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CRANKCASE VENTILATING SYSTEM

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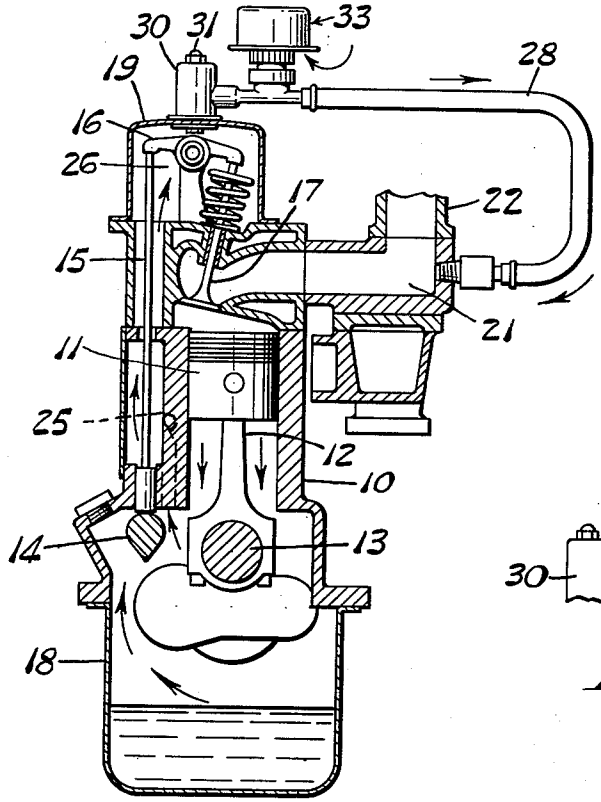


Fig. 1.

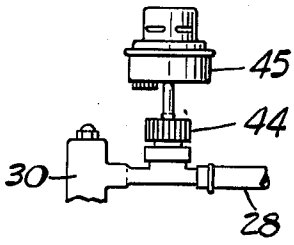
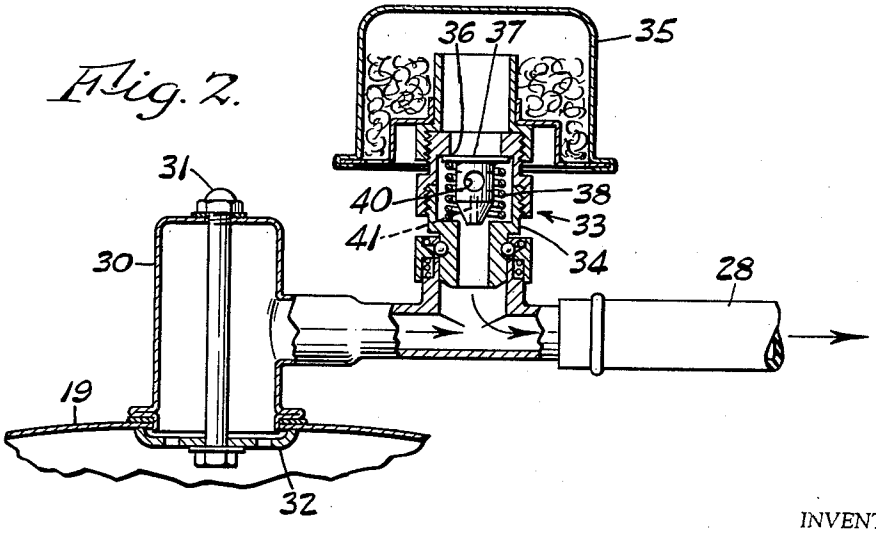


Fig. 3.

Fig. 2.



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CRANKCASE VENTILATING SYSTEM

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This invention relates to internal combustion engines and particularly to a novel system for ventilating the crank cases of internal combustion engines while avoiding direct discharge of gases therefrom to the atmosphere.

It is well known in the internal combustion engine art that there is an overall tendency for pressure to build up in the crank case due to gases which escape from the combustion chambers past the pistons into the crank case. There is also a high degree of turbulence in such a crank case due to the rapid movements of the pistons, the connecting rods and the crank shaft.

It is conventional to provide a breather or vent leading from the crank case to the ambient air, either separately or in conjunction with a crank case filler pipe. Such vents or breathers generally operate in either direction so that moisture laden air can enter the crank case from the atmosphere and, more importantly, air or other gas discharging from the crank case, particularly due to blow-by (the gas which passes from the combustion chamber to the crank case past the pistons) discharges noxious gases to the atmosphere surrounding the engine.

Since engine compartments are generally imperfectly sealed from the passenger compartment, there is substantial likelihood of air or other gases entering the passenger compartment. The air thus discharged from the crank case usually contains substantial amounts of vaporized unburned fuel and harmful products of partial combustion. Frequent attempts have been made in the prior art to avoid this discharge from the crank case to the surrounding atmosphere.

The present invention provides a novel, generally closed-circuit, ventilation system for internal combustion engines which provides air or gas flow from the interior of the crank case upwardly into the valve rocker arm compartment of the engine and thence to the intake manifold between the carburetor and the combustion chambers of the engine. In the present invention there is no outside gaseous communication with the crank case interior excepting past the pistons of the engine and from the crank case to the aforesaid rocker arm compartment.

In the combination of the present invention ingress means for ambient air is provided in a conduit leading from the rocker arm compartment of the engine to the intake manifold whereby air enters this conduit from the surrounding atmosphere when the subatmospheric pressure in the intake manifold exerts a sufficient pull on the line of communication from the crank case. In any event, the air ingress means is provided with a one-way valve which positively prevents movement of air or gas from the conduit to the atmosphere and normally closes the ingress means with respect to the movement of air or gas in either direction unless there is a predetermined pressure differential between the interior of the conduit and the ambient air.

When this predetermined pressure differential is reached, assuming the atmospheric pressure is greater than the pressure within the conduit, then the valve in the ingress means opens to admit atmospheric air to the conduit. Suitable filter means are provided for purifying the entering air. Ordinarily the aforesaid valve will be open during all periods of normal engine operation and air entering the conduit past the valve will pass to the combustion chambers along with the air-gas mixture from the carburetor and the gas flowing from the crank case through such conduit.

Specific apparatus exemplifying the principles of the present invention is illustrated in the accompanying drawing and is described in detail in the following specification. However, it is to be understood that the scope of the present invention is not limited to the specific apparatus thus shown and described and that the principles of the invention are not limited otherwise than as defined in the appended claims.

In the drawing:

FIG. 1 is a general transverse cross-sectional view through an internal combustion engine which incorporates one form of the ventilating system of the present invention;

FIG. 2 is an enlarged fragmentary view of the upper portion of the structure shown in FIG. 1 partially in cross-section; and

FIG. 3 is a fragmentary elevational view of a modified form of the air ingress component of the invention.

In the drawing, like characters of reference denote like parts and the numeral **10** designates a cylinder block of the type commonly used in automotive vehicle internal combustion engines. In the illustrated instance the engine is of the valve-in-head type, having pistons **11**, connecting rods **12**, a crank shaft **13**, cam shaft **14**, pushrods **15**, rocker arms **16** and valves **17**. The numeral **18** designates a generally conventional crank case and **19** designates a rocker arm cover. In FIG. 1 the numeral **21** designates an intake manifold having the usual carburetor **22** shown fragmentarily in association therewith.

One or more passages **25** are provided in the cylinder block **10** leading from the crank case to the pushrod housing portion of the engine which is in free fluid communication with the rocker arm compartment **26**, the latter being enclosed within rocker arm cover **19**. In the present invention any desired filler pipe or filler opening means may be provided but such means does not include a vent or breather. Accordingly, the only ingress or egress of air or other gas to or form the interior of the crank case **18** is past the pistons **11**, so-called "blow-by," or by way of passage or passages **25**.

A conduit **28** establishes free and open fluid communication between the rocker arm compartment within cover **19** and the intake manifold **21**. Fluid connection between conduit **28** and the rocker arm compartment is by way of a cup-shaped member **30** which is removably clamped over an opening in cover **19** by a bolt and nut device **31** and a perforated clamp plate **32**.

Conduit **28** is provided with a one-way inlet valve device designated generally by the numeral **33** and comprising a branch conduit **34** terminating in a filter cap **35** and including an annular valve seat **36**. A valve **37** seats yieldably upwardly against seat **36** under the impetus of a coil spring **38**. Differential pressure against the top of valve **36** exceeding the bias of spring **38** will unseat the valve but valve **37** positively prevents fluid flow upwardly from conduit **28**.

It will be noted that downward movement of valve **37** is limited by engagement of the conical lower end thereof in a reduced passage portion of conduit **34** but that such engagement does cut off air flow into conduit **28** from the atmosphere through valve device **33** by reason of passages **40** and **41** in valve **37**.

While spring **38** requires only a fairly light counteracting pressure to overcome the same and open valve **37**, its presence insures a predetermined minimum sub-atmospheric differential pressure in conduit **28** at all times when the engine is operating. Therefore a predetermined minimum pull or suction on the interior of the crank case is assured at all times when the engine is operating.

The point at which air enters the ventilating system

of the present invention, namely beyond the crank case and beyond the engine proper, and shortly in advance of the intake manifold, avoids introducing moisture laden air to the crank case as in conventional breathers. This moisture laden air in conventional arrangements creates sludge in the crank case and the harmful effects of this condition are well known. Furthermore, the moisture laden air which enters pipe 28 through inlet valve device 33 more or less constantly during normal engine operation is entrained by and mixes with the air-gas mixture flowing toward the combustion chambers from the carburetor and thus improves the efficiency of engine operation to a very noticeable degree.

The modification shown in FIG. 3 is the same as that of FIGS. 1 and 2 excepting only that a pressure gauge 44 is disposed in the inlet valve device 45 which corresponds to the inlet valve device 33 of the previous embodiment. Such differential pressure gauges for checking the operation of crank case ventilation systems are well known in the automotive engine art. The gauge merely measures and indicates the pressure differential between the ambient atmosphere and the interior of conduit 28, in the present instance. Such gauges in the form illustrated in outline in FIG. 3 are commercially available as General Motors Corporation AC Positive Crank Case Ventilation Testers and their construction and operation are known to those skilled in the automotive engine art.

I claim:

1. In an internal combustion engine crank case ventilating system, an internal combustion engine having a crank case at the bottom thereof, a valve rocker arm compartment at the top thereof, and a fuel-air intake manifold, passage means extending upwardly in said engine from the crank case to said rocker arm compartment, said crank case being normally closed and unvented excepting for said passage means, a conduit establishing continuous open communication between said rocker arm compartment and said intake manifold, a passage leading from said conduit to the atmosphere, and one-way valve means in said passage continuously operable to permit ingress of atmospheric air to said conduit whenever pressure in said conduit is substantially subatmospheric but preventing reverse fluid flow.

2. In an internal combustion engine crank case ventilating system, an internal combustion engine having a crank case at the bottom thereof, a valve rocker arm compartment at the top thereof, and a fuel-air intake manifold, passage means extending upwardly in said engine from the crank case to said rocker arm compartment, said crank case being normally closed and unvented excepting

for said passage means, a conduit establishing continuous open communication between said rocker arm compartment and said intake manifold, a passage leading from said conduit to the atmosphere, one-way valve means in said passage openable toward said conduit and continuously operable to permit flow of atmospheric air to said conduit whenever pressure in said conduit is substantially sub-atmospheric but preventing reverse fluid flow, and yieldable means urging said valve to closed position whereby the valve opens only when atmospheric pressure exceeds the pressure within said conduit.

3. An internal combustion engine having a crank case, a valve rocker arm compartment and a fuel-air intake manifold, passage means extending upwardly in said engine from the crank case to said rocker arm compartment, said crank case being normally closed and unvented excepting for said passage means, a conduit establishing continuous open communication between said rocker arm compartment and said intake manifold, a passage leading from said conduit to the atmosphere, and one-way valve means in said passage continuously operable to permit ingress of atmospheric air to said conduit whenever pressure in said conduit is substantially sub-atmospheric but preventing reverse fluid flow.

4. An internal combustion engine having a crank case, a valve rocker arm compartment and a fuel-air intake manifold, passage means extending upwardly in said engine from the crank case to said rocker arm compartment, said crank case being normally closed and unvented excepting for said passage means, a conduit establishing continuous open communication between said rocker arm compartment and said intake manifold, a passage leading from said conduit to the atmosphere, one-way valve means in said passage openable toward said conduit and continuously operable to permit flow of atmospheric air to said conduit whenever pressure in said conduit is substantially sub-atmospheric but preventing reverse fluid flow, and spring means urging said valve to closed position whereby the valve opens only when atmospheric pressure substantially exceeds the pressure within said conduit.

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