3. A pressure filter for use in the lubricating system of an automotive engine, comprising a pressure tight casing capable of being received and supported beneath the hood of the vehicle, an inlet into said casing, an outlet from said casing, a drainage tube extending into said casing and communicating with said outlet, a plurality of disk shaped filter elements on said drainage tube, compression means for holding said elements on said tube, a tire valve nipple communicating with the interior of said drainage tube and means for opening said casing to the atmosphere when air is blown thru said drainage tube.

4. A pressure filter for use in the lubricating system of an automotive engine, comprising a pressure tight casing capable of being received and supported beneath the hood of the vehicle, an inlet into said casing, an outlet from said casing, a drainage tube extending into said casing and communicating with said outlet, filter elements on said drainage tube including a plurality of felt disks, compression means for holding said filter elements on said tube, a tire air valve communicating with the interior of said drainage tube and means for opening said casing to the atmosphere when air is blown through said drainage tube.

In testimony whereof I have affixed my signature to this specification.

ERNEST J. SWEETLAND.