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OIL CONDITIONING SYSTEM

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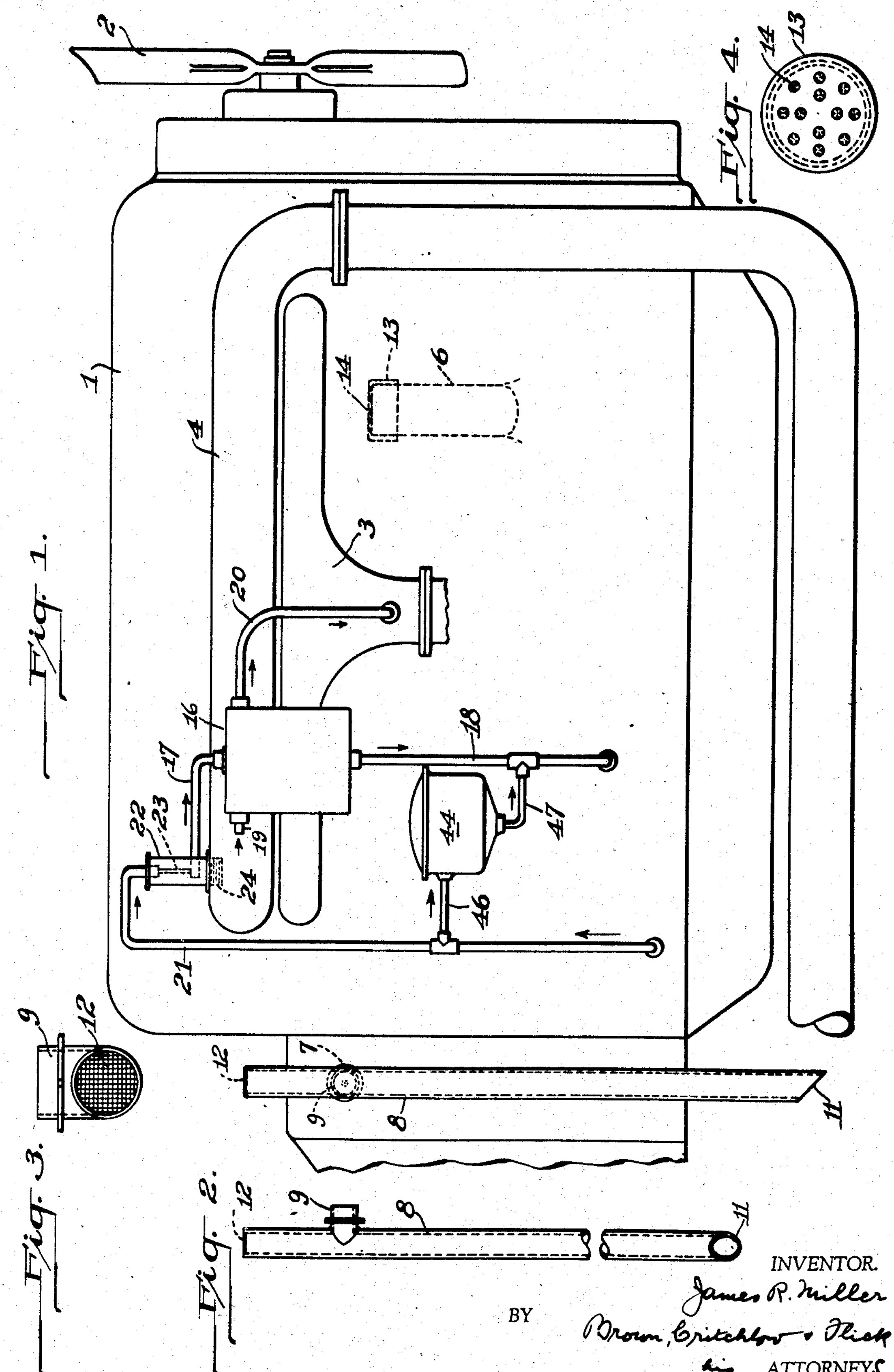

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Fig. 5.

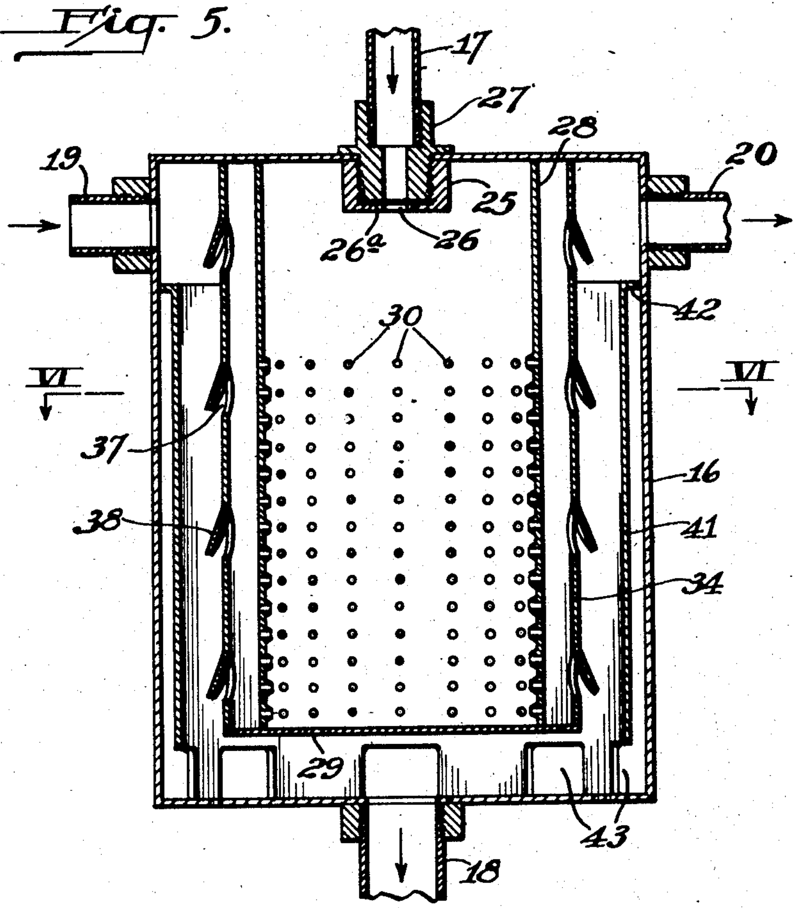
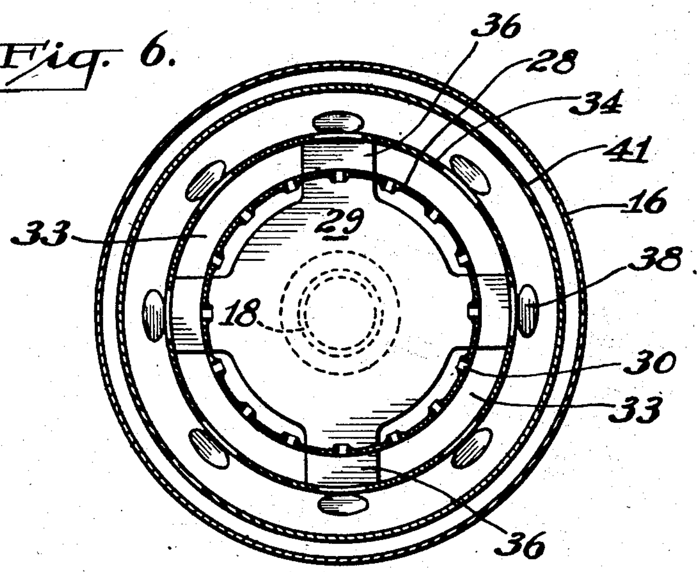


Fig. 6.



WITNESSES

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OIL CONDITIONING SYSTEM

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This invention relates to internal combustion engines, and more particularly to the preservation of lubricating oil therein in good condition.

Internal combustion engines are provided at the bottom with a crank case in which a supply of lubricating oil is maintained for lubricating the bearings and cylinder walls. When such engines, particularly those in automobiles, first began to be used extensively, the crank cases were generally closed except for a single opening through which lubricating oil was introduced when necessary, but this opening was sealed by a removable cap. As the gasoline and water vapors in the products of combustion escaping past the pistons into the crank case could not escape from the latter, the oil was rapidly diluted and its lubricating qualities destroyed. This necessitated the troublesome and expensive practice of draining the oil from the crank case at frequent intervals and replacing it with new oil.

In an attempt to overcome this undesirable situation crank-case ventilation was introduced, usually by forming a port in the rear part of the engine wall to connect the crank case with the atmosphere. A tube is connected to this passage and led downwardly below the engine to position its lower end in the flow of air past the engine as the automobile moves along, and likewise in the air current created by the fan whether the engine is moving or stationary. The lower end of the tube is cut off at an angle to cause the opening to face toward the rear of the engine somewhat. Consequently, air flowing rapidly across the lower end of the tube tends to create a low pressure area at the opening which draws air into the oil filler pipe past its cap, which is loose fitting for this purpose, and through the crank case and out of the tube. Crank-case vapors are carried away to some extent by this current of air when the engine is running, but it also carries dust and dirt into the crank case where they contribute to bearing and cylinder wear. Furthermore, in spite of crank-case ventilation, engines have continued to wear much more rapidly than they should with proper lubrication, proving that the lubrication obtained is not what it should be. Likewise, draining of the crank case is still necessary.

Another highly undesirable factor is that the oil oxidizes and forms sludge which clogs the oil ducts and prevents or retards the flow of oil to bearing surfaces, and which in itself acts somewhat in the nature of a catalyst and contributes to the formation of more sludge. Attempts to prevent sludge by treating lubricating oil to remove from it the products that oxidize readily have not generally been successful because engine heat causes a chemical change in the oil that breaks it down into products that oxidize. In addition, it is difficult to remove from the oil all of the chemical used to treat it, and this chemical contributes materially to the oxidation of the treated oil in the crank case.

Oil filters have likewise not generally been successful because the dirt carried into the crank case by the ventilating air current may cause considerable damage before it reaches and is removed by the filter, and because sludge clogs the filter so rapidly that it becomes inoperative usually long before the filter element is removed or replaced.

Regardless of the means provided for keeping the oil in good condition, nearly all motorists, and certainly all automobile manufacturers, recommend draining the crank case every thousand miles, and specify the use of relatively high grade oil selling for at least 25¢ a quart. The use of cheaper grades of oil, such as the naphthenic base oils, is generally regarded as dangerous practice.

I have found, and proved to my satisfaction by extensive road tests, a way in which these and other problems in engine lubrication can be solved simply and inexpensively in a manner that insures proper engine lubrication at all times, that very materially reduces wear of moving engine parts and thereby maintains high cylinder compression and consequent power, that removes the necessity for draining the crank case, that permits the successful use of the so-called low grade oils, and that apparently improves the oil as it is used. My invention is predicated on my discovery that, in general, the lubrication difficulties encountered heretofore arise from circulation of air through the crank case while the engine is running, and from lack of circulation when the engine is not running. By going counter to well-established practice and, in effect, reversing these two factors, an unexpected and highly desirable result is obtained.

To be more explicit, while a ventilated internal combustion engine is operating, the air passing through the crank case is mixed quite thoroughly with the oil which is being churned and splashed by the crank shaft and connecting rods. I have discovered that the normal running temperature of the oil is high enough to cause it to readily oxidize in the intimate presence of this air and to form sludge, but that by closing the crank case in such a way as to cut off this supply of air the temperature of the oil is not sufficient to cause enough oxidation or sludge to be noticeable. Of course, in the absence of a current of air through the crank case, large quantities of dirt and dust are not carried into it with their attendant injurious results. However, sealing the crank case would bring about the old evil of crank-case dilution, and to avoid this I provide for the escape of vapor therefrom while the engine is idle as well as when it is operative.

In the former situation dilution is not only avoided, but the vapors are removed that continue for some time to arise from the hot oil when the engine is stopped and which I have found were accustomed to condense on the cylinder walls below the pistons and wash the oil film therefrom leaving them bare and subject to corrosion by condensed water vapor, whereby severe wear took place when the engine was started and before the oil film could be built up again. Vapor can not escape from the ordinary ventilated crank case when the engine is not running because, being hot, the vapor rises and will not travel downwardly through the ventilating tube at the back of the engine, nor downwardly through the space between the oil filter pipe and the overlying side wall of its cap. When piston and cylinder wear occurs, more gasoline and products of combustion are permitted to escape past the piston and into the crank case to further dilute the oil, and engine compression or power is lost.

It is among the objects of this invention to provide an internal combustion engine lubricating system in which the lubricating oil retains its lubricating characteristics completely and as long as it remains unconsumed, in which all parts exposed to the oil are properly lubricated at all times, and in which inexpensive low grade oil can be used safely and satisfactorily. More specific objects are to prevent crank-case dilution, sludge formation, introduction of an excessive amount of abrasive matter, engine wear and power loss.

In the practice of my invention I provide an internal combustion engine with at least two laterally spaced passages connecting the crank case with the atmosphere, these passages being adapted to serve as outlets for crank-case vapor whether the engine is operating or idle, and having their outer ends positioned to prevent an appreciable current of air from being drawn or forced through the engine while it is running. It is preferred to use a rectifier to assist in removing volatile products from the oil, and it is so constructed as to avoid oxidation of the oil passing through it. It is also desirable to use a filter for removing from the oil the solid particles that unavoidably become mixed with it.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a side view of an automobile engine constructed in accordance with my invention; Fig. 2 is a side view of the ventilating tube used in conjunction therewith; Fig. 3 is an enlarged view of the upper end of the tube; Fig. 4 is an enlarged plan view of the cap for the oil filler pipe; Fig. 5 is a vertical section through an oil rectifier; and Fig. 6 is a horizontal section through the rectifier taken on the line VI—VI of Fig. 5.

Referring to Fig. 1, an internal combustion engine 1 is provided with the usual fan 2, intake manifold 3, exhaust manifold 4 and oil filler pipe 6. The lower part of the engine forms the crank case in which several quarts of lubricating oil are kept for lubricating the bearings and the cylinder walls. As set forth above, it is a feature of this invention that the engine is so constructed that air is substantially excluded from the crank case while the engine is running, but is permitted to enter it and cause circulation therein when the engine is idle. In accordance with this invention, the oil filler pipe 6 (shown in dotted lines because it is on the far side of the engine) most suitably serves as one of the two ventilating passages referred to, and the other passage is advantageously located on the opposite side of the engine near the rear and preferably consists of a port 7 near the top of the engine and an open tube 8 having an opening in its side wall connected to the port by a nipple 9 (Fig. 2). One end of the tube extends in an upwardly direction from the port to permit crank-case vapors to escape through it when the engine is idle, but any tendency of air passing across the upper end of the tube to create a low pressure area at that point and thereby draw an appreciable current of air through the crank case would be avoided by the portion of the tube below the port which would in effect short-circuit most of the air current and cause it to merely be drawn through the tube.

However, to likewise avoid any tendency for the passing air to create a suction at both ends of the tube at once, which might draw air through the crank case, the tube is arranged with the opening in one end only facing somewhat toward the rear of the engine so that flow of air through the tube in only one direction is assured. By extending one end of the tube below the engine and making that the outlet end, vapors and gases emerging from port 7 are drawn downwardly by air drawn into the upper end of the tube and are carried away beneath the automobile. The most suitable tube for this purpose is therefore a straight one disposed substantially vertically, as shown in Fig. 1, with its lower end cut off at an angle as at 11, and with a screen 12 mounted in its upper end (Fig. 3) to prevent foreign solid matter from dropping into the tube and possibly entering the crank case through port 7. If desired, especially in stationary engines, the opening in the upper end of the tube can be positioned to intercept some of the air flowing past the engine to increase the down-draft through the tube. Or, the tube can be disposed horizontally with an opening in its upper wall directly above port 7 for escape of vapor when the engine is stopped.

The removable cap 13, with which the filler pipe is provided in accordance with the usual practice, may be a tight-fitting cap, but it has upwardly extending perforations in it to permit warm crank-case vapors to freely rise through it when the engine is stopped and cool air settles into the crank case through port 7 and the filler pipe. These perforations 14 are preferably in the top of the cap, as shown in Fig. 4, and their outer ends are disposed in a plane substantially parallel to the flow of air past the engine when it is running so as to prevent that air from either entering the perforations or from drawing air through the crank case. If the perforations are formed by punching the top of the cap outwardly with pointed instruments in a manner to leave the displaced metal in the form of a jagged flange around each perforation, moisture or dirt settling on top of the cap will not pass through the perforations and into the filler pipe. When the engine is stopped, crank-case vapors escape through port 7 and the upper end of the ventilating tube as well as through the filler pipe, because circulation is set up in the crank case by the incoming cool air. When the engine is started again the newly forming vapors force the purging air out before the temperature of the oil rises sufficiently to cause oxidation.

During operation of the engine the vapor formed in the unventilated crank case completely fills it to the exclusion of any appreciable amount of air, and the excess vapor which would otherwise cause crank-case dilution is free to escape through the oil filter pipe and the ventilating tube. However, it is always possible that vapor may be forming in the crank case faster than it is escaping therefrom, and that there may be diluents in the oil that have not vaporized because the oil is not hot enough. Therefore, in order to aid in the removal of crank-case vapor, and especially to extract diluents from the oil and carry them away, it is preferred to use a rectifier.

This rectifier should be so constructed that the oil passing through it will not become oxidized, a suitable one invented for this purpose being shown in detail in Figs. 5 and 6. It comprises a container 16 provided at its upper end with an oil inlet to which one end of a tube 17 is connected, and at its lower end with an oil outlet connected by a tube 18 to the crank case (Fig. 1). Opposite sides of the container near the top are provided with inlet and outlet ports for a current of carrier air, the inlet being provided with a nipple 19 open to the atmosphere, and the outlet being connected by a tube 20 to the intake manifold 3 the section of which draws a current of air into nipple 19 and through the upper part of the rectifier. Oil is pumped out of the crank case by the oil pump (not shown) and up through a tube 21, as shown in Fig. 1, but before it enters tube 17 it is heated to a temperature high enough to cause the diluents therein, such as gasoline and water, to vaporize when the oil enters the rectifier.

The heater preferably comprises a metal rod 22 of aluminum, copper or the like, the upper end of which is provided with a threaded bore connected to tube 21 and the lower end with a bore connected to tube 17. The two bores are joined by a small duct 23 through which oil flows without coking. This receptacle is heated by conduction by a solid depending portion 24 extending downwardly into exhaust manifold 4 in which it is threaded. The heat of the exhaust manifold is conducted through the rod to the thick wall surrounding duct 23 where it heats the oil.

The hot oil pumped into the rectifier enters it in a fine stream and with considerable force, because the inner end of the rectifier inlet is provided with a nozzle. To make the nozzle adjustable for the different oil pressures found in different makes of engines, and for the different grades of oil used, it preferably comprises a cup 25 secured to the top of the container and provided with a threaded bore and an outlet 26 registering with the rectifier oil inlet, a removable disc 26*a* provided with a single orifice in its center, and a fitting 27 screwed into the cup for clamping it and sealing the disc against the bottom of the cup. The upper end of the fitting receives one end of tube 17. By changing the disc to one with a larger or smaller orifice, the size of the oil stream can be varied.

Inside of the container there is a cylindrical casing 28 attached at its upper end to the top of the container and at its lower end to a plate 29 spaced from the bottom of the container. The upper portion of this casing is solid, but its lower portion is provided with relatively small perforations 30. The stream of hot oil emerging from the nozzle strikes the center of plate 29 and breaks up into a fine spray which splashes upwardly and outwardly. By breaking up the oil into a spray the volatile products readily separate from the oil and escape from the casing through its perforations, whereupon they rise into the upper part of the container from which they are carried into the intake manifold by the current of carrier air. Although most of the oil spray strikes the casing and drains down its sides, the possibility of some of it escaping through perforations 30 and being carried away by the carrier air is diminished by forming the perforations by punching the metal inwardly to leave a jagged flange surrounding each opening. These flanges also prevent a film of oil from forming over the perforations and preventing the volatile products from passing therethrough. Plate 29 at the bottom of the casing is provided in its edge with arcuate notches 33, as shown in Fig. 6, so that the oil draining down the perforated casing can flow directly into the bottom of the container and down through tube 18 to the crank case.

To further insure against oil spray rising into the path of the carrier air, in case some of the spray passes through the perforated casing, an intermediate cylinder 34 is disposed in container 16 where it encircles the casing in spaced relation thereto. The bottom of this cylinder rests on the projecting portions 36 of plate 29. The openings 37 with which this cylinder is provided are relatively large to permit the rapid escape of volatile matter, and are spaced far apart so that the solid areas between them are also relatively large to provide adequate surface area between them for the oil spray to strike and run down. Furthermore, the metal punched out of the cylinder to form these openings is left attached at its top to the cylinder to form baffles 38 which deflect downwardly any spray that may pass through the openings. Due to the fact that the carrier air passes through only the upper part of the container and that the oil spray is confined to the lower part, the air does not strike the oil and therefore does not oxidize it.

To help maintain a high temperature in the rectifier it is preferably insulated. This can be done conveniently by means of a shell 41 disposed in the container and spaced from the side wall thereof by an outwardly extending flange 42 (Fig. 5) at its upper end just below the air inlet and outlet ports. To permit any oil that may seep behind the shell to escape therefrom, the lower end of the shell is provided with drain notches 43.

To remove from the oil abrasive matter entering the engine through the carbureter, and to also remove particles of carbon formed by oxidation of oil on the cylinder walls during the power stroke, it is desirable to provide an oil filter 44. This filter may be of any suitable construction, and is preferably shunted across oil tubes 18 and 21, connected to the rectifier, by means of tubes 46 and 47 as shown in Fig. 1.

Consequently, with an engine constructed in accordance with this invention air which oxidizes the oil to an injurious extent and carries grit into the engine is barred from the engine while it is running, but is admitted to the crank case when the engine stops in order to force vapors out of the crank case before they have an opportunity to wash the oil film off the cylinder walls and to cause corrosion.

While the engine is running, excess crank-case vapors escape therefrom through the outlet passages, and unvaporized products in the oil are separated from it in the rectifier without oxidizing the oil therein, whereby crank-case dilution is reduced almost to the vanishing point. As a result of this and of elimination of sludge, proper lubrication is insured at all times because oil of uniformly good lubricating quality is free to reach all moving parts. As sludge formation need not be considered, inexpensive lubricating oil can be used satisfactorily. Also, without sludge formation and dilution it becomes unnecessary to drain the crank case. Finally, with the excellent lubrication provided at all times by this invention, wear of moving parts becomes so minor that the life of the engine is increased and it maintains its high power after a long period of operation.

According to the provisions of the patent statutes, I have explained the principle and manner of practicing my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. An internal combustion engine having a closed crank case for receiving lubricating oil and provided with at least two laterally spaced passages connecting the crank case with the atmosphere, said passages serving as outlets for crank case vapor when the engine is not operating and each having an outer end so positioned relative to air flow past the engine as to maintain the passages free of a sufficient current of air flowing either into or out of the crank case while the engine is running to appreciably affect the oil in the crank case in a deleterious manner.

2. An internal combustion engine having a closed crank case for receiving lubricating oil and provided with at least two laterally spaced passages connecting the crank case with the atmosphere, both of said passages serving as outlets for crank-case vapor at all times and each having an outer end so positioned relative to air flow past the engine as to maintain the passages free of a sufficient current of air flowing either into or out of the crank case while the engine is running to appreciably affect the oil in the crank case in a deleterious manner.

3. An internal combustion engine having a closed crank case for receiving lubricating oil and provided with at least two laterally spaced passages connecting the crank case with the atmosphere, said passages having upwardly facing openings serving as outlets for crank-case vapors when the engine is not operating and so positioned relative to air flow past the engine as to maintain the passages free of a sufficient current of air flowing either into or out of the crank case while the engine is running to appreciably affect the oil in the crank case in a deleterious manner.

4. An internal combustion engine having a closed crank case for receiving lubricating oil and provided adjacent one end with an opening for the introduction of said oil, said engine being provided adjacent its opposite end with a port connecting the crank case with the atmosphere, an open tube having an opening in its side wall connected to said port, the openings in the opposite ends of said tube being so positioned relative to flow of air past the engine when it is running as to cause circulation of air through the tube in only one direction.

5. An internal combustion engine having a closed crank case for receiving lubricating oil and provided adjacent one end with an opening for the introduction of said oil, said engine being provided adjacent its opposite end with a port connecting the crank case with the atmosphere, an open tube having an opening in its side wall connected to said port, the opening in one end of said tube facing rearwardly to cause some of the air flowing past the engine when it is running to enter the opposite end of the tube and circulate through said tube toward and out of said rearwardly facing opening.

6. An internal combustion engine having a closed crank case for receiving lubricating oil and provided adjacent one end with an opening for the introduction of said oil, said engine being provided adjacent its opposite end with a port connecting the crank case with the atmosphere, and a substantially vertical open tube having an opening in its side wall connected to said port.

7. An internal combustion engine having a closed crank case for receiving lubricating oil and provided adjacent one end with an opening for the introduction of said oil, said engine being provided adjacent its opposite end with a port connecting the crank case with the atmosphere, and a substantially vertical open tube having an opening in its side wall connected to said port, the opening in the lower end of the tube facing rearwardly to cause some of the air flowing past the engine when it is running to enter its upper end and circulate downwardly through the tube.

8. An internal combustion engine having a closed crank case for receiving lubricating oil and provided adjacent one end with an oil inlet, a removable closure for said inlet provided with a perforated top, said engine being provided adjacent its opposite end with a port connecting the crank case with the atmosphere, an open tube having an opening in its side wall connected to said port, the openings in the opposite ends of said tube being so positioned relative to flow of air past the engine when it is running as to cause circulation of air through the tube in only one direction.

9. A method of preserving lubricating oil in an internal combustion engine in good condition, comprising operating said engine with its crank case full of vapor given off by said oil, and circulating a material current of air in the crank case only when said operation ceases in order to remove said vapor.

10. A method of preserving lubricating oil in an internal combustion engine in good condition, comprising substantially excluding circulation of an appreciable amount of outside air through the crank case of the engine while it is running, and admitting and circulating an appreciable amount of air in the crank case when the engine ceases running in order to expel from the crank case vapor given off by said oil.

JAMES R. MILLER.