April 29, 1941. H. H. McDOWELL. 2,240,459

FUEL ECONOMIZER FOR INTERNAL COMBUSTION ENGINES

Filed Feb. 5, 1940 2 Sheets-Sheet 1

Fig. 1.

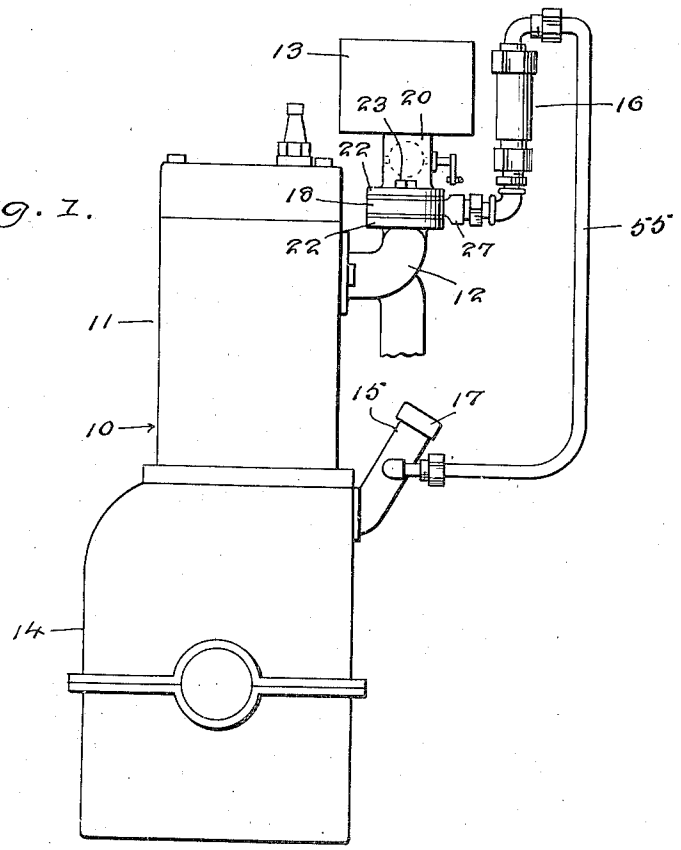


Fig. 8.

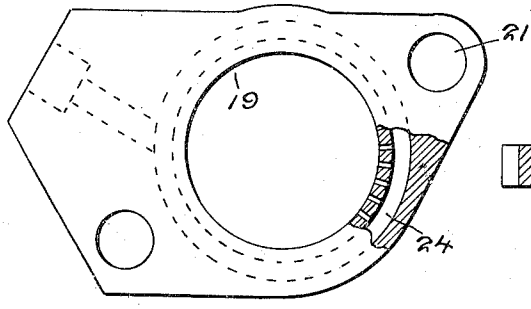
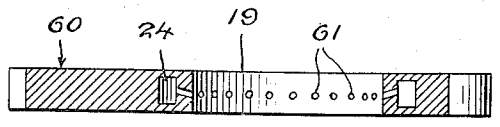


Fig. 9.



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Filed Feb. 5, 1940 2 Sheets-Sheet 2

Fig. 2.

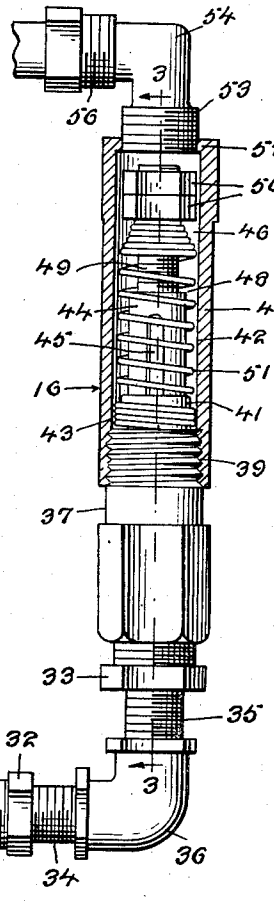


Fig. 3.

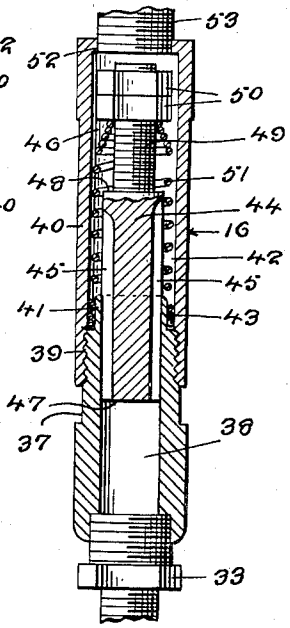


Fig. 4.

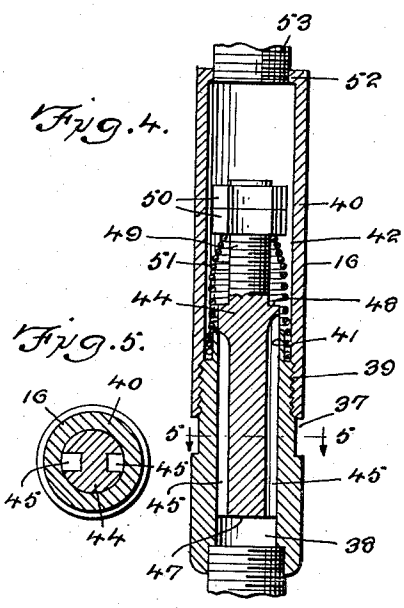


Fig. 5.

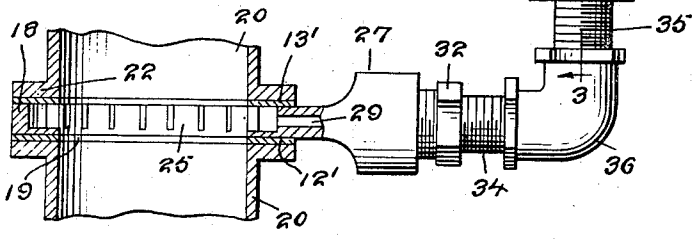


Fig. 7.

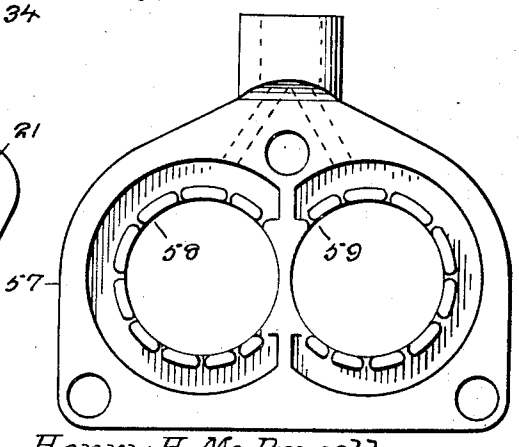
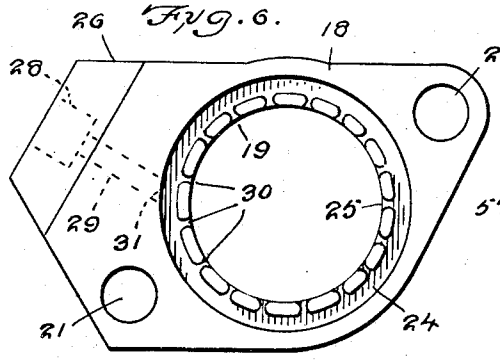


Fig. 6.



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Patented Apr. 29, 1941

2,240,459

UNITED STATES PATENT OFFICE

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FUEL ECONOMIZER FOR INTERNAL COMBUSTION ENGINES

Henry H. McDowell, Portland, Oreg.

Application February 5, 1940, Serial No. 317,395

4 Claims. (Cl. 123—119)

My invention relates broadly to internal combustion engines and more particularly to new and useful improvements in fuel economizers therefor.

An important object of my invention is the provision of a device that may be easily applied to any internal combustion engine and that is adapted to permit the mixture of air and gas that passes by the pistons into the crankcase to return to the compression chamber of the cylinders.

Another object of my invention is the provision of a device of the above-mentioned character that is automatic in its action to cut off the auxiliary flow of the crankcase fuel vapors to the cylinders when the engine is idling, but when the motor is accelerated to cause greater quantities of fuel to pass by the cylinders, the present invention will uniquely adapt itself to permit an increasingly greater flow of the crankcase vapors to the engine.

Still another object of my invention is the provision of a device of the above-mentioned character that provides for the lubrication of the valves and upper piston rings by means of the oil vapors taken from the crankcase.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the drawings, forming a part of this specification, and wherein like numerals are employed to designate like parts throughout the same—

Figure 1 is an end elevation of an internal combustion engine, and showing a device embodying my invention incorporated therewith,

Figure 2 is a side elevation, showing parts in section, of my device,

Figure 3 is a fragmentary longitudinal sectional view taken on the line 3—3 of Figure 2,

Figure 4 is a view similar to Figure 3, but showing the valve in a substantially closed position,

Figure 5 is a transverse sectional view taken on the line 5—5 of Figure 4,

Figure 6 is a top plan view of a spray washer or spacer embodying a part of my invention,

Figure 7 is a top plan view of a modified form of spray washer,

Figure 8 is a bottom plan view, showing parts broken away, of the spray washer illustrated in Figure 6, and

Figure 9 is a vertical sectional view of yet another form of spray washer.

In the accompanying drawings, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 10 designates an internal combustion engine including an engine block 11, intake manifold 12, carburetor 13, and a crankcase 14 having a filler tube 15 closed by the cap 17 communicating therewith in the conventional manner.

My invention comprises a pressure actuated valve 16 communicating at one end with the fuel passage between the carburetor and intake manifold and at the other end to any chamber in the internal combustion engine where blow-by exhaust gases accumulate. The last-mentioned end of the valve is here illustrated as being attached to the crankcase filler tube in a manner to communicate with the crankcase above the level of the oil contained therein.

It is a well known fact that when the piston rings become worn the exhaust gases from the combustion chamber of the cylinders frequently blow by the pistons into the crankcase and that this action is substantially greater when the engine is running at a high rate of speed. Leaky valves sometimes permit the gases in the combustion chamber of the cylinder to escape by the valves and into the chamber rearwardly thereof.

In internal combustion engines of the type employing overhead valves, the valve 16 may be applied thereto in a manner to communicate with the fuel passage between the carburetor and intake manifold and with either the filler tube of the crankcase or the rocker arm cover. In internal combustion engines of the type employing a push valve arrangement, the last-mentioned end of the valve 16 may be connected to either the crankcase filler tube or the valve plate cover.

The present invention is uniquely adapted to employ the vacuum or suction normally existent in the fuel passage between the carburetor and intake manifold to draw the blow-by exhaust gases from their respective chambers and to return the same to the combustion chambers of the cylinders through the intake manifold and to thereby provide a better fuel mixture for the combustion chamber. In addition to reducing the quantity of fuel flowing from the carburetor into the combustion chamber, the oil fumes in the returned blow-by vapors will lubricate the top piston ring and valves to improve the operation of the engine. The utilization of a portion of the vacuum or suction in the intake manifold to draw the blow-by exhaust gases therein will slightly reduce the pull of the vacuum on the gasolene needle valve in the carburetor, and the

blow-by exhaust gases will furnish the additional increment of fuel necessary to fully charge the combustion chamber of the cylinders.

The spray washer or spacer 18 comprises a flat plate adapted to be interposed between the carburetor 13 and the intake manifold 12 and gaskets 12' and 13' are provided at opposite sides of the spacer to assure a tight connection between the parts. The plate is provided with a central opening 19 adapted to register with the fuel passage 20 of the carburetor and manifold and with openings 21 at opposite sides of the opening 19 adapted to register with openings in the carburetor and manifold flanges 22 to receive the threaded bolts 23 by which the carburetor and manifold are joined together. An annular chamber or reservoir 24 opens through one face of the washer and is positioned in circumjacent relation to the central opening 19 but spaced therefrom by the upstanding partition 25. The side 26 of the washer is elongated to extend beyond the periphery of the flanges 22 of the carburetor and intake manifold and the extending portion is of substantially greater thickness than the main body of the washer to provide a boss 27. The boss is formed with a screw-threaded recess 28 and the passage 29 affords communication between the recess and the annular chamber or reservoir 24.

As illustrated in Figure 6, the partition 25 is provided with a plurality of spaced slots 30 which afford direct communication between the annular chamber 24 and the inner opening 19. The slots 30 are spaced the greatest distance apart adjacent the discharge end 31 of the passage 29 and the distance between adjacent slots is gradually decreased toward the side of the opening diametrically opposed to the discharge end of the passage.

The nipple 32 is received by the boss 27 of the washer and the nipple 33 is received by the end 34 of the valve 16. Pipe sections 34 and 35 connect the nipples 32 and 33 with the elbow connection 36 in a manner to position the valve 16 normally to a plane containing the washer.

The valve 16 includes a tubular body 37 formed with an internal bore 38 and the end 39 thereof is externally screw-threaded to receive the tubular valve cover 40. An extension 41 is formed on the valve body beyond the screw-threaded portion 39 thereof, which extension is of reduced diameter in a manner to cooperate with the internal wall 42 of the valve cover in providing an annular recess 43.

The cylindrical plunger 44 is slidably mounted in the internal bore 38 of the valve body and is formed with a plurality of circumferentially spaced longitudinal grooves 45 which afford communication between the axial bore 46 of the valve cover and the bore 38 of the valve body. As illustrated in Figure 3, all of the grooves open through the end 47 of the valve and terminate short of the end 48 thereof. The end of the grooves adjacent the end 48 open through the side wall of the valve and at different distances from the said end 48 whereby each of the passages will be of a different length and will act to progressively close communication between the bore 46 of the valve cover and the bore 38 of the valve body when the valve plunger is slidably actuated a sufficient distance into the bore 38 to move the entire length of the passages 45 therein. The end 48 of the valve is formed with a longitudinally extending externally screw-threaded shank 49 which receives the check nuts 50. A coil spring 51 has one end thereof disposed in the annular recess 43 and around the extension 41 of the valve body and the other end thereof seated against the underside of the nuts 50 whereby rotation of the nuts axially along the shank 49 will vary the tension on the springs 51. The resilient action of the spring is exercised in a direction to move the valve plunger 44 out of the bore 38 and into the bore 46.

The grooves 45 in the periphery of the valve plunger 44 are here illustrated as being two in number and as being positioned at diametrically opposed sides thereof; however, it is to be understood that any desired number of grooves may be used.

The end 52 of the valve cover is internally screw-threaded to receive the end 53 of the elbow 54, and a pipe connection 55 is coupled to the end 56 of the elbow 54 and to the filler tube 15 of the crankcase.

The operation of my device is as follows:

When the engine 10 is idling, the vacuum or suction in the fuel passage 20 of the intake manifold is relatively great. The nuts 50 carried by the plunger 44 are adjusted so that the tension of the coil spring 51 will permit the suction in the fuel passage 20, during idling of the engine, to pull the plunger valve into the bore 38 of the valve body and to close communication between the valve cover and the valve body. It is thus evident that during idling of the engine, when little or no exhaust gases are escaping by the pistons, the pressure control valve 16 will be closed to permit all of the fuel to be received from the carburetor 13.

As the engine 10 is accelerated, the blow-by vapors passed by the cylinders will begin to accumulate in the crankcase and the pressure or suction in the manifold fuel passage 20 will gradually decrease to permit the resilient action of the coil spring 51 to move the plunger valve into the bore of the valve casing and to expose the upper ends of the grooves 45. During the initial acceleration of the engine, the reduction of the suction in the manifold fuel passage will be relatively small whereby the resilient action of the spring 51 will only be sufficient to move the plunger valve but a slight distance into the valve casing and to expose but one of the grooves 45, as illustrated in Figure 4.

When the engine is traveling at a high rate of speed, the blow-by gases will be accumulating at a very rapid rate of speed, and the suction in the manifold passage will be substantially diminished to permit the resilient action of the spring 51 to move the plunger valve substantially all the way into the bore of the valve cover, as illustrated in Figure 3. By making certain of the grooves of greater length than other of the grooves, fluttering or vibration of the plunger valve will be prevented by virtue of the fact that the fuel vapors passing through the grooves will first enter the longer of the grooves to force the plunger laterally against the wall of the bore of the valve casing.

When the fuel vapors pass from the valve 16 into the annular chamber or reservoir 24 of the spray washer, they will be drawn into the fuel passage 20 of the intake manifold through the slots 30. The manner in which the slots are disposed progressively closer together in a direction away from the discharge end 31 of the passage 29 will permit the fuel vapors to substantially fill the entire chamber 24 and to be substantially evenly introduced into the passage 20.

Figure 7 illustrates a spray washer or spacer 57 similar in shape and adapted to operate in the same manner as the spacer 18 hereinbefore described, with the exception that the spacer 57 is provided with a pair of spaced openings 58 and 59. The spacer 57 is adapted to be applied to a V-shaped combustion engine and to be inserted between the carburetor and intake manifold with the openings 58 and 59 in register with the divergent fuel passages leading from the carburetor. The remaining construction and operation of the spacer 57 is so similar to the spacer 18 that no further explanation is thought to be necessary.

Figure 9 illustrates a spacer 60 which is similar to the spacer 18 with the exception that the annular chamber or reservoir 24 does not open through either face of the spacer, but is entirely enclosed and communicates with the central opening 19 through a plurality of circumferentially spaced passages 61. The passages 61 are preferably spaced from the discharge end 31 of the passage 29 in the same manner and for the same reason set forth for the slots 30.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of my invention, or scope of the appended claims.

Having thus described my invention, I claim:

1. In an internal combustion engine including a carburetor to control the flow of fuel to the intake manifold and a crankcase disposed below the engine block, the improvements comprising a by-pass to return fuel vapors in the crankcase to the intake manifold, said by-pass comprising a disk-shaped spacer interposed between the carburetor and manifold; a valve casing having an axial bore a portion of which is of reduced diameter and in communication with the fuel passage of the intake manifold through the side wall of the said spacer, the other end of the casing being in communication with the said crankcase; a valve slidable in the reduced portion of the bore of the casing and having longitudinal grooves which open through the end of the valve nearest the said manifold but which terminate short of the end remote therefrom; spring means urging the valve in a direction away from the manifold; and means to vary the tension of the said spring means, whereby the vacuum in the intake manifold during idling of the engine will move the valve into the reduced portion of the bore against the resilient action of the spring means to close the remote ends of the grooves, and whereby diminution of the vacuum caused by acceleration of the engine will permit the spring means to gradually move the closed ends of the grooves into the enlarged portion of the bore to permit vapors from the crankcase to be drawn into the intake manifold.

2. In an internal combustion engine including a carburetor to control the flow of fuel to the intake manifold and a crankcase disposed below the engine block, the improvements comprising a by-pass to return fuel vapors in the crankcase to the intake manifold, said by-pass comprising a valve casing having an axial bore a portion of which is reduced and in communication with the fuel passage of the intake manifold, the other end of the casing being in communication with the said crankcase; a valve slidable in the reduced portion of the bore and having longitudinal grooves which open through the end of the valve nearest the said manifold but which terminate short of the end remote therefrom; spring means urging the valve away from the manifold; and means to adjust the tension of the said spring means, whereby the vacuum in the intake manifold during idling of the engine will move the valve into the reduced portion of the bore of the casing against the resilient action of the spring means to close the remote ends of the grooves, and whereby diminution of the vacuum caused by acceleration of the engine will permit the spring means to gradually move the closed ends of the grooves into the enlarged portion of the bore to permit vapors from the crankcase to be drawn into the intake manifold.

3. In an internal combustion engine including a carburetor to control the flow of fuel to the intake manifold and a crankcase disposed below the engine block, the improvements comprising a by-pass to return fuel vapors in the crankcase to the intake manifold, said by-pass comprising a valve casing having an axial bore a portion of which is reduced and in communication with the fuel passage of the intake manifold, the other end of the casing communicating with the said crankcase; a valve slidable in the casing and having a plurality of longitudinal passages spaced circumferentially therearound, each of the passages being of different lengths and all of the passages opening through the end of the valve nearest the manifold and through the side wall of the valve at the end remote therefrom; spring means urging the valve away from the manifold; and means to vary the tension of the said spring means, whereby the vacuum in the intake manifold during idling of the engine will move the valve into the reduced portion of the bore of the casing against the resilient action of the spring means to close the remote ends of the passages, and whereby diminution of the vacuum caused by acceleration of the engine will permit the spring means to progressively move the closed ends of the passages into the enlarged portion of the bore to permit vapors from the crankcase to be drawn into the intake manifold.

4. A valve assembly comprising a spacer having a central opening and an annular chamber separate from and circumjacent to the central opening but having communication therewith through a plurality of spaced ports; a valve casing having an axial bore, a portion of the bore at one end of the casing being of reduced diameter and in communication with the annular chamber of the said spacer, and the portion of the bore of greater diameter being in communication with the said crankcase; a cylindrical valve slidable in the reduced portion of the bore of the casing and having a plurality of longitudinal passages spaced circumferentially thereabout, each of the passages being of different lengths and all of the passages opening through the end of the valve remote from the enlarged portion of the bore and through the side wall of the valve at the end thereof adjacent the enlarged portion of the bore; spring means urging the valve into the enlarged portion of the bore; and means to vary the tension of the said spring means.

HENRY H. McDOWELL.