April 6, 1965 T. SINIBALDI 3,176,670

INTERNAL COMBUSTION ENGINES

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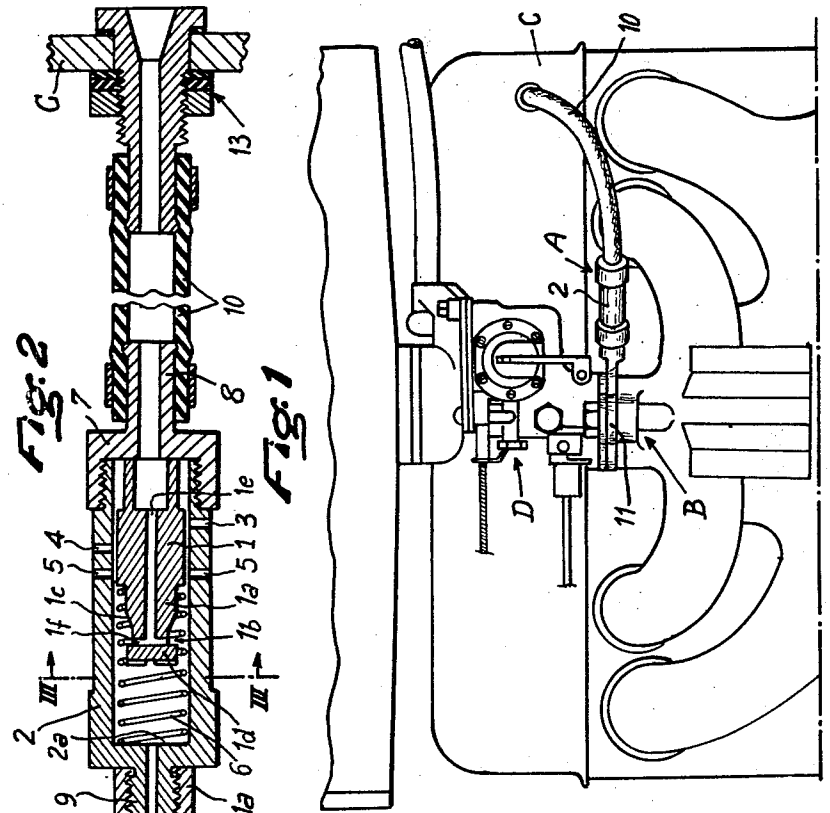

Fig. 1

Fig. 2

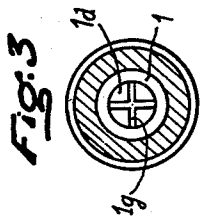

Fig. 3

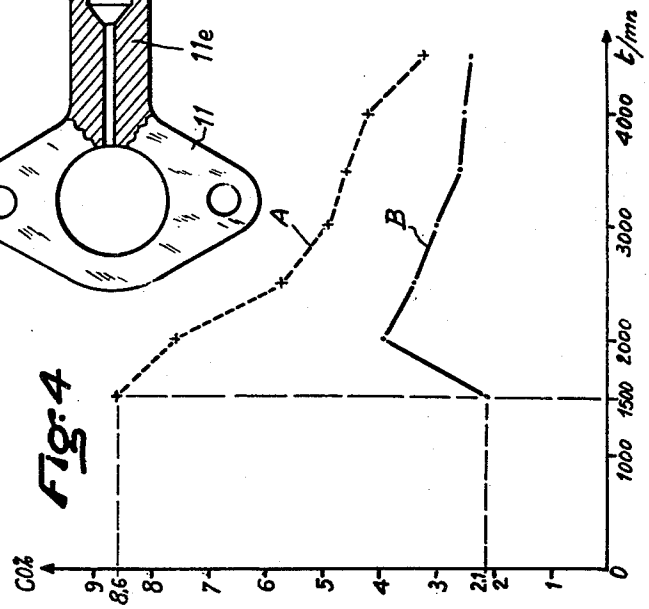

Fig. 4

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INTERNAL COMBUSTION ENGINES

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This invention relates to an arrangement for improving the combustion in internal combustion engines of the explosion or vaporizing type with a partciular view to reducing the carbon monoxide (CO) content of the exhaust gas of such engines.

The arrangement according to the invention comprises a conduit inter-connecting the inlet manifold of the engine with the interior of the valve cover to remove oil fumes therefrom and in which is incorporated a valve comprising a body having air inlet orifices opening into the atmosphere and a movable valve member which is subjected to the depression prevailing in the inlet manifold against the action of a restoring spring, the said valve being designed and arranged to operate in such a manner that its movable valve member uncovers a number of air inlet orifices which increases with the depression in the inlet manifold.

Such an arrangement, which is connected to the valve cover, sucks in only oil fumes and thus does not run the risk of becoming blocked by drops of oil as with arrangements which inject liquid oil coming from the crankcase into the air filter or air inlet. Moreover the progressive increase in the amount of added air, at the same time as oil fumes, ensures, by appropriate metering, proper functioning under all operating conditions of the engine.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 shows the embodiment mounted on an internal combustion engine.

FIG. 2 is a longitudinal sectional view on a larger scale of the embodiment.

FIG. 3 is a cross-section on the line III—III of FIG. 2, and

FIG. 4 is a graph showing the carbon monoxide content of exhaust gas plotted against engine speed of an engine working at quarter load.

The apparatus of the arrangement shown at A in FIG. 1 interconnects the inlet manifold B of an internal combustion engine with the interior of the valve and rocker cover C. In this embodiment, the apparatus carries a flange 11 (FIG. 2) which is placed between the flange of the carburetor D and the inlet manifold B.

The apparatus A comprises a piston 1 capable of sliding longitudinally in the interior of a cylindrical body 2 in which are formed radially extending air inlet holes which are staggered in three rows in the direction of movement of the piston 1.

The first row comprises a single hole 3, the second row a single hole 4 on the opposite side of the bore and the third row comprises four holes 5 in the same transverse plane of the body 2.

The piston 1 has an extension 1*a* in which is cut an annular groove 1*b* bounded on one side by a truncated conical surface 1*c* and on the other side by a cylindrical flange 1*d*. A weak helical spring 6 is engaged over the extension 1*a* and its ends bear against the piston 1 and the corresponding internal end face of he body 2. The piston 1 has an axial passage 1*e* which communicates with the exterior of the piston through two diametrically opposite radial conduits 1*f* which open into the groove 1*b*.

The body 2 is closed by a plug 7 provided with a nipple 8. At its other end, the body carries a threaded nipple 9. On the nipple 8 is engaged a rubber tube 10 which communicates with the interior of the rocker cover C of the

engine by means of a suitable fitting 13, while the threaded nipple 9 is screwed into a threaded hole drilled in a radial extension 11*e* of a flange which is clamped between the inlet manifold B (FIG. 1) and the supporting flange of the carburetor D.

The end face of the downstream end of the piston 1 is grooved in the form of a cross 1*g* to allow air to pass over it when the piston is in contact with the end wall 2*a* of the body 2.

With these arrangements, the oil fumes are conveyed from the rocker chamber and crankcase by the tube 10 to the nipple 8 and to the interior of the body 2. They then pass into the interior of the piston and leave it through the passages 1*f*. Depending on the depression which obtains downstream of the carburetor in the inlet manifold, the piston is displaced to a greater or lesser extent against the action of the spring 6 and one or several of the air inlet holes are uncovered. Air then mixes with the oil fumes and this mixture is well homogenized due to the flange 1*d* which causes considerable turbulence at the outlets of the pasasges 1*f*. The air fumes mixture is drawn into the inlet manifold and there mixes with the petrol (gasolene) air mixture before entering the combustion chamber.

Due to the excellent combustion effected by the mixture of air-petrol (gasolene) -oil fumes, the exhaust gases of the engine are almost wholly free from noxious gases.

It is well known that the exhaust gases of engines contain, among other gases, carbon monoxide and carbon dioxide and that it is during slow running that carbon monoxide (the most noxious gas) occurs in the greatest quantity; now engines run slowly most often in towns and it is precisely there that carbon monoxide is least easily dispersed since there is little or no stirring up of the layers of air. As a result, the emitted carbon monoxide attains its maximum noxiousness in the most densely populated areas and thus it is during slow running of the engine that it is most important to obtain maximum purification of the exhaust gases. Now the previously known exhaust purifiers only give efficient purification of the exhaust gases at higher engine speeds.

By way of example, FIG. 4 shows a graph of the carbon monoxide percentage (by volume) in the exhaust gas of an engine running under quarter load plotted against engine speed in revolutions per minute. The greatest improvement occurs at 1500 r.p.m. where it will be seen that there is 2.1% of CO (curve B) when the engine is equipped with an arrangement according to the invention as against 8.6% (curve A) for the same engine without the arrangement.

The following table shows values obtained by experiment at quarter load.

Approximate engine speed in r.p.m.	Approximate engine H.P.	CO content of exhaust gas (percent by volume)	
		Without the arrangement	With the arrangement
500	(1)	3.6	0.8
1,500	3	8.6	2.1
2,000	4	7.6	3.9
2,500	5	5.7	3.4
3,000	6	4.9	3.0
3,500	7	4.6	2.6
4,000	8	4.2	2.5
4,500	9	3.2	1.9

[1] Idling, no load.

What I claim is:

1. An arrangement for improving the combustion in internal combustion engines of the explosion or vaporizing type having an intake manifold and a valve cover, com-

prising a conduit adapted for interconnecting the inlet manifold of the engine with the interior of the valve cover to suck oil fumes from the latter, and a valve incorporated in said conduit and comprising a body having a bore interconnecting an oil fume inlet opening and an outlet opening in the body, a valve member, which has a passageway therethrough intercommunicating said inlet and outlet openings, slidably mounted in the bore, and resilient means urging the valve member towards the oil fume inlet opening, the said body having air inlet means opening into said bore and progressively uncovered by the valve member as the valve member is moved against the resilient means by increasing depression at the outlet opening to increase the air inflow in accordance with increasing inlet manifold suction.

2. An arrangement according to claim 1, wherein the air inlet means includes holes in the body, which are spaced longitudinally in the direction of movement of the valve member.

3. An arrangement according to claim 1, wherein the bore is cylindrical and the passageway in the valve member includes an axial portion extending from the end of the valve member nearer the oil fume inlet, the said axial passageway portion communicating at its other end with radially extending passages opening through a part of the external surface of the valve member which includes the end of the valve member nearer the valve outlet and which is of a diameter less than that of the bore.

4. An arrangement according to claim 3, wherein the said radial passages open into an annular groove in the valve member, the said groove being bounded on its side nearer the valve outlet by a flange of external diameter less than that of the bore.

5. An arrangement according to claim 4, wherein the annular groove is bounded on its other side by a frusto-conical surface of the valve member.

6. An arrangement according to claim 1, wherein the end faces of the valve member and the bore end wall nearer the outlet are shaped to provide communication between the bore and the outlet even when said valve member contacts said bore end wall.

7. A valve for connecting the interior of a valve cover of an internal combustion engine to the inlet manifold thereof to such oil fumes from the valve cover and to

deliver a mixture of such oil fumes and air to the inlet manifold, said valve comprising, in combination, a body having a bore interconnecting an oil fume inlet opening and an outlet opening in the body, a valve member, which has a passageway therethrough intercommunicating said inlet and outlet openings, slidably mounted in the bore, and resilient means urging the valve member toward the oil fume inlet opening, the said body having air inlet means opening into said bore and progressively uncovered by the valve member as the valve member is moved against the resilient means by increasing depression at the outlet opening to increase the air flow in accordance with increasing suction at the outlet opening.

8. A valve as claimed in claim 7, wherein the air inlet means includes holes in the body which are spaced longitudinally in the direction of movement of the valve member.

9. A valve as claimed in claim 7, wherein said bore is cylindrical and the passageway in the valve member includes an axial portion extending from the end of the valve member nearer the oil fume inlet, the said axial passageway portion communicating at its other end with radially extending passages opening through a part of the external surface of the valve member which includes the end of the valve member nearer the valve outlet and which is of a diameter less than that of the bore.

10. A valve as claimed in claim 9, wherein the said radial passages open into an annular groove in the valve member, the said groove being bounded on its side nearer the valve outlet by a flange of external diameter less than the diameter of the bore.

11. A valve as claimed in claim 10, wherein the annular groove is bounded on its other side by a frustro-conical surface of the valve member.

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