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[22] Filed **Oct. 27, 1969**
[45] Patented **June 28, 1971**
[73] Assignee **Green Bay Research Corporation**
Green Bay, Wis.

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[54] **ENGINE VAPOR RECYCLING DEVICE WITH INTERNAL TEMPERATURE REGULATION**
11 Claims, 4 Drawing Figs.

[52] U.S. Cl..... 123/119,
123/122, 123/142.5
[51] Int. Cl..... F02f 9/02,
F02n 17/02, F02m 31/00
[50] Field of Search..... 123/119
(B), 142.5, 122 (F), 122 (A)

ABSTRACT: An engine vapor recycling device having valve balls slideable in a sleeve and which may stick at low temperatures. The balls are prevented from sticking by controlling the temperature thereof when the engine is off. This may be accomplished by an insulating casing, or by a thermostat controlled heating coil. Starting of the engine will cause the thermostat to shut off an operating coil.

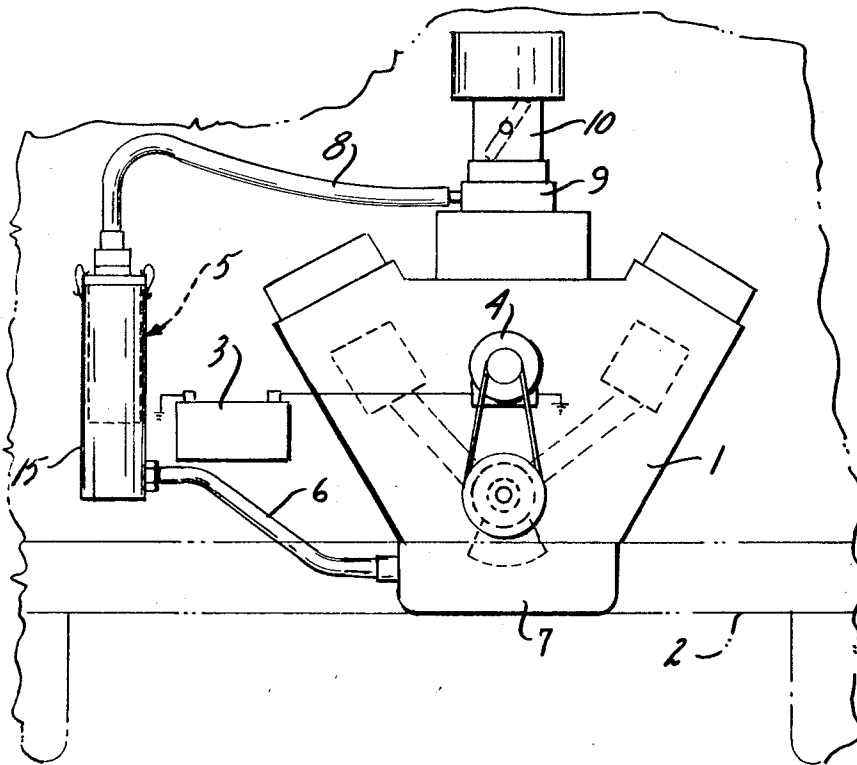


FIG. 1

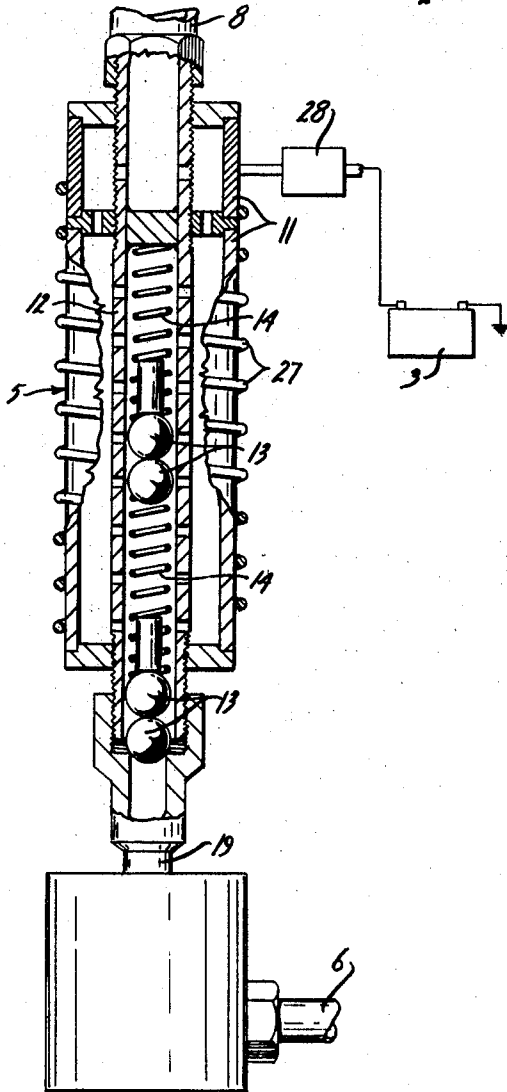
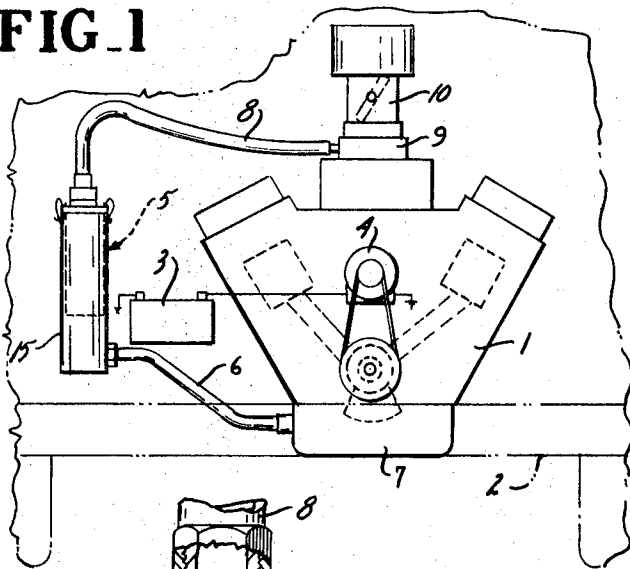


FIG. 4

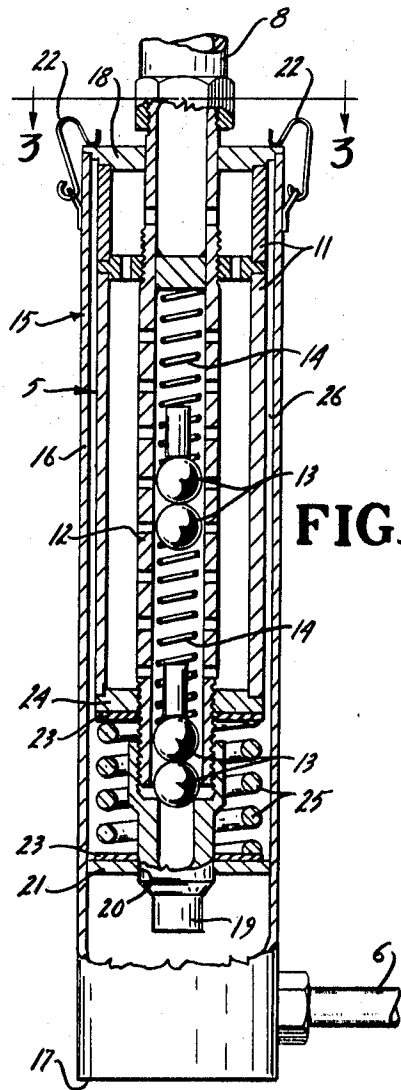


FIG. 2

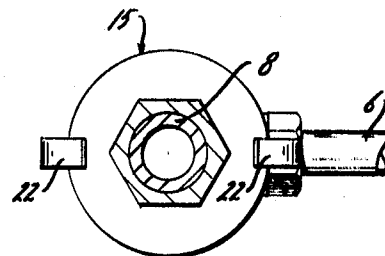


FIG. 3

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ENGINE VAPOR RECYCLING DEVICE WITH INTERNAL TEMPERATURE REGULATION

BACKGROUND OF THE INVENTION

This invention relates to an engine vapor recycling device with internal temperature regulation.

The reduction of undesirable emissions from exhausts of internal combustion engines has long been desirable. More recently, the increase in smog in many areas has made the matter more urgent than in the past.

The present inventor has developed a number of engine vapor recycling devices, as evidenced by his U.S. Pat. No. 3,450,114, as well as by his copending U.S. Pat. application Ser. No. 821,335, Filed May 2, 1969. See also the present inventor's copending U.S. Pat. application Ser. No. 821,336, Filed May 2, 1969.

These devices of the inventor utilize unique valve means therein which assist in removing undesirable pollutants in the engine crankcase discharge gases. The gases are then returned to the engine manifold. The valve means under consideration includes a number of spring biased balls which ride up and down in vertical sleeves through which the gases flow. While the balls must be able to move within the sleeves, and in some instances permit gases to pass thereby, the tolerances are quite close.

When the engine has not been running for some time, it has been found that the valve balls will tend to stick in position and will not always function properly upon engine start-up. This is true, for example, in an automobile which has been parked overnight during cold weather, and is probably due to the contraction of the valve parts.

SUMMARY OF THE INVENTION

The present invention solves the aforementioned problem, and provides a means to maintain the recycling device valves at a higher than ambient temperature, even when the engine is inoperative over an extended period. In one embodiment, the walls of the recycling device are insulated from the external air, while in another embodiment, additional heat is applied directly to the device.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing illustrates the best mode presently contemplated by the inventor for carrying out the invention.

In the drawing:

FIG. 1 is a schematic showing of a portion of a motor vehicle having an engine and vapor recycling device embodying the present invention;

FIG. 2 is a central vertical section of the recycling device which includes an insulating type temperature control;

FIG. 3 is a transverse section taken on line 3-3 of FIG. 2; and

FIG. 4 is a view similar to FIG. 2 and showing another embodiment of temperature control.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown generally in FIG. 1 of the drawing, the invention may be embodied in connection with the engine 1 of a motor vehicle 2. A suitable battery 3 and generator 4 are connected to engine 1.

The input to engine vapor recycling device 5 is connected through a suitable passage or conduit 6 to the sealed crankcase 7 of engine 1, while another conduit 8 connects the output of device 5 to engine intake manifold 9. Device 5 is disposed externally of engine 1. A carburetor 10 of any suitable design is mounted adjacent manifold 9.

Device 5 is disposed between crankcase 7 and manifold 9 and is adapted to receive polluted gases from crankcase 7 through conduit 6, treat them, and then discharge the treated gases through conduit 8 where they return to manifold 9.

The device shown in FIGS. 2 and 3 is similar to that disclosed in the inventor's above-mentioned copending application Ser. No. 821,335. It includes an outer housing 11 having an inner sleeve 12 with balls 13 biased by springs 14 disposed for sliding movement therein to provide valve means responsive to manifold vacuum (and crankcase pressure). The invention is also usable in a device similar to that shown in the inventor's above-mentioned U.S. Pat. Ser. No. 3,450,114.

It has been found that balls 13 may tend to stick in position when engine 1 is restarted after extended inactivity in cold weather. To solve this problem, temperature regulation means are provided to assist in maintaining device 5, sleeve 12 and balls 13 in a normal condition above a desired predetermined minimum temperature to reduce sticking. Such a minimum temperature may be about 35° F.

As shown in FIGS. 2 and 3, device 5 is insulated from the ambient air. For this purpose, device 5 is enclosed within an outer casing 15 which is provided with a sidewall 16 and a bottom 17. Device 5 is held in aligned position within casing 15 at the top and bottom. At the top, a stepped cover 18 is provided, with the outer step fitting into the top edge of casing wall 16 and an inner step fitting into the top edge of housing 11. At the bottom, a drain tube 19 for device 5 extends downwardly through the central opening 20 in a platelike support 21 in casing 15. Cover 18 and the edges of opening 20 thus align device 5 so that its outer sidewalls are spaced from walls 16 and so that the device is in an enclosed chamber.

Suitable clamp means 22 fixedly secure cover 18 in place and against vertical movement. In addition, means are provided to biasingly urge device 5 upwardly against cover 18. For this purpose, a pair of spaced fiber washers 23 are respectively disposed on drain tube 19 beneath the bottom 24 of device 5 and above support 21. A spring 25 is confined between washers 23 and provides the biasing force.

The insulating space 26 has been found to substantially slow the cooling of device 5 after engine 1 is turned off and hot gases cease flowing through the device.

In FIG. 4, the temperature control device is of the positive type. Instead of providing an insulating casing, a heating coil 27 directly surrounds device 5, and is connected through a temperature activated thermostat 28 to battery 3 or some other suitable source of electric power. When the ambient temperature reaches a set minimum, thermostat 28 will cause coil 27 to heat device 5 and maintain it at such a temperature that balls 13 will not stick. When engine 1 starts, the hot gases therefrom will heat device 5 quickly, thus causing thermostat 28 to deactivate the heater in response thereto.

In both embodiments, suitable valve means may be utilized for automatically draining sludge through tube 19. Such valve means are disclosed in the inventor's U.S. Pat. Ser. No. 3,450,114 and copending application Ser. No. 821,336.

I claim:

1. For connection to an engine having an intake manifold and crankcase, an engine vapor recycling device for treating hot crankcase gases and returning them to the manifold, said device including:

- a. gas flow valve means having moving parts which tend to stick at low temperatures,
- b. means for connecting said valve means between the engine crankcase and manifold so that said valve means is disposed externally of the engine and is exposed to low ambient air temperatures when the engine is off,
- c. and temperature regulating means for maintaining said valve means above said low ambient air temperatures when the engine is off for an extended period.

2. The device of claim 1 in which:

- a. said recycling device running an outer housing,
- b. and said temperature regulating means surrounds said housing.

3. The device of claim 2 wherein said temperature regulating means comprises:

- a. a casing having an outer wall,

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b. and means for aligningly mounting said recycling device housing within said casing so that said housing is spaced from said outer wall.

4. The device of claim 3 wherein said mounting means, comprises a stepped cover, said casing outer wall being mounted on the outer step of said cover, and said housing being mounted on an inner step of said cover.

5. The device of claim 3 wherein said mounting means includes:

- a. a drain tube extending downwardly from said housing,
- b. and a support forming part of said casing,
- c. said support having an opening therein through which said tube extends.

6. The device of claim 3

a. wherein said mounting means includes:

- 1. a cover on which said casing wall and housing are mounted at the top,
- 2. a drain tube extending downwardly from the bottom of said housing,
- 3. and a support forming part of said casing,
- 4. said support having an opening therein through which said tube extends,

b. and means means said housing upwardly against said cover.

7. The device of claim 6 wherein said biasing means comprises: a spring confined between said support and the bottom of said housing.

8. The device of claim 2 wherein said temperature regulating means comprises:

- a. a heater disposed about said housing,
- b. and means responsive to the ambient temperature to activate said heater when said ambient temperature drops to a predetermined minimum.

9. The device of claim 8 in which said heater activating means is responsive to restarting of the engine to deactivate said heater.

10. In an engine vapor recycling device for treating hot engine gases and which is exposed to low ambient temperatures when the engine is off, said device including an outer housing:

- a. gas flow valve means having moving parts which tend to stick at low temperatures,
- b. and temperature regulating means surrounding said outer housing for maintaining said valve means above said low ambient temperatures when the engine is off for an extended period, said temperature regulating means comprising:

- 1. a heater disposed about said housing,
- 2. and means responsive to the ambient temperature to activate said heater when said ambient temperature drops to a predetermined minimum.

11. The device of claim 10 in which said heater activating means is responsive to restarting of the engine to deactivate said heater.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,587,544 Dated June 28, 1971

Inventor(s) Cecil W. Miles

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 23, cancel "means", second occurrence,
and substitute therefor ---biasing---

Signed and sealed this 21st day of December 1971.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents