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CENTRIFUGAL OIL CLEANER, INCLUDING A CYLINDRICAL FILTER

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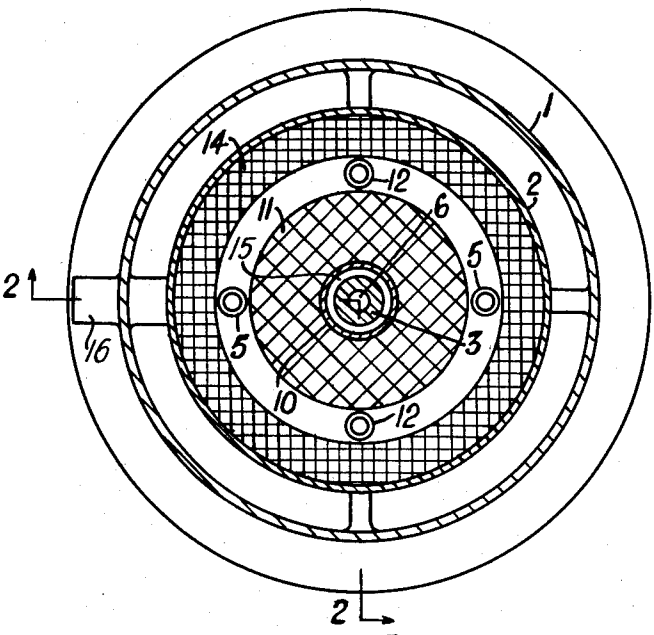


FIG. 1.

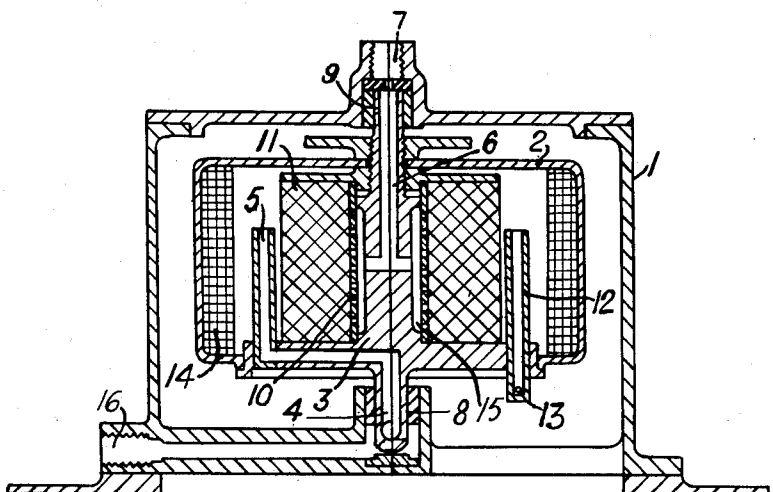


FIG. 2.

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1

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CENTRIFUGAL OIL CLEANER, INCLUDING A CYLINDRICAL FILTER

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4 Claims. (Cl. 233—2)

This invention relates to centrifugal oil cleaners.

In the interest of brevity we shall hereafter assume that the liquid to be cleaned is fuel oil as used in compression ignition engines, but essentially the system is equally applicable to the cleaning of lubrication oil or other liquids.

Experience has shown that the most effective cleaner for fuel oil is a centrifuge including a drum driven mechanically or electrically, or by jet reaction as described in the specification of the prior application Serial No. 181,178 filed August 24, 1950, now Patent No. 2,650,022, granted August 25, 1953.

Normally the installation of a centrifuge as part of the engine fuel feed system is complicated in that manual or automatic starting is required to allow the centrifuge to reach its operating speed before the fuel supply is started. Otherwise, the initial flow of fuel will be unfiltered, and there is also a great danger that any loose dirt in the centrifuge drum may be carried over and cause severe wear to the engine injection equipment.

There may be loose particles of dirt in the centrifuge drum if the dirt consists of sandy material without any gummy constituent to bind it firmly to the drum wall. The solvent properties of the fuel oil and vibration tend to loosen the sandy cake from the vertical wall when the drum is at rest.

Engines applied to road vehicles are subjected to frequent stopping and starting, and it is undesirable in applications of this class to have to employ an elaborate automatic gear to provide the delay period during which drum speed is built up before the fuel starts to flow.

The present invention has for an object to provide a centrifuge which can deliver finely filtered fuel immediately on starting.

According to the invention, in a centrifugal oil cleaner the centrifuge includes a rotatable drum and filter means so arranged that oil flowing from the centrifuge drum passes through the filter means in a centripetal direction.

The drum may be fixed to, or rotatable with, a spindle formed with inlet and outlet passageways or ducts terminating in inlet and outlet openings through which oil is conducted into and out of the drum. Alternatively, the spindle may be fixed, the drum being supported by and rotatable about a fixed shaft. In another alternative the drum may be supported by and rotatable about two fixed stub shafts.

The inlet passageways or duct may terminate in at least one stand pipe parallel to and radially spaced from the axis of the drum, the inlet opening being the open end of the stand pipe which is preferably brought near the top of the drum.

The outlet opening may be at least one port in the wall of the spindle, or of the shaft, the filtering element being in the form of a cylinder co-axial with and surrounding the spindle or the shaft.

In a preferred construction, the centre portion of the spindle is formed with a broad annular groove from the bottom of which an opening leads to the discharge passage-

2

way or duct, a perforated sleeve surrounds the spindle, and a cylindrical filtering element surrounds the sleeve. The filtering element rotates with the drum at a rotational speed such that the centrifugal force is great enough to prevent dirt deposits from forming on said element, and also great enough to throw off the dirt deposits which may have formed temporarily on said element during the starting up period.

The dirt collects on the inside of the drum and can be scraped out at convenient cleaning periods. The filtering element, being self-cleaning, requires no attention.

The filtering element may be made of a material having smaller interstices than is practicable in a conventional oil cleaner, because in conventional cleaners the deposits of fine dirt which would build up on a fine grade element would be too dense and would quickly slow down and eventually block the flow through the element.

The filtering element may consist of dense felt, paper, porous metal, ceramic, etc., provided these are constructed to resist break-up or displacement when subjected to a high centrifugal force.

The centrifuge operates well with a centrifugal force of 600 g at the filtering element and 1000 g at the mean radius of the dirt collection zone, but these values are not critical, and should be regarded only as preferred minima for steady conditions.

Only one fuel feed pump is required in conjunction with an oil cleaner as described because the output pressure from this pump can supply both the force for driving the drum and also the force to feed the fuel from the centrifuge to the engine injection pump.

A practical embodiment of the invention in which the drum is rotated by jet reaction is illustrated in the accompanying drawings in which Fig. 1 is a section on a horizontal plane through a filter, and Fig. 2 is a section through a filter on the line 2—2 of Fig. 1.

In the drawings, 1 denotes a casing containing a drum 2 fixed to a spindle 3 formed with an axial inlet passageway or duct 4 connecting with inlet pipes 5, and formed with an axial oil outlet passageway or duct 6 open to a discharge connection 7 on the top of the casing 1. The passageways 4 and 6 are in communication with the exterior of the casing through extensions 8 and 9 of the spindle 3, said extensions serving as journals supported in bearings in the casing 1. The central portion of the spindle 3 is provided with a broad annular groove 15 surrounded by a perforated sleeve 10 encased in a cylindrical filtering element 11. 12 denotes stand pipes open at the top end to the interior of the drum and terminating at the lower end in reaction nozzles of which one is illustrated at 13. 14 denotes a deposit of dirt on the inside of the drum 2. The passageway 4 is open to an oil supply connection 16.

In practice, fuel is normally drawn from a fuel tank by an engine-driven feed pump which may be of the spring-loaded plunger type giving a nearly constant delivery pressure over a wide range of engine speeds. The fuel is fed under pressure to the drum 2 and enters the drum 2 through the inlet passageway 4 and the inlet pipes 5. As the drum rotates, centrifugal action separates and deposits dirt on the drum wall.

Cleaned fuel for the engine passes through the filtering element 11 and out through the perforated sleeve 10 and the outlet passageway 6 in the spindle 3. The remainder of the fuel passes out through the pipes 12 and reaction nozzles 13. The fuel from the nozzles 13 drains directly back to the fuel tank.

Before reaching the engine, fuel from the cleaner may be conducted through an orifice or spring-loaded valve to reduce the fuel pressure to a convenient value.

An advantage associated with a reaction jet driven oil cleaner as described lies in the fact that on shut down of

the cleaner an automatic reversal of flow takes place through the filtering element. The flow reversal occurs when the engine stops and the feed pump has ceased to deliver fuel. The drum momentum, however, causes the drum to spin for a short time before coming to rest. During this period the moving nozzles act as a pump and cause the oil to flow back out of the element, thus flushing the element and supplementing the normal centrifugal self-cleaning action.

An advantage connected with the use of stand pipes is that they prevent dirt, which may become loosened from the drum walls by the solvent properties of the fuel when the drum is at rest, from sliding down into the inlet and the jet passages.

Under any given operating conditions one series of inspection checks on the rate of dirt accumulation in the drum will indicate the desirable regular cleaning interval.

A cleaner as described can be used for the full flow or by-pass filtration of lubricating oil or other liquids.

What is claimed is:

1. An oil cleaner comprising a rotatable drum, an upright spindle extending axially through the drum and to which the drum is fixed for rotation therewith on an upright axis, oil inlet pipes in the drum parallel to the spindle and radially spaced therefrom and from the periphery of the drum, an oil inlet passageway in the lower portion of the spindle communicating with said oil inlet pipes for the delivery of oil to be cleaned to the interior of said drum, said oil inlet pipes terminating with open ends in the upper portion of the drum, an outlet passageway for clean oil in the upper portion of said spindle and opening into the drum above the oil inlet passageway in the spindle, a cylindrical filtering element surrounding the spindle arranged to filter oil flowing to the opening of the outlet passageway for clean oil, and means for rotating said drum, whereby the oil to be cleaned and delivered through said pipes into the upper portion of the drum is subjected to the centrifugal action produced by the rotation of the drum for the separation of dirt, which accumulates on the inner periphery of the drum, and oil flowing to the opening from the drum to the outlet passageway in the upper portion of the spindle is passed through said cylindrical filtering element.

2. An oil cleaner as claimed in claim 1, including a perforated sleeve surrounding the major portion of the spindle in the drum and in spaced relation thereto, the said opening of the outlet passageway leading from the space between the spindle and the perforated sleeve, and said cylindrical filtering element encasing said perforated sleeve.

3. An oil cleaner comprising a rotatable drum, an upright spindle extending axially through the drum and to which the drum is fixed for rotation therewith on an upright axis, oil inlet pipes in the drum parallel to the spindle and radially spaced therefrom and from the periphery of the drum, an oil inlet passageway in the lower portion of the spindle communicating with said

oil inlet pipes for the delivery of oil to be cleaned to the interior of said drum, said oil inlet pipes terminating with open ends in the upper portion of the drum, an outlet passageway for clean oil in the upper portion of said spindle and opening into the drum above the oil inlet passageway in the spindle, a cylindrical filtering element rotatable with the drum and surrounding the spindle to filter oil flowing to the opening of the outlet passageway for clean oil, means for rotating said drum including at least one reaction nozzle having a tangential setting and arranged to deliver outside the drum, and means for conducting oil from the upper portion of said drum outside the cylindrical filtering element to the reaction nozzle, whereby the oil to be cleaned and delivered through said pipes into the upper portion of the drum is subjected to the centrifugal action produced by the rotation of the drum for the separation of dirt, which accumulates on the inner periphery of the drum, and oil flowing to the opening from the drum to the outlet passageway in the upper portion of the spindle is passed through said cylindrical filtering element.

4. An oil cleaner comprising a rotatable drum, an upright spindle extending axially through the drum and to which the drum is fixed for rotation therewith on an upright axis, an oil inlet passageway in the lower portion of the spindle, conduit means rotatable with the drum communicating with said oil inlet passageway for the delivery of oil to be cleaned to the interior of said drum, said conduit means terminating and having an outlet in the upper portion of the drum in spaced relation to its periphery and to said spindle, an outlet passageway for clean oil in the upper portion of said spindle and opening into the drum above the oil inlet passageway in the spindle, a cylindrical filtering element surrounding the spindle arranged to filter oil flowing to the opening of the outlet passageway for clean oil, and means for rotating said drum, whereby the oil to be cleaned and delivered through said conduit means into the upper portion of the drum is subjected to the centrifugal action produced by the rotation of the drum for the separation of dirt, which accumulates on the inner periphery of the drum, and oil flowing to the opening from the drum to the outlet passageway in the upper portion of the spindle is passed through said cylindrical filtering element.

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