

[54] LUBRICATING OIL FILTERING DEVICE

[76] Inventor: **Masazi Hayashi**, No. 23-9, 1-chome,
Nishi-shinbashi, Minato-ku, Tokyo,
Japan

[22] Filed: **Aug. 9, 1973**

[21] Appl. No.: **386,993**

[52] U.S. Cl. **210/223; 210/444**

[51] Int. Cl. **B01d 35/06**

[58] Field of Search 210/222, 223, 443, 444;
209/221

[56] References Cited

UNITED STATES PATENTS

2,358,612	9/1944	Acker	210/222
2,980,257	4/1961	Paton	210/223
3,186,549	6/1965	Botstiber	210/222 X
3,325,009	6/1967	Botstiber et al.	210/223 X
3,342,339	9/1967	Riolo	210/223

3,371,790	3/1968	Kudlatly et al.	210/223
3,421,627	1/1969	Lammers	210/223 X
3,468,420	9/1969	Rosaen	210/223 X
3,727,761	4/1973	Aspinwall et al.	210/223

Primary Examiner—Theodore A. Granger

Attorney, Agent, or Firm—Steinberg & Blake

[57]

ABSTRACT

A lubricating oil filtering device comprising a magnetic filter having a magnet in a tank equipped with an inlet port and an outlet port, an inner chamber for storing secondary oil, a series of polycurved surface filters to cover the periphery of the inner chamber, the tank supplying the primary oil to the outer surface of the filter alone, a magnet block which establishes a magnetic gap to choke the top of the inner chamber, and a secondary oil outlet port in the magnetic block to obtain a tertiary oil.

3 Claims, 4 Drawing Figures

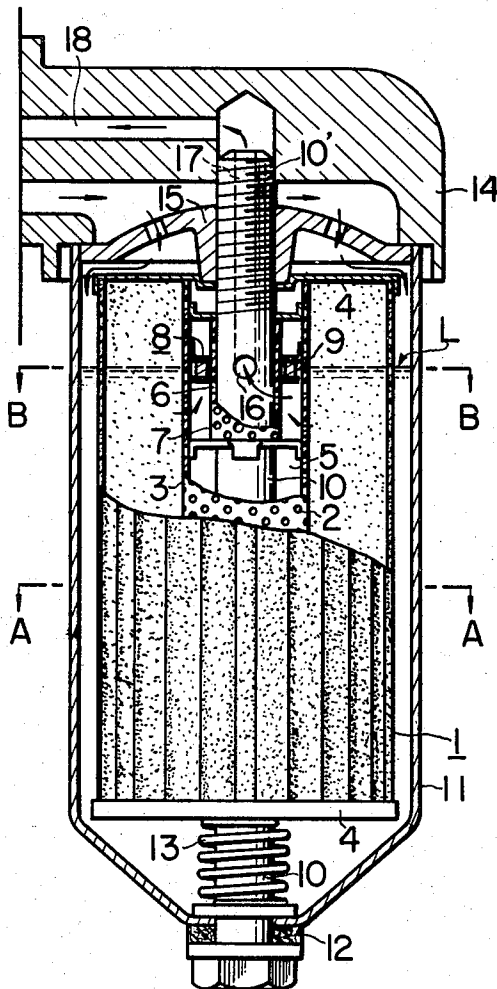


FIG. 1

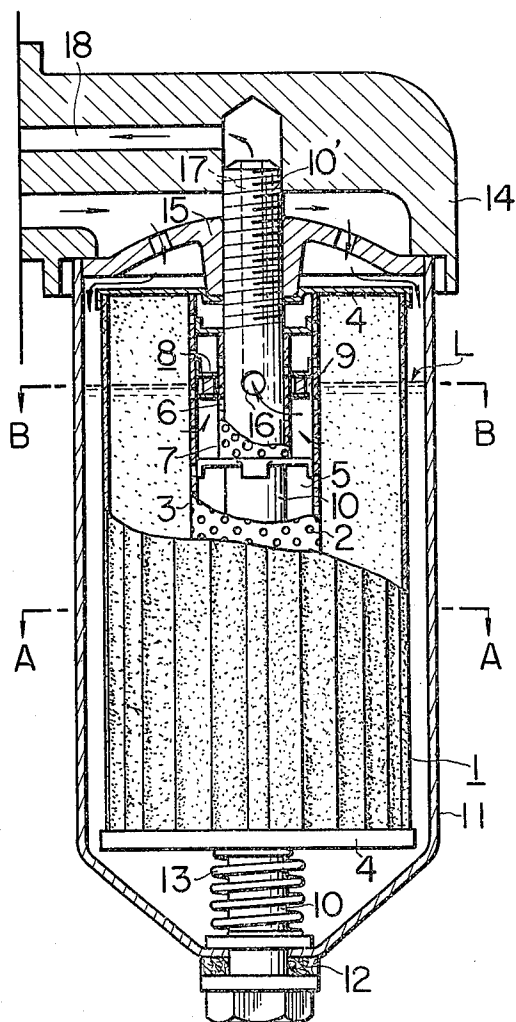


FIG. 2

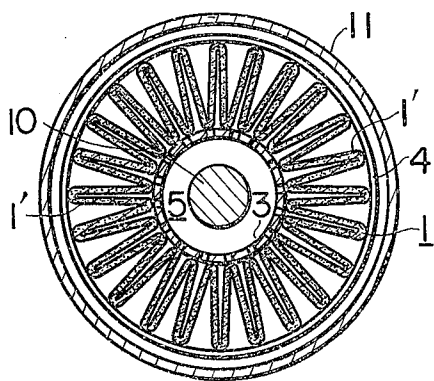


FIG. 3

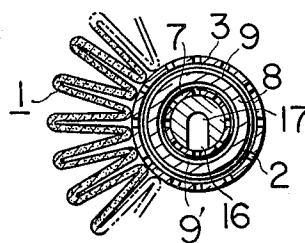
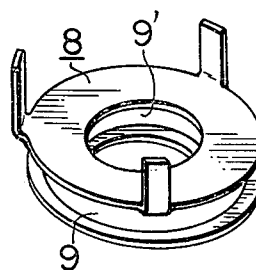


FIG. 4



LUBRICATING OIL FILTERING DEVICE

SUMMARY OF THE INVENTION

This invention relates to a lubricating oil filtering device, and the main object is to heighten the filtering efficiency and to double the lubricating oil efficiency and the machine life.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view showing in cross section the lubricating oil filtering device of this invention,

FIG. 2 is a cross sectional plan view taken along line A—A in FIG. 1,

FIG. 3 is taken along sectional plan view important portion across the line B—B in FIG. 1, and

FIG. 4 is a perspective view of the magnet block parts.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Lubricating oil, by its own nature, has the object of reducing the wear in shafts and other rotating portions. Portions which are usually rotated inevitably undergo wearing on the rotating portions, and the worn fine metallic particles are mixed into the lubricating oil, deteriorating the efficiency of the lubricating oil, and requiring early exchange of the lubricating oil. For the purpose of filtering the lubricating oils, earlier magnetic filters had a magnet in the tank which is equipped with an inlet port and an outlet port. But with such devices in which a magnet is simply made present between the inlet port and the outlet port, impurities in the lubricating oil were not removed effectively.

According to this invention, metallic powder, dust, and all other impurities contained in the lubricating oil stored in the engine crank casing, etc. can be removed more completely, to increase the filtering efficiency. The lubricating oil filtering device of this invention is described below by referring to an embodiment shown in the drawings.

The filter 1 is formed in a series of continuous zig-zag polycurved fanfolded surfaces extending radially outward from and along the periphery of the inner cylinder 3 which is punched with many openings 2. On the top and bottom of the filter there are crowned covers 4,4. Hence the lubricating oil flowing into the inner chamber 5 is a secondary oil turned through filtration from the primary oil which has infiltrated through the zig-zag slit surface of the radially arranged filter 1.

A second cylinder 7 punched with many openings 6 is provided concentrically within the inner cylinder 3, and between the inner cylinder 3 and the second cylinder 7 is inserted one or more magnet blocks 8. Said magnet block 8 consists of angular-ringlike magnets and thin iron plates having a diameter nearly equal to the inner diameter of the cylinder 3. The iron plates are well-adhered to the upper and lower surfaces of the ring-like magnets. The said thin iron plates define gaps 9,9' at their inner and outer peripheries and are weld-adhered onto the inner surface of the wall of the inner cylinder 3 by means of several support pieces extending upward around the periphery of the upper thin iron plate. By making the inner cylinder 3 of an iron, the inner cylinder 3 itself will be magnetized, and removal of fine iron powder in the lubricating oil can be increased. The magnet block 8 is shut off at its top and bottom with thin iron plates; hence the magnetic force converges in the radial direction, and fine powder of iron is adsorbed onto the gaps 9,9'. In the inner cylin-

der 3 is inserted a threaded rod 10 having a diameter permitting it to slide in the double cylinder 7 from the bottom of the tank 11 through the packing 12 and spring 13. The threaded rod 10 itself has a screw thread 10' on the top to be screwed into the boss 15 of the holder 14, so that the holder 14 and the tank 11 are set up as a single unit. In addition, the filter 1 is always pushed up to the level of boss 15 due to said spring 13.

Through the threaded rod 10 is formed a flow-out port 16 in a radial direction along a diameter of the rod 10 and at a position facing the center of the second cylinder 7. The flow-out port 16 is in fluid communication with a flow-out hole 17 which has been formed in the axial direction of. The threaded rod 10; the secondary oil flowing into the inner chamber 5 is filtrated through the gaps 9,9' of the magnet block and many openings 6 in the second cylinder 7 to turn into tertiary oil, and then flows out to the flow-out port 18 of the holder 14, and thus circulated into the engine. L in the drawing represents a lubricating oil level in the tank 11.

Being constructed as mentioned above, according to the lubricating oil filtering device of this invention, the primary oil containing impurities, i.e., the used oil in the engine, is first filtered through the filter 1, and the remaining impurities are precipitated down the tank 11. The filtrated secondary oil is first stored in the inner chamber 5, and as the level L reaches the flow-out port 16 via said magnet block 8, the oil will flow out through the flow-out port 16. But the oil does not flow out in the state of secondary oil. That is, the secondary oil stored in the inner chamber 5 promotes not only the precipitation of very fine metallic particles which have penetrated through the filter 1, but also at the step of reducing the secondary oil, there have been positively set up a number of magnetic gaps at the top of the inner chamber facing the flow-out port 16, so that the secondary oil in the inner chamber 5 necessarily flows through the magnetic gap. Consequently, fine iron particles which have passed through the filter 1 are adsorbed onto the magnet block 8, and the oil flowing out of the flow-out port 16 turns to a tertiary oil.

It will thus be seen that with the structure of the invention the outer casing 11 has at one end, namely its upper end as viewed in FIG. 1, an inlet for the oil which is to be filtered, this oil which enters through the inlet being first compelled to be filtered through the filter means 1 before reaching the annular space defined between the concentric perforated cylinders 3 and 7. Thus filter means 1 is situated in the path of flow of the oil entering through the inlet and traveling to the annular space between the cylinders 3 and 7. The axial bore 17 in the screw 10 forms an outlet means for the filtered oil, this outlet communicating at the radial bore portion 16 with the annular space between the cylinders 3 and 7 at a predetermined elevation along the axis of the concentric cylinders. At this latter predetermined elevation in the annular space between the cylinders 3 and 7 is situated the ring-shaped magnet means 8 which acts magnetically on particles in the oil flowing to the outlet 17. This magnet means 8 is made up of the intermediate ring and pair of end plates which engage the opposed ends of the intermediate ring and project beyond the inner and outer peripheries thereof to define the outer circumferential channel 9 and the inner circumferential channel 9' which are respectively directed toward the inner surface of the outer cylinder 3 and the outer surface of the inner cylinder 7, the upper

plate having the upwardly extending fingers shown in FIG. 4 by means of which contact is made directly with the cylinder 3 so that the magnet also acts through the latter.

The lubricating oil filtering device of this invention constructed as mentioned in the foregoing, has increased filtering efficiency as compared to the prior counterparts, and helps double the lubricating efficiency and machine life. Furthermore, since each element has been assembled only by means of a threaded rod to the holder, cleaning and replacement of individual parts are easy, providing many advantages.

I claim:

1. In an oil filter, an outer casing formed with an inlet through which oil to be filtered enters said casing, a pair of concentric perforated cylinders in said casing, said cylinders having different diameters and defining between themselves an elongated annular space, filter means situated in said casing in the path of flow of oil from said inlet through one of said cylinders to said annular space for filtering the oil prior to the time when the oil reaches said annular space, said cylinders and the common axis thereof being upright during use of the filter, and outlet means for discharging oil from said casing, said outlet means communicating through the other of said perforated cylinders with said annular space at a predetermined elevation along the common axis of said cylinders, and ring-shaped magnet means situated in said annular space at said predetermined elevation therein for acting magnetically on particles in oil flowing to said outlet means through the other of said cylinders, whereby particles remaining in the oil in said annular space flowing toward said outlet means

which respond to magnetism will be retained by said magnet means before reaching said outlet means, said cylinders including inner and outer cylinders respectively having outer and inner surfaces between which said annular space is defined, said filter means surrounding said outer cylinder and said outlet means communicating with the interior of said inner cylinder, said ring-shaped magnet means including an intermediate magnetic ring and a pair of magnetic end plates respectively engaging upper and lower end surfaces of said ring and projecting radially beyond the inner and outer peripheries of said ring to define a pair of circumferential channels respectively directed toward the inner and outer surfaces of said outer and inner cylinders.

2. The combination of claim 1 and wherein one of said plates directly engages said outer cylinder and said outer cylinder being made of a magnetic material.

3. The combination of claim 2 and wherein a mounting means is provided for mounting the components of the filter in operative relation with respect to each other, said mounting means including a bolt extending through said inner cylinder and a carrier member formed with a discharge passage, said bolt being threaded to said carrier member and being formed with an axial bore communicating with said passage and forming part of said outlet means, said outlet means including a radial bore formed in said bolt and extending from said axial bore thereof at said predetermined elevation to receive oil from said annular space through said inner perforated cylinder at the elevation of said magnet means.

* * * * *

35

40

45

50

55

60

65