Aug. 17, 1926. 1,596,534

R. O. HENDRICKSON

INTERNAL COMBUSTION ENGINE

Filed Oct. 7, 1921

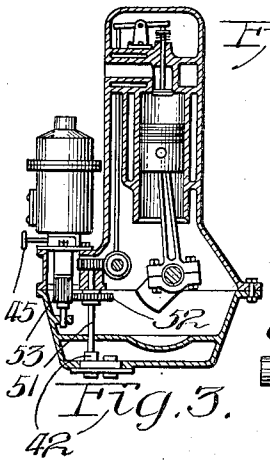



Fig. 4.

Fig. 3.

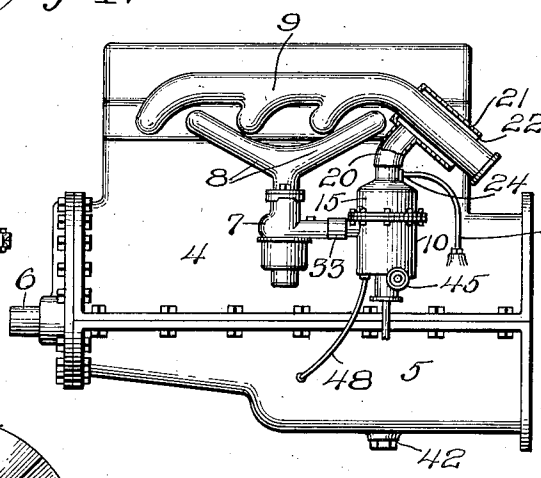
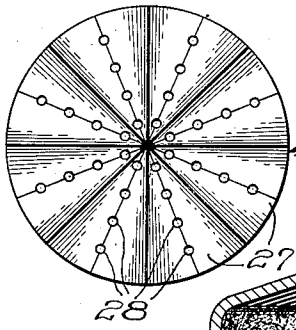



Fig. 1.



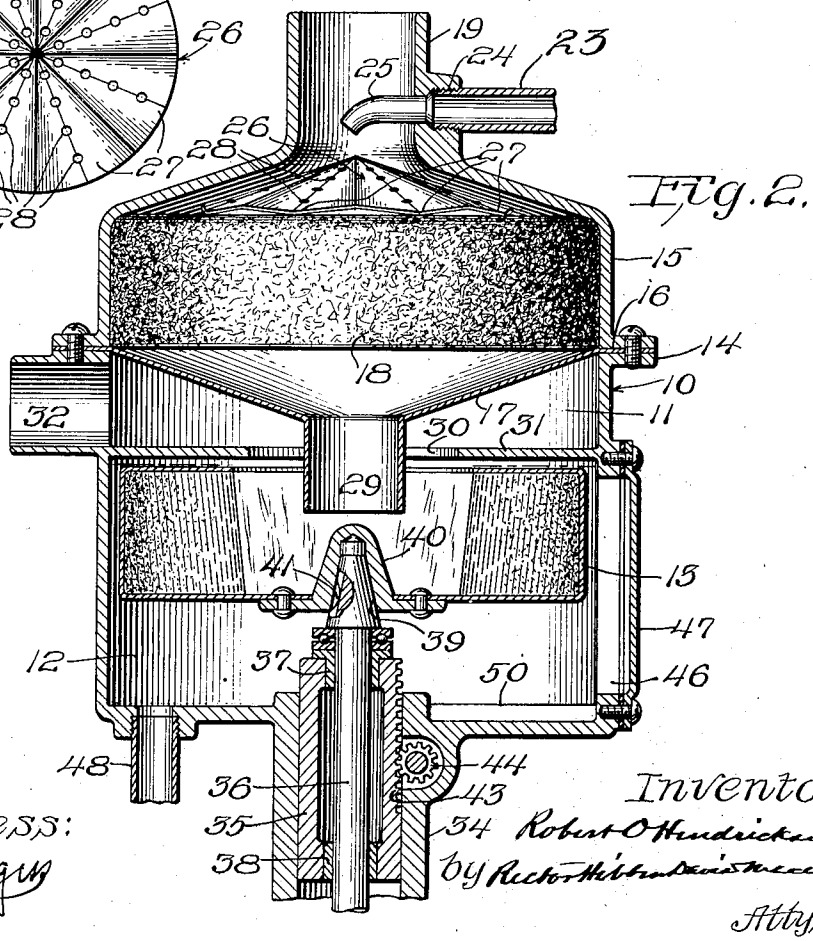




Fig. 2.

Witness:

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# UNITED STATES PATENT OFFICE.

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## INTERNAL-COMBUSTION ENGINE.

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My invention has for its objects the separation from the air before it becomes a component of the combustible mixture, of all dirt, dust and grit or foreign substances which it may contain and also the removal from the oil in the lubricating system of both the fuel with which it ordinarily becomes more or less diluted and the heavier particles, dirt, etc., with which it becomes contaminated in use. With these objects in view my invention comprises a body of fibrous filtering material such as wool or the like to which oil is continuously fed, preferably from the lubricating system of the engine, and through which the air which subsequently enters into the combustible mixture is drawn. The air previous to being passed through the oil saturated filtering material is heated, as a result of which any light or more volatile products, such as gasoline, kerosene, or the like contained in the lubricating oil, with which the filtering material is saturated is volatilized and passes from the apparatus with the air. My invention further includes a separator which receives the oil as it drips or escapes from the fibrous material and separates the heavier particles, dirt and the like therefrom. Preferably the separator takes the form of a centrifugal bowl in which the heavier matters accumulate, the oil which is lighter overflowing therefrom and returning to the crank case or other part of the lubricating system. The centrifugal separator in the preferred form of the device shown is removable for the purpose of cleaning the same.

In the accompanying drawing I have shown and in the following specification described a preferred embodiment of the invention; it is to be understood however, that the specific disclosure is for the purpose of exemplification only, the scope of the invention being defined in the following claims in which I have endeavored to distinguish it from the prior art so far as known to me without however, relinquishing or abandoning any portion or feature thereof.

Referring to the accompanying drawing Fig. 1 is a side elevation of an internal combustion engine to which my invention has been applied, parts being shown in vertical section; Fig. 2 is a vertical section on an enlarged scale of so much of the apparatus shown in Fig. 1 as includes the more essential features of the improvement, Fig. 3 is a plan view of an element of the construction shown in Fig. 2 and Fig. 4 a vertical section through the engine, adjacent my improvement. Each part is identified by the same reference character wherever it occurs in the several views.

Referring now to Fig. 1, the main casting or cylinder block of the engine, which, except in the respects hereinafter pointed out, may be of usual or approved form, is indicated by numeral 4 and the base casting by numeral 5. The shaft of the engine is seen at 6, the carburetor at 7, the branch inlet at 8 and the exhaust manifold at 9. Referring now more particularly to Figs. 2 and 3, a casting 10 is divided into an upper chamber 11 and a lower chamber 12, in the latter of which is revolubly mounted the centrifugal bowl 13. The upper chamber terminates in a flange 14 to which is screwed or otherwise secured an upper casting 15, the edge 16 of a funnel 17 being clamped between the flanges of castings 10 and 15 respectively. In the chamber formed by the upper casting 15 is enclosed a mass 18 of loosely packed fibrous material, such as wool, which completely fills the cross section of the chamber and serves as a filter or cleaner for the air supplied to the carburetor as will presently appear. The upper end of the casting 15 is contracted to form a neck 19 through which the air enters the filtering chamber, and the neck is connected by an elbow 20 with a heating chamber 21 surrounding the exhaust manifold, the end of the heating chamber being open at 22 to permit the influx of air, (see Fig. 1). The mass of fibrous material is constantly supplied with a small amount of oil, preferably from the lubricating system of the engine. For this purpose a small pipe 23 connected to the lubricating system is tapped into a boss on the neck 19 at 24 and communicates with a nozzle 25 extending to about the axis of the neck, the nozzle being downwardly turned as shown in Fig. 2. In order to distribute the oil upon the mass of fibrous material I preferably provide a distributor plate 26 which is generally conical in shape with shallow radial grooves or depressions as at 27, the bottoms of the grooves being perforated at 28 as best shown in Fig. 3. The apex of the cone being located to directly receive the flow from nozzle 25, the oil is evenly distributed among the radial grooves

and dripping through the perforations 28 moistens the wool or other fibrous material, the action of capillarity assisting its distribution throughout the mass.

The oil supplied in the manner described keeps the mass of fibrous material thoroughly saturated and drips from the latter into the funnel 17, the outlet 29 of which projects through the relatively large opening 30 in the diaphragm 31 separating the chambers 11 and 12 into the latter chamber. Thus the oil from the air filter is conveyed to the oil cleaning or separating apparatus to be presently described. The air flowing downward through the filter passes downward through the neck of the funnel and into the center of centrifuge 13, but here the direction of the current is reversed and it passes back upwardly around the neck of the funnel through the opening 30 in diaphragm 31 into the chamber 11 below the funnel and from the latter flows by the outlet opening 32 and connection 33 (see Fig. 1) to the carburetor 7.

As heretofore stated the centrifugal separator bowl 13 is revolubly mounted in the chamber 12. For this purpose the bottom of the casting 10 is formed with a sleeve 34, the interior of which is machined to form a sliding fit for a generally cylindrical vertical adjustable support 35 in which shaft 36 is journaled at 37—38. Tne upper end of the shaft supports the bowl 13 and for this purpose is formed with a tapered seat 39 which is received in the tapered cavity of the upwardly projecting boss 40 of the bowl, the latter being keyed to the shaft at 41. The shaft 36 may be revolved by any suitable means and in the present instance I have indicated it as driven from the rotary lubricating pump 42 which is or may be of well known type and located in the bottom of the crank casing. In the preferred form of the device however, the shaft 36 is axially adjustable relative to the driving means to provide for the removal of the centrifugal bowl when desired for the purpose of cleaning or the like. The support 35 is adjustable in sleeve 34 and I have shown the former as formed with a rack 43 with which a pinion 44 connected to a hand wheel 45 (see Fig. 1) meshes for the purpose of raising and lowering the support 35. Normally the support 35 and the parts carried thereby are in the upper position shown in Fig. 2 but for the purpose of removing the bowl they are lowered by the mechanism just described so that the shaft 39 may be withdrawn from the socket in the bowl and the latter removed through side opening 46 normally closed by the cover 47. The shaft 36 is driven from the shaft 51 which drives the oil pump 42 and is provided with a gear 52 which meshes with a long gear 53 on shaft 36 to permit the above described axial adjustment of the latter shaft to remove and replace the centrifugal bowl. The above described method of driving the centrifugal bowl is satisfactory but obviously numerous other methods are feasible.

A pipe 48 tapped into the bottom of the chamber 12 connects the latter with the crank casing (see Fig. 1) whereby the oil collecting in the chamber 12 is returned to the lubricating system of the engine. As shown in Fig. 2 the pipe 48 taps the bottom of the chamber 12 and through which pipe the clean oil is returned to the crank case.

The operation of the invention will now be readily understood. The mass of fibrous material is maintained in saturated condition as stated above and the air for forming the combustible mixture for the engine after being heated by the exhaust manifold is drawn downward through the filter and through the outlet of the funnel thereof and thence to the carburetor after dust and other foreign matter has been separated therefrom by the filter. By the use of air cleaned in this manner for forming the combustible mixture the evils resulting from grit, etc., to the engine are avoided. The lubricating oil is deprived of any fuel oil with which it may have become diluted by leakage or otherwise, since the oil is distributed in thin films throughout the fibrous mass and thereby brought into intimate contact with the heated air flowing through the filter which vaporizes the fuel oil and carries it along to the carburetor, thus not only purifying the lubricating oil with respect to fuel oil but economizing the latter which partially carburets the air prior to its admission to the carburetor proper.

The lubricating oil dripping or flowing through the funnel into the rapidly rotating centrifugal bowl and carrying with it its contents of heavier impurities, carbon, dust, and the like is separated from the latter impurities which are thrown to the periphery of the bowl and the oil flowing over the upper inner edge of the bowl in purified condition drops to the bottom of the chamber 12 from which it is returned to the lubricating system by pipe 48.

I claim:

1. In an internal combustion engine, a filtering chamber for air and oil having an air inlet and an air outlet, connections from the outlet to the carbureter of the engine, a filter in the chamber between said inlet and outlet, a connection and means for feeding oil from the lubricating system of the engine to the filter, and connections for returning the oil to the lubricating system of the engine.

2. In an internal combustion engine, a filtering chamber for oil and air, a filter in said chamber, air heating means, a passage for conducting hot air from said heating

means to said chamber, an outlet from the chamber, connections from said outlet to the carbureter of the engine, means for supplying the filter with oil from the lubricating system of the engine, and means for returning the oil to the lubricating system.

3. In an internal combustion engine, a chamber containing a mass of air filtering material and having an air inlet and an air outlet, a connection from the lubricating system of the engine continuously supplying oil to said chamber, a centrifugal separator receiving the oil from said chamber and means for conveying the oil overflowing from said separator to the lubricating system.

4. In an internal combustion engine, a casing having an upper and a lower chamber, a centrifugal separator in the lower chamber, a mass of air filtering material in the upper chamber, means for continuously feeding lubricating oil from the lubricating system of the engine to the upper chamber, an air inlet to the upper chamber, an outlet therefrom for air connected to the carburetor of the engine, a connection whereby the oil is led from the filter chamber to the centrifugal separator and a connection whereby the overflow from the centrifugal separator is returned to the lubricating system.

5. In a device of the class described, a casing having an upper and a lower chamber, a mass of air filtering material in the upper chamber, means for supplying the material with oil, an air inlet and an air outlet on opposite sides of the filtering material, means for directing the oil dripping from the filtering material to the lower chamber, a centrifugal bowl in the lower chamber adapted to receive said drip and a connection from said lower chamber for withdrawing oil therefrom.

6. In a device of the class described, a casing, an air filter in the casing, means for supplying the air filter with oil, a centrifugal bowl in the casing adapted to receive oil from the filter, a vertical revoluble shaft on which the bowl is loosely mounted, a vertical removable bearing for the shaft, means for raising and lowering the bearing, the casing having an opening through which the centrifugal bowl is removable and a cover for said opening.

7. In an internal combustion engine, a chamber containing a mass of air filtering material and having an air inlet and an air outlet, a connection from the lubricating system of the engine for supplying oil to said chamber, a separator, and means for conveying the cleansed oil from said separator to the lubricator system.

8. In an internal combustion engine, a chamber containing a mass of air filtering material having an air inlet and an air outlet, means for heating the air passing through said inlet, a connection from the lubricating system of the engine for supplying oil to said chamber, a separator receiving oil from said chamber, and means for conveying the cleansed oil from said separator to the lubricating system.

9. In an internal combustion engine, a chamber containing a mass of air filtering material having an air inlet and an air outlet, a connection from the lubricating system of the engine for supplying oil to said chamber, a separator receiving oil from said chamber, means for conducting the current of air into said separator, and means for conveying the cleansed oil from said separator to the lubricating system.

10. In a combined air and lubricating oil cleaner, a chamber containing a mass of air filtering material having an air inlet and an air outlet, means for heating the air passing through said inlet, a connection from the lubricating system of the engine for supplying oil to said chamber, a separator receiving oil from said chamber, and means for conveying the cleansed oil from said separator to the lubricating system.

ROBERT O. HENDRICKSON.