Sept. 30, 1952 F. ALWARD 2,612,150

METHOD AND APPARATUS FOR CONTROLLING THE CRANKCASE PRESSURE IN INTERNAL-COMBUSTION ENGINES

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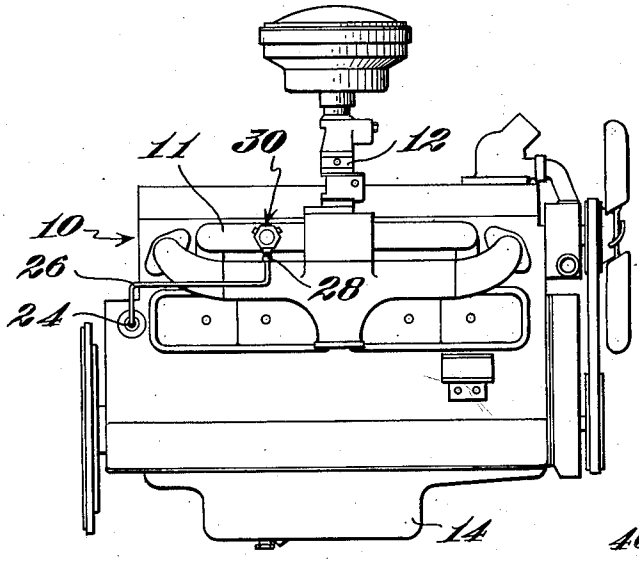


Fig. 1

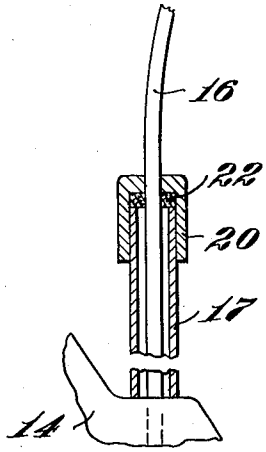


Fig. 5

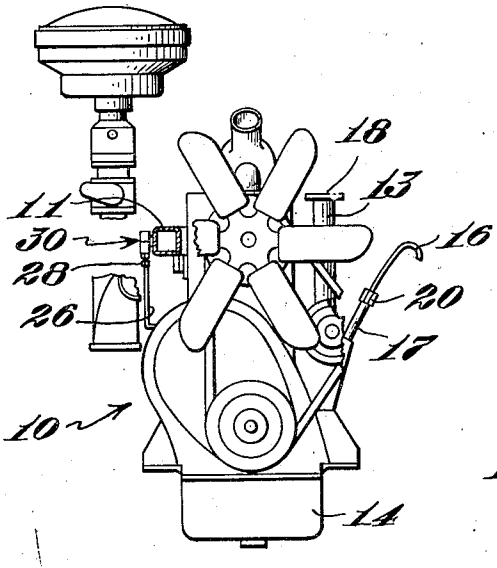


Fig. 2

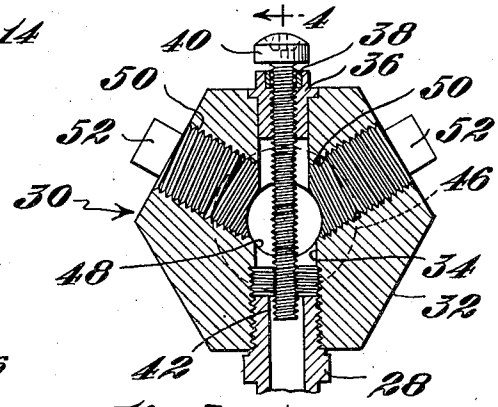


Fig. 3

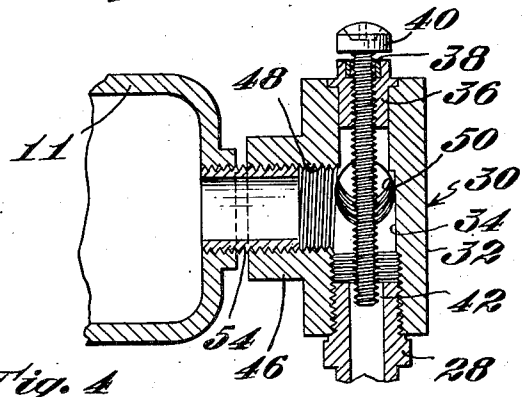


Fig. 4

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METHOD AND APPARATUS FOR CONTROLLING THE CRANKCASE PRESSURE IN INTERNAL-COMBUSTION ENGINES

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8 Claims. (Cl. 123—119)

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In internal combustion engines the hot gases which blow by the piston rings condense upon contact with the colder engine parts and form water and acids which in combination with the oil, dirt and vapors create sludge which tends to block oil passages in the piston ring grooves, bearings, journals and other vital engine parts. The gases and impurities contacting the high temperature portions of the engine, such as the pistons, rings and valves, bake to a hard varnish which causes sticking and malfunctioning of these parts.

Objects of this invention are to provide both a method and apparatus which exhaust the crankcase (including all intercommunicating parts) of an internal combustion engine, which prevent dirt from entering the crankcase, which remove the gases and vapors from the crankcase when the engine is idling or lightly loaded, which eliminate objectionable fumes, which greatly reduce the formation of sludge, which do not interfere with the lubrication of the cylinder walls, which materially lengthen the life of the engine, which increase the power delivered by the engine, which reduce the oil and gasoline consumption of the engine, which prevent etching of the valve springs and other vital engine parts, which are automatic in operation, which are reliable and troublefree, which are simple and economical to construct, which can be easily incorporated in new engine designs or installed upon existing engines, which do not interfere with the normal operation of the engine and which generally advanve the art to which they are related.

In one principal aspect the invention involves the method of controlling crankcase pressure in internal combustion engines which comprises the steps of substantially sealing all crankcase openings such as the oil filler and measuring bayonet openings from the atmosphere and interconnecting the engine intake manifold or other portion maintained at a negative pressure by the engine operation to the crankcase so that the vapors and gases are withdrawn from the crankcase into the manifold, thence through the combustion chambers and out the exhaust pipe. The relative flow of gas from the crankcase into the manifold and the flow of gases into the crankcase due to atmospheric leakage by the seals and piston blowby is regulated, for example, by throttling the gas flow to the manifold, so that the lower manifold pressure at light loads causes substantially lower pressure in the crankcase than atmospheric pressure.

In a more specific aspect adjustment is made

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so that, with the engine idling, approximately one-half an atmosphere of pressure results in the crankcase, thereby producing the maximum exhaust effect when it is needed most, and with the engine under heavy load the crankcase pressure rises substantially to ambient pressure or higher to provide added lubrication of the cylinder walls by the oil drawn up upon the walls by the pressure differential above and below the pistons.

In another principal aspect the invention contemplates means for closing the external openings into the crankcase, including timing gear case or chain case and valve chambers so that the interior of the crankcase is substantially sealed from the atmosphere. Conduit or other means interconnect the crankcase with the engine intake manifold to reduce the pressure in the crankcase below atmospheric pressure when the engine is idling or lightly loaded and the manifold pressure is at a minimum. Regulating means, such as a valve or orifice, are located in the conduit means to limit the flow of gases through the conduit so that as the load increases the ratio of leakage into the crankcase to the outflow of gases from the crankcase increases and the pressure in the crankcase rises. Further objects related to various features of construction will be apparent from a consideration of the following description and accompanying drawing where

Fig. 1 is a side elevation of an engine incorporating the invention;

Fig. 2 is a front elevation view of the engine shown in Fig. 1;

Fig. 3 is a sectional view showing the details of the metering valve;

Fig. 4 is a sectional view on line 4—4 of Fig. 3; and

Fig. 5 is a sectional view showing the manner in which the oil bayonet of the engine is sealed.

Referring to Figs. 1 and 2, the numeral 10 designates an internal combustion engine. The engine is of any conventional design having an intake manifold 11 acting as a conduit connecting the carburetor 12 with the intake valves which conform to standard practice and are not material to the present invention. The engine is also provided with an oil filler pipe 13 communicating with a crankcase 14 which acts as a reservoir for the lubricating oil supply. The oil level in the crankcase 14 is measured by means of a bayonet or dip stick 16 which projects downwardly into the crankcase 14 through a tube 17.

In carrying out the invention, the crankcase

14 is substantially completely sealed from the ambient atmosphere. This is accomplished by replacing the conventional breather filler cap with a tightly fitting cap 18 similar to those used to seal the cooling system and gasoline tank of an automobile. The opening in the conduit 17 for the oil level bayonet 16 is made from a piece of round or hex bar stock. A recess having a diameter such that it fits over the tube 17 is bored in one end of the bar stock. The opposite end is provided with an aperture through which is inserted the bayonet 16. The seal is made by a washer 22 of oil resistant yieldable material such as leather or neoprene. The washer 22 is compressed between the top of the tube 17 and the bottom of the recess in cap 20. When a vacuum is created in the crankcase 14 as described below, the difference in pressure above and below the cap helps to hold it tightly in place. The conventional draft tube which is ordinarily used to provide ventilation of the crankcase 14 is replaced by a compression fitting 24 (Fig. 1). One end of a conduit such as the tubing 26 is secured in the fitting 24. The opposite end of the tube 26 is secured to a metering valve 30 by means of a similar fitting 28.

The details of construction of the metering valve 30 are shown in Figs. 3 and 4. The valve comprises a body 32 machined from a short length of hex bar stock. Extending through the body is an aperture 34. One end of the aperture 34 is threaded to accommodate the threaded end of the compression fitting 28 connecting the tubing 26 (Fig. 1). The opposite end of the aperture 34 is counterbored to receive the flange of a hollow bushing 36 which is pressed into the aperture end. The bushing 38 is provided with internal threads which engage the threads upon a metering pin 40. The portion of the bushing 36 projecting above the face of the body 32 is provided with a threaded fiber insert 38 which acts as a locking device for the pin 40. The shank 42 of the pin 40 projects downwardly into the aperture in the fitting 28 thereby to restrict partially the aperture. The amount of restriction provided by the shank 42 is adjustable by moving the screw 40 in or out.

As is shown in Fig. 4, an integral boss 46 is provided upon the rear of the valve body 32. The boss 46 has an internally threaded aperture 48 interconnecting with the aperture 34. Each of the hex faces adjoining the face carrying the bushing 36 are also provided with threaded apertures 50 which interconnect with the aperture 34. These apertures 50 are provided as convenient connections for a vacuum windshield wiper or other use. When not being so employed, the apertures 50 are closed by means of the screw plugs 52.

The valve 30 is connected to and supported from the engine intake manifold 11 by means of a close nipple 54 (Fig. 4). One end of the nipple 54 is threaded into the boss 46. The other end of the nipple 54 engages the manifold aperture provided for the connection to vacuum windshield wipers or other threaded aperture tapped into the manifold 11 or in communication therewith.

As will be readily appreciated from the above, the vacuum created in the intake manifold 11 by the operation of the engine 10 creates a partil vacuum in the crankcase 14 exhausting the moisture and gases or other matter blown by the piston rings. Because of the sealing of the crankcase 14 to the atmosphere there is no substantial draft through the crankcase; therefore lubricating oil is not drawn through the conduit 26 into the manifold 11 and a check valve is not required in this line.

The amount of negative pressure in the crankcase 14 is dependent upon the relative rates of leakage into the crankcase 14 and the flow of gases, air and vapors out through the conduit 26. The fluid flow through the conduit 26 is a function of both the negative pressure in the intake manifold and the resistance to the flow offered by the conduit and the valve 30.

The most satisfactory setting of the screw 40 of the valve 30 has been found to be that setting which restricts the flow from the crankcase 14 so that a negative pressure of approximately one half an atmosphere is created in the crankcase when the engine 10 is operating at idling speed under no load. For a new engine with normal compression a negative pressure of 13 inches of mercury has been found to be satisfactory. With such a negative pressure the difference of pressure above and below the piston rings is greatly reduced so that oil does not work past the rings into the combustion chamber. Vapors and gases are exhausted from the crankcase 14 so that they are not present to combine with other elements to form sludge and varnish upon, or to etch, the internal engine parts.

As the load imposed upon the engine is increased the negative pressure in the intake manifold decreases so that the flow of gases and vapor through the conduit 26 is also decreased. The increase in pressure in the crankcase increases the difference of pressure above and below the piston rings so that on the intake strokes oil flows up to lubricate the cylinder walls during heavy load conditions when the need for the lubricant is greatest.

This apparatus is unique in that the crankcase is completely sealed and a substantial vacuum is created in the crankcase through a suction pipe leading to the intake manifold, the pipe containing a constant-position valve set to produce maximum vacuum in the crankcase when the butterfly valve is closed and therefore when needed most to prevent oil from being drawn up past the piston rings.

This apparatus is not to be confused with prior ventilating systems where air is not only drawn out of the crankcase but also continuously admitted to the crankcase to produce a draft therethrough. In those systems the continuous draft through the crankcase needlessly carries away oil vapor. Moreover the draft cools the parts in the crankcase sufficiently to condense the water vapor which leaks past the piston rings, and this water combined with the oil and impurities to form injurious acid and sludge. According to the present invention the crankcase is entirely sealed so that only a negligible amount of air need be withdrawn to maintain a substantial vacuum, and no substantial draft is produced in the crankcase.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. In controlling crankcase pressure in internal combustion engines, the method which comprises the steps of substantially sealing the crankcase from the atmosphere, interconnecting the engine intake manifold and the crankcase so that gases are drawn from the crankcase, and adjusting the

relative rates of flow of gases into and from the crankcase so that the negative pressure within the crankcase substantially to ambient pressure engine is lightly loaded than when the engine is heavily loaded.

2. In controlling crankcase pressure in internal combustion engines, the method which comprises the steps of substantially sealing the crankcase from the atmosphere, interconnecting the engine intake manifold and the crankcase so that gases are drawn from the crankcase, and adjusting the relative rates of flow of gases into and from the crankcase to reduce the pressure within the crankcase below atmosphere pressure when the engine is lightly loaded and to increase the pressure within the crankcase substantially to atmospheric pressure when the engine is heavily loaded.

3. In controlling crankcase pressure in internal combustion engines, the method which comprises the steps of substantially sealing the crankcase from the atmosphere, interconnecting the engine intake manifold and the crankcase so that gases are drawn from the crankcase, and adjusting the relative rates of flow of gases into and from the crankcase to reduce the pressure within the crankcase to approximately one-half an atmosphere below ambient pressure when the engine is lightly loaded and to increase the pressure within the crankcase substantially to ambient pressure when the engine is heavily loaded.

4. For use with an internal combustion engine having an intake manifold and a crankcase acting as a reservoir for the lubricating oil supply, means for substantially sealing the interior of the crankcase from the atmosphere, conduit means interconnecting the manifold and the crankcase to reduce the pressure in the crankcase below atmospheric pressure when the engine is lightly loaded, and restricting means located in the conduit means for limiting the flow of gases through the conduit means to less than the leakage into the crankcase when the load upon the engine is increased.

5. For use with an internal combustion engine having an intake manifold and a crankcase acting as a reservoir for the lubricating oil supply, means for substantially sealing the interior of the crankcase from the atmosphere, conduit means interconnecting the manifold and the crankcase to reduce the pressure in the crankcase below atmospheric pressure when the engine is lightly loaded, said conduit means including a restricted portion of constant size at all loads for limiting the flow of gases through the conduit means to less than the leakage into the crankcase when the load upon the engine is increased.

6. For use with an internal combustion engine having an intake manifold and a crankcase acting as a reservoir for the lubricating oil supply, means for substantially sealing the interior of the crankcase from the atmosphere, a conduit interconnecting the manifold and the crankcase to reduce the pressure in the crankcase below atmospheric pressure when the engine is lightly loaded, and a constant-position valve located in the conduit for limiting the flow of gases through the conduit means to less than the leakage into the crankcase when the load upon the engine is increased.

7. For use with an internal combustion engine having an intake manifold and a crankcase acting as a reservoir for the lubricating oil supply, means for sealing the dip stick and oil inlet openings to the crankcase, a conduit having one end connected to the rear vent, opening in the engine, and a constant-position valve connected between the interior of the manifold and the other end of the conduit to reduce the pressure in the crankcase below atmospheric pressure when the engine is lightly loaded for limiting the flow of gases through the conduit to less than the leakage into the crankcase when the load upon the engine is increased.

8. For use with an internal combustion engine having an intake manifold containing a butterfly valve and a crankcase acting as a reservoir for the lubricating oil supply, means for substantially sealing the interior of the crankcase from the atmosphere, conduit means interconnecting the manifold and the crankcase to reduce the pressure in the crankcase below atmospheric pressure when the engine is lightly loaded, and a constant-position valve to restrict the flow of gases through said conduit means, and means to set the valve to produce maximum vacuum in the crankcase when said butterfly valve is closed.

FRANCIS ALWARD.

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