March 12, 1940. H. G. EISLER 2,193,480

OIL FILTER

Filed June 30, 1937

Fig. 1.

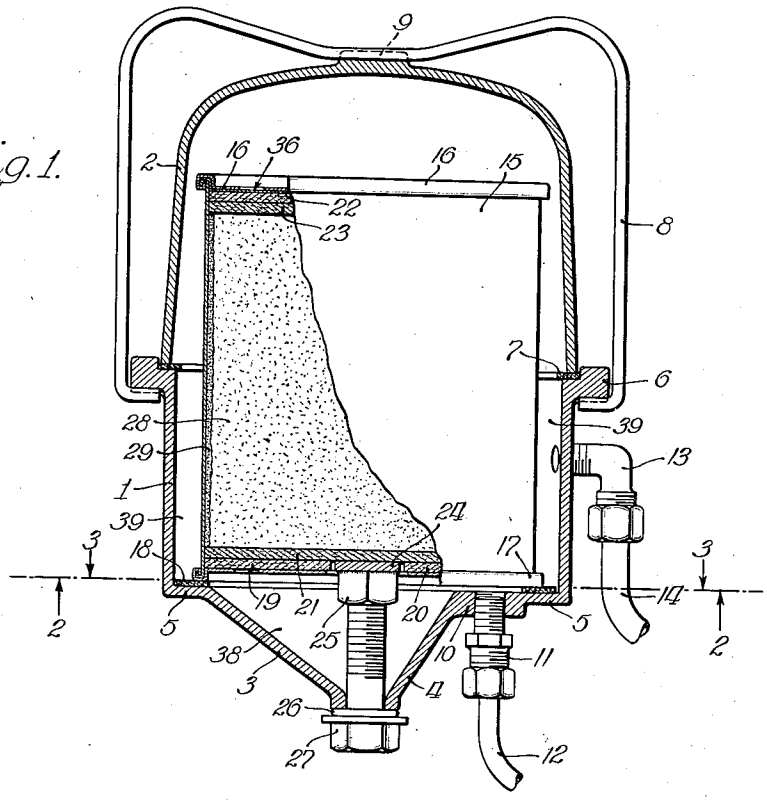


Fig. 2.

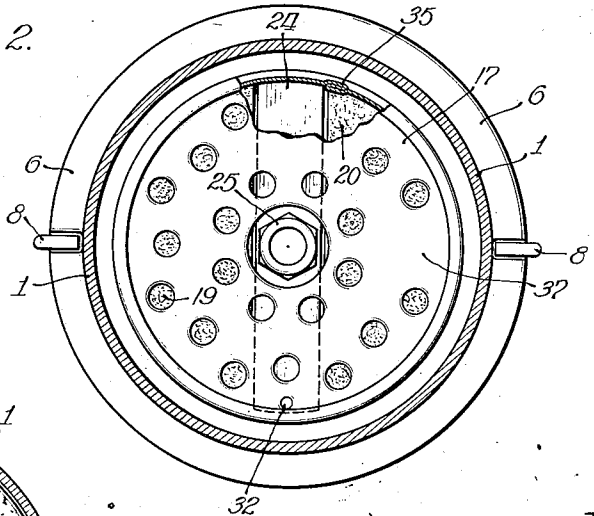
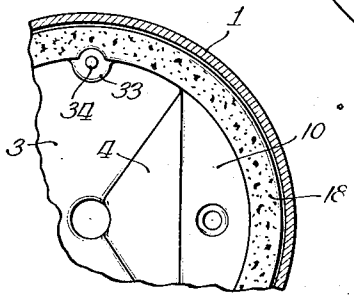


Fig. 3.



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2,193,480

OIL FILTER

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9 Claims. (Cl. 210—131)

The present invention relates in general to oil filters, and more in particular to oil filters for use in connection with internal combustion engines, especially the engines or motors of trucks and automobiles. The object of the invention is to provide a more convenient, efficient, and economical device of this character than has been known heretofore.

The various features of the invention and its advantages will be pointed out in detail in the course of the following description, in which reference is made to the accompanying drawing.

In the drawing,

Fig. 1 is a vertical section through the complete device, except that the removable filter can is shown only partly in section;

Fig. 2 is a horizontal section on the line 2—2, Fig. 1; and

Fig. 3 is a partial horizontal section on the same line as Fig. 2, but looking in the opposite direction.

Referring to the drawing, the reference character 1 indicates a cylindrical casing or housing, which is provided with a cup or dome-shaped cover 2. These parts may be of cast-iron, or they may be drawn from sheet metal. As shown, the housing 1 has a heavy rim 6 around the top, in which there is formed an internal annular channel to receive the gasket 7. The cover 2 rests on the gasket 7 and is held in place by a stiff bail-like spring 8. The ends of the latter are positioned in grooves in the rim 6, while the central top portion normally rests in a groove in the projection 9 on the top of the cover. This projection has rounded or sloping sides so that the spring member 8 can be readily forced into the groove and disengaged therefrom.

The bottom of the housing comprises an annular shelf or ledge 5, a wall portion 3 shaped like part of an inverted cone, and a flat sloping wall portion 4. The shape of the bottom will be understood clearly from Figs. 1 and 3. It will be seen that the modification of the cone-shaped bottom wall 3 by the flat portion 4 has the effect of widening the annular shelf 5 on one side to form an extension 10, which is provided with a threaded opening for a coupling 11 by means of which the inlet pipe 12 is connected. There is also an opening in the wall of the housing 1 in which is threaded the coupling 13, for connecting the outlet pipe 14. As seen in Fig. 3, there is a ledge 33 projecting from the inner surface of the wall 3, in which there is fixed an upwardly-extending pin 34, having a pointed or rounded end. The purpose of this pin will be explained later on.

The filter can is indicated by the reference character 15, and will now be described. It may be similar to an ordinary tin can, but the top and bottom 16 and 17 are perforated. Fig. 2 shows the perforations in the bottom of the can. These perforations of course provide for the passage of oil through the can. Resting on the bottom of the can on the inside is a flat metal strip 24, to which there is spot welded the nut 25. The latter projects through a central opening in the bottom of the can. On opposite sides of the strip 24 are the semi-circular pieces of filter board 19 and 20, and just above the strip is a disk of filter board 21. The can may be filled with any desired filtering material, but I prefer to use a mixture of ground bone and fuller's earth, indicated at 28. This mixture is granular. Above the filtering mixture and underneath the top 16 are two disks 22 and 23 of filter board. The disks of filter board above and below perform a filtering function and are also effective to retain the rather fine granular filtering mixture. Filter board of known character may be used, such as board made from many layers of crepe paper. As an additional means of preventing escape of the filtering material there may be a disk 36 of paper or fine wire gauge inserted between the upper filter board disk 22 and the top 16, as will be explained subsequently.

The filter can or cartridge may be further described by explaining the method of assembly of the complete cans, which of course are received from the manufacturer with the tops unattached. In assembling a complete can, the inside is first given a coating of shellac, and then the pieces of filter board 19 and 20 and the metal strip 24 are placed on the bottom and are covered by the disk 21. The strip 24 must be so positioned that the small opening 32, Fig. 2, coincides with a similar opening in the strip and to this end a template is preferably provided, having a circular recess the size of the can, a central depression large enough to receive the nut 25, and a short stud or pin which enters the opening 32. This template may be a part of the machine by means of which the top is attached. In practice the empty can may be placed in position on the template with the pin above referred to entering the opening 32. The strip 24 is now placed in position so that the said pin enters the opening near one end of the strip, with the other end of the strip adjacent the side seam 35, as shown in Fig. 2. The bottom of the can may be attached in manufacture through the aid of positioning means which insures the desired positional relation between the opening 32 in the bottom and the seam 35 of the can, or the openings may be punched

after the bottom is attached. The pieces of filter board 19 and 20 are now placed in position one on each side of the strip 24, and the disk 21 is then pressed into place. These pieces of filter board should fit tightly into the bottom of the can.

A quantity of the filtering mixture is now placed in the can, and the latter is shaken or rolled so as the give part of the mixture an opportunity of adhering to the inside of the can due to the coating of shellac that has been applied. The can may be removed from the template for this purpose, and the tight fitting disk 21 of filter board will keep the strip 24 in place. The adherent layer of filtering material is indicated at 29. The can is then replaced and filled with the filtering mixture, after which the filter board disks 22 and 23 are pressed into place. The cover 16 may now be placed in position and is secured by the machine, which rolls the edge of the top and the flared upper edge of the can together in the well known manner.

These can tops are usually provided with an annular gasket of paper or other material which is rolled into the joint to make it tight. I prefer, however, to use a complete disk which may be of paper or very fine metal gauze, as indicated at 36, and which completely covers the inside of the top and has its edges secured by being rolled into the joint. This is an extra precaution to prevent any possibility of fine grains of filtering mixture escaping along with the filtered oil. The filter board disks 22 and 23 fit tightly in the can and their edges are held by the shellac which ordinarily effectively seals the can. However, the operation of making the rolled joint which attaches the top requires considerable force and may distort the shape of the can enough to break the seal between the side of the can and the edge of the disks 22 and 23 at some point, and it is conceivable that a very fine crack might result which would permit small particles of filtering material to work out. I prefer, therefore, to insert the additional disk 36, as stated, although in most cases it will be unnecessary.

The manner in which the filter can is assembled in the housing will now be described. The cover 2, it may be assumed, has not yet been placed in position. The gasket 18 is first placed in the open housing, resting on the ledge 5, and the filter can is then inserted centrally in the housing. The can is then rotated if necessary until the pin 34, Fig. 3, enters the opening 32, Fig. 2, whereupon the can will rest evenly on the gasket 18. Pin 34 should be long enough to extend through the strip 24, but should not perforate the disk 21. This pin, it will be seen, is a positioning pin and serves to insure such location of the can within the housing that the area 37 on the bottom of the can comes directly above the opening for the inlet pipe 12. This prevents any possibility of perforating the filter boards 19 or 20 and 21 by the pressure of the inflowing oil, as would be liable to occur if one of the large openings in the bottom should happen to come over the inlet opening, which would often be the case if the can were located at random.

The filter can having been placed in position, the bolt 27 is inserted through the opening in the bottom of the housing and screwed into the nut 25. The bolt is then turned in tight, which draws the filter can down against the gasket 18, making an oil tight connection at this point. The can is prevented from turning by the long line of contact at the gasket 18, and strip 24 is prevented from turning in the can by the pin 34 at one end and the seam 35 at the other. There is a gasket 26 under the head of the bolt 27, so as to seal the bottom of the housing. The gasket 7 may now be placed in position, also the cover 2, and the latter is secured in place by the spring 8, as previously explained. The filter is now complete and ready for use.

The filter is installed in any suitable manner adjacent the motor with which it is to function. For instance, it may be located on the partition just in rear of the motor and underneath the hood, where it is secured in place by a U bolt. A small block of wood may be provided to space the filter away from the partition somewhat. This block should have a flat surface on the side next the partition and a semi-circular opening to receive the cylindrical housing 1 of the filter. After the block and filter are in position the U bolt is passed through holes in the block and partition which have been previously bored for this purpose, and the nuts are put on and tightened up. The U bolt is preferably located just beneath the rim 6 and above the coupling 13. The filter is thus held firmly in position.

The pipe 12 leads to the oil pressure line, to which it is connected at any suitable point. It will be generally most convenient to connect to the branch line which extends to the pressure gauge on the dash or instrument panel. The pipe 14 extends to the crank-case.

The operation of the filter may now be explained. When the motor is started up, the oil pump develops pressure in the lubricating system and oil will flow through the inlet pipe 12 into the bottom of the housing 1. The oil strikes the bottom of the filter can at the unperforated area 37 and is diverted into the sludge sump 38, which is soon filled up. This sludge sump is the space surrounding the bolt 27 between the bottom of the housing and the bottom of the filter can. As soon as the sludge sump becomes filled, pressure is developed which forces oil into the filter can through the perforated bottom 17 and through the filter boards 19, 20, and 21. The oil next passes through the filtering mixture 28, and out of the can through the filter boards 22 and 23 and the perforated top 16, whereupon it flows down the sides of the can and collects in the annular space or reservoir 39. When the reservoir 39 becomes full up to the level of the opening for the outlet pipe 14, it begins to drain off into the crank-case. The outlet pipe should be large enough to readily take care of all the oil that can pass through the filter, so that the oil level outside the can will not rise above the outlet opening.

When the filter can is new it will pass a considerable quantity of oil, in the neighborhood of one quart or more per minute. This rate of course decreases as the filtering material becomes clogged with dirt and other impurities that are extracted in the operation of the filter. The coarser particles of dirt, metal from the bearings, carbon, etc., are stopped at the bottom of the filter can by the filter boards and collect in the sump 38. Finer particles are stopped by the filtering mixture 28 in the interior of the can, which is also effective to remove other impurities such as the fatty acids which are gradually formed by decomposition of the oil.

The filtering action will be readily understood, in general, but it will be desirable to point out certain advantageous features of applicant's construction which enhance its effectiveness as com-

pared with known filters. The arrangement of housing and filter can whereby the sludge sump is formed between the bottom of the can and the conical bottom of the housing is of primary importance in facilitating the deposit of the larger impurities. The oil is delivered through the inlet 12 at considerable velocity but is deflected by the bottom of the can and flows off with greatly diminished velocity in a fan-shaped stream directly across the sump, being again diverted upward through the cam at a plurality of points distributed over the entire area of the can. This arrangement gives the maximum opportunity for deposit of the heavier impurities. Finer particles which are stopped by the filter board have a certain tendency to adhere to the filter board and clog it up, but this tendency is much reduced by the fact that the filter board is horizontal and the particles are stopped by the under surface where they have much less chance of remaining than they do on the vertical surfaces of other filters. Further aid in preventing clogging is afforded by the action of the oil flowing across the bottom of the can and by the shaking which occurs on the road, which tend to dislodge particles temporarily adherent to the filter board.

It should be noted at this point that the area presented by the bottom of the can for the intake of oil is not limited to the area of the perforations therein, but is substantially the entire area of the bottom of the can, from which of course must be subtracted the area blocked off by the strip 24. This is because the tightening of the bolt 27 draws the bottom of the can down slightly, causing it to separate from the filter boards 19 and 20 enough so that the oil, after passing through the large holes in the bottom 17, has access to the whole under surface of the filter board. The amount of separation is usually very small and is not indicated in Fig. 1, but it is sufficient for the purpose. At the top of the can there is no such effect, but it is not needed, as the oil has been cleared of most of its impurities when it reaches this point, and there is no tendency for the filter boards 22 and 23 to clog up.

The upward flow of oil through the filtering mixture in the interior of the can is uniform, because the cross section of the material is the same from the bottom to the top. This tends to prevent channeling, which is apt to start at any point of restricted cross section where the velocity of flow is necessarily increased. Channeling along the sides of the can is prevented by the expedient already referred to, which consists in forming an adherent coating of the filtering mixture on the inside of the can. This coating has a rough irregular outline blending with the adjacent material packed into the can and entirely eliminates the natural tendency of the oil to follow up along the side of the can and form channels by-passing the filtering mixture.

After the oil passes out of the top of the filter can it flows down over the sides of the can, as previously explained, to the reservoir 39, where foreign particles such as might accidentally be on the outside of the can when installed have a chance to settle.

Filter cans as described herein are comparatively inexpensive, and it is contemplated that they should be replaced at rather frequent intervals. In the case of trucks which are serviced in accordance with a regular schedule the filter can may be replaced as a matter of routine at every servicing of the motor. This may be every thousand miles, for example. Where a regular service schedule is not observed, as would be the case with most private passenger cars, the filter may be readily inspected by the service station attendant at times when the oil is checked to ascertain if any should be added. This is an important feature of the invention, not found in other filters, so far as known.

In order to inspect the filter and its operation the attendant merely has to detach the spring 8 and remove the cover 2. This is done while the motor is running, and exposes the whole upper portion of the filter can so that the flow of oil out of the top of the can and over the sides thereof into the reservoir 39 can be directly observed. If the oil is passing through at a good rate, and appears to be clean, the attendant will know that the filter is all right and will replace the cover. On the other hand, if the flow of oil is scant or entirely stopped, or if the oil appears dirty even though coming through at a good rate, the attendant will be advised that the filter can has become defective. An insufficient flow or stoppage will of course be due to clogging of the filter which is bound to occur in time, while failure to clean the oil, which may occasionally happen, may be due to any unforeseen or accidental defect. In any event, if the filter can is not functioning properly the fact is at once evident.

In order to change the filter can the attendant places some convenient receptacle under the filter, the motor having been stopped, and then unscrews the bolt 27. When the bolt is removed the oil in the sump 38 runs out. The filter can may now be removed, which allows the oil in the reservoir 39 to run out also. The draining of the sump and reservoir will wash out most of the sludge and various impurities that have collected in the sump and any remaining may be readily wiped out with a rag or ball of waste. The oil lost in thus draining the filter is very small due to the design of the sump and reservoir, which hold a minimum quantity of oil. A new filter can is now inserted and is secured in place with the bolt 27, as previously explained, after which the cover is replaced and the change is complete. The time occupied is inconsiderable, being scarcely more than is required for checking and replenishing the oil.

The foregoing explanation of the manner of changing a filter can will make evident an important feature of the filter, which consists in the fact that every time the attendant changes the filter can he is practically forced to clean out the sump also. Indeed, this is to a large extent accomplished automatically by the drainage of the sump and reservoir. The enforced emptying of the sump is due to the fact that the bolt which holds the filter can in place also serves to close the sump and thus the sump is opened and emptied every time the bolt is removed in changing the filter can. This is a decided advantage over other filters having separate drainage cocks or plugs, as the drainage and cleaning of such filters is difficult and is often neglected.

While I have described in detail a certain specific embodiment of my invention, it will be understood that this has been done merely to facilitate the explanation, and that the invention is not limited to the exact construction shown and described. Modifications may be made to suit varying conditions, or for other reasons. I do not therefore wish to be restricted to the precise form and construction which has been illustrated and described, but desire to include and

have protected by Letters Patent all forms and modifications thereof that come within the scope of the appended claims.

I claim:

1. In an oil filter, a cylindrical housing having an opening at the top and an internal annular shoulder, a filter can partly enclosed in said housing and having its lower rim resting on said shoulder, means for sealing the joint at said rim, including an element extending up through the bottom of said housing for drawing said rim against said shoulder, means for introducing oil into said housing beneath said can, the oil being under pressure and the can having perforations in the bottom and top to permit the oil to be forced through it lengthwise, filtering material in the can, an annular reservoir surrounding said can for receiving the oil from the top of the can, and means for continuously draining said reservoir at a point above the bottom thereof.

2. In an oil filter, a housing having an opening at the top and a depressed portion at the bottom to form a sump, a filter can having its lower rim resting on a portion of the bottom of the housing surrounding said sump, said can projecting above the housing and cooperating with the wall of the housing to form a reservoir surrounding the lower portion of the can, means for introducing oil under pressure into said housing beneath the can, filling said sump, and means effective while the housing is open for sealing the sump from the reservoir at the point where the lower rim of the can engages the bottom of the housing, whereby oil is forced lengthwise through the can from bottom to top and overflows into said reservoir, said last means including an element extending through the bottom of the housing for compressing the low rim of the can against the housing.

3. In an oil filter, a housing having a sump at the bottom thereof, said sump having a drainage opening, an annular ledge surrounding said sump, a filter can disposed in said housing with its lower rim resting on said ledge, a gasket inserted between said rim and ledge, means passing through said drainage opening and effective to close the same, and means cooperating with said closing means to compress the rim of said can against said gasket.

4. In an oil filter, a housing having a depressed portion at the bottom forming a sump, there being a drainage opening at the bottom of said sump, a filter can having a nut secured to the bottom thereof, a ledge surrounding said sump on which the lower rim of the can is adapted to rest, and a bolt passing through said drainage opening and screwed into the said nut to clamp the can against said ledge and also functioning to close said drainage opening.

5. In an oil filter, a housing having a sump at the bottom thereof, said sump having a drainage opening, a filter can resting on the bottom of said housing above said sump, and means passing through said drainage opening for temporarily securing said can in position, said means also being effective to close said opening, whereby the removal of said means to permit substitution of a new can effects automatic draining of the sump.

6. In an oil filter, a housing having an offset oil inlet at the bottom thereof, a filter can adapted to be disposed in said housing with the bottom of the can adjacent said inlet, said can bottom being perforated except for a small area thereof removed from the center, and means for insuring correct angular adjustment of the can when it is inserted in the housing so that the unperforated area of the bottom will be positioned directly above said inlet.

7. A filter can comprising a cylindrical body having a side seam and perforated top and bottom members, and securing means having a threaded opening and including a member extending across the bottom of said can on the inside, said member having an edge portion abutting against said seam, whereby the said seam tends to prevent said means from turning in the can when a threaded member adapted to cooperate therewith to hold the can in the filter in which it is to be used is screwed into said threaded opening.

8. A filter can comprising a cylindrical body and perforated top and bottom members, filtering material in said can, a metal strip extending across the bottom of said can on the inside, and a nut welded to said strip and projecting through an opening in the bottom.

9. In an oil filter, a housing, a container disposed in said housing, a cover for said housing, filtering material in said container, a sump comprising the space in the housing beneath the container, a reservoir comprising the space in the housing surrounding the container, sealing means independent of said cover for preventing the direct passage of oil from said sump to said reservoir, said means including a gasket inserted between the lower rim of said container and an annular ledge surrounding said sump, together with an element extending from outside the housing through said sump into threaded engagement with the bottom of the container, means for introducing oil under pressure into said sump, whereby said oil is forced through said container and filtering material into said reservoir, and means for draining the oil from said reservoir to prevent its rise above a predetermined level, whereby said cover may be removed to observe the operation of the filter without escape of oil.

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