

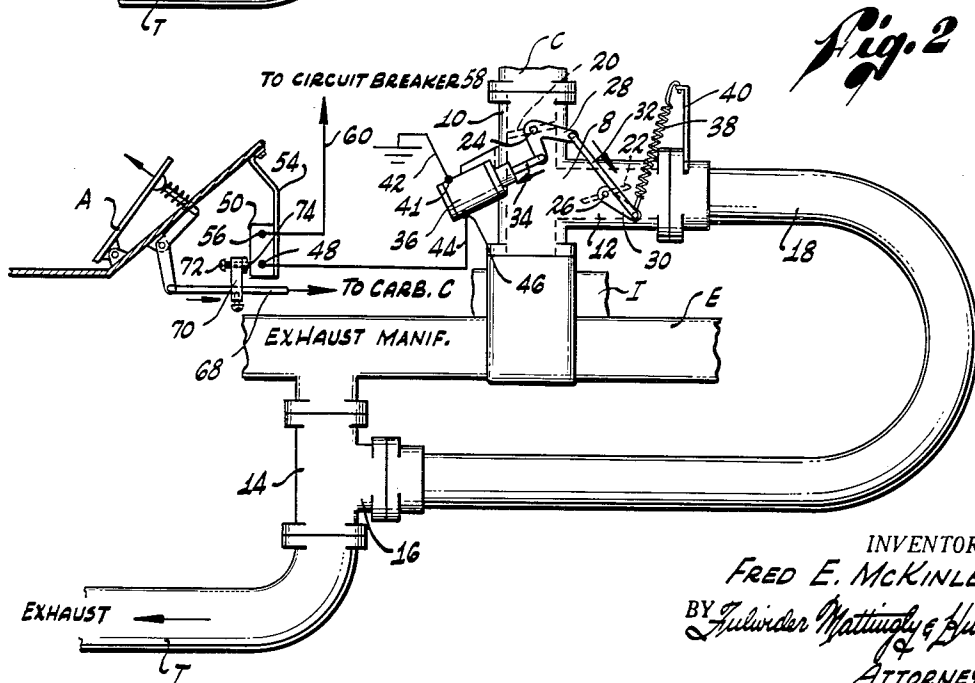
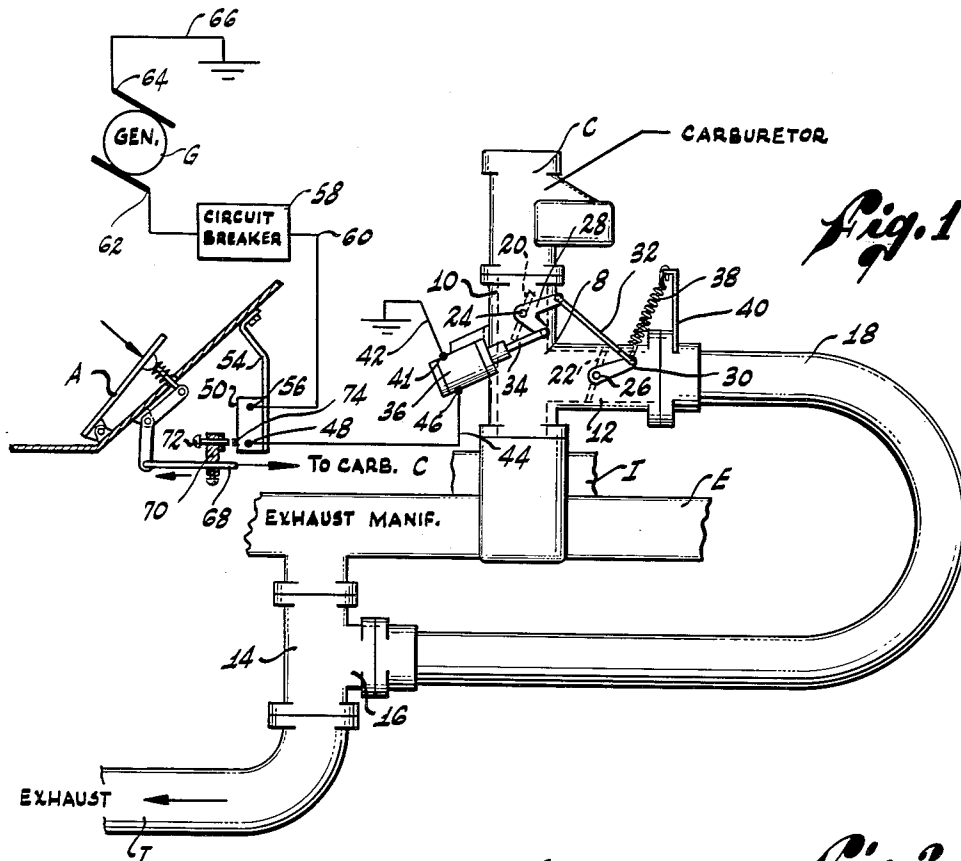
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APPARATUS FOR PREVENTING RELEASE OF CONTAMINANTS FROM
THE EXHAUST OF AN INTERNAL COMBUSTION ENGINE

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1

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APPARATUS FOR PREVENTING RELEASE OF CONTAMINANTS FROM THE EXHAUST OF AN INTERNAL COMBUSTION ENGINE

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The present invention relates generally to the field of internal combustion engines and more particularly to a novel apparatus for preventing the release of contaminants from the exhaust thereof.

It is well known that the exhaust gases issuing from the internal combustion engines of automotive vehicles constitute a prime source of the so-called "smog" which exists in and around the principal population centers of the country. The harmful effects of this smog upon both animate and inanimate objects is likewise very well known. Although many forms of apparatus for preventing the release of contaminants from the exhaust gases of such engines have been heretofore proposed, such devices have for various reasons proven to be unsatisfactory and accordingly are not now in general usage.

It is a major object of the present invention to provide an effective apparatus for preventing the release of contaminants from the exhaust of an internal combustion engine.

Another object of the invention is to provide an apparatus of the aforescribed nature which may be readily installed upon the engine of any conventional automotive vehicle.

It is another object of the invention to provide apparatus of the aforescribed nature which includes means for re-cycling exhaust gas through the intake manifold of the engine during deceleration.

Another object is to provide apparatus of the aforescribed nature that is simple in design and rugged of construction whereby it may afford a long and trouble-free service life.

It is yet another object to provide apparatus of this nature that is foolproof and entirely automatic in operation.

A further object is to provide apparatus of the aforescribed nature which does not in any way affect the operation of the engine during other than deceleration conditions.

Another object is to provide apparatus of the aforescribed nature which is compact in size and light in weight.

These and other objects and advantages of the present invention will become apparent from the following detailed description, when taken in conjunction with the appended drawings, wherein:

Figure 1 is a partially diagrammatic side elevational view of a preferred form of apparatus embodying the present invention mounted upon a conventional internal combustion engine; and

Figure 2 is a view similar to Figure 1 but showing the parts of the apparatus during deceleration of said engine.

Referring to the drawings, a preferred form of apparatus embodying the present invention is shown mounted upon the side of an internal combustion engine having an intake manifold I, an exhaust manifold E, and a carburetor C. The exhaust manifold E is connected to a tail pipe T. The carburetor C is operated by means of an accel-

2

erator pedal A. The engine also includes a conventional electrical generator G.

Interposed between the intake manifold I and the lower end of the carburetor C is a generally T-shaped fitting, generally designated 8, having a vertical leg 10 and a horizontal leg 12. A second T-fitting, generally designated 14, is interposed between the exhaust manifold E and the tail pipe T. The horizontal leg 16 on the second T-fitting 14 is connected to the horizontal leg 12 of the fitting 8 by means of a curved pipe 18. This pipe 18 permits exhaust gas to be re-cycled through the intake manifold I. A fuel shut-off valve 20 is mounted in the upper portion of the vertical leg 10 of the fitting 8. A re-cycling valve 22 is likewise mounted in the horizontal leg 12 of the fitting 14.

Referring now to Figure 2, during deceleration of the engine the fuel shut-off valve 20 will be arranged in a closed position while the re-cycling valve 22 will be opened. With this arrangement, during operating conditions of the engine other than deceleration, the carburetor C will be in free communication with the intake manifold I, while the re-cycling valve 22 will prevent the flow of re-cycled exhaust gases into the intake manifold I. During deceleration of the engine, however, the fuel shut-off valve 20 will prevent the flow of fuel from the carburetor C to the intake manifold I. At the same time the re-cycling valve 22 will be opened so as to permit exhaust gases to be re-cycled from the exhaust manifold E into the intake manifold I.

More particularly, both the fuel shut-off valve 20 and the re-cycling valve 22 may be of the butterfly type. Other types of valves, however, may also prove satisfactory. The fuel shut-off valve 20 is pivotally supported within the vertical leg 10 of the fitting 8 by means of a horizontal shaft 24. The re-cycling valve 22 is pivotally supported within the horizontal leg 12 of the fitting 14 by a second horizontal shaft 26. The fuel shut-off valve shaft 24 is keyed to the mid-portion of a generally V-shaped link 28. The re-cycling valve shaft 26 is keyed to one end of a lever 30. The free end of the lever 30 and one leg of the V-shaped link 28 are interconnected by a rigid bar 32. The other end of the V-shaped link 28 is pivotally connected to the plunger 34 of an electric solenoid 36. Both the fuel shut-off valve 20 and the re-cycling valve 22 are normally biased towards a closed position by means of a tension spring 38, the latter having one of its ends secured to the free end of the lever 30. The opposite end of the spring 38 is secured to a bracket 40 which is affixed to the engine.

During operating conditions of the engine other than deceleration, the solenoid 36 will not be energized. Referring to Figure 2, at such time as the solenoid is energized, however, its plunger 34 will be partially retracted so as to effect clockwise rotation of the V-shaped link 28 and hence of both the fuel shut-off valve 20 and the re-cycling valve 22. Preferably, one terminal 41 of the solenoid 36 will be connected to ground by means of a lead 42. A second lead 44 connects the other terminal 46 of the solenoid to the output terminal 48 of a micro-switch 50. This microswitch 50 is fixed to the vehicle's floor board 52 by means of a bracket 54. The input terminal 56 of the microswitch 50 is connected to one side of a circuit breaker 58 by a lead 60. The opposite side of the circuit breaker 58 is connected to one terminal 62 of the generator G. The opposite terminal 64 of the generator G is connected to ground by a lead 66.

The accelerator pedal A is connected to the carburetor C by suitable linkage. This linkage includes a horizontally extending rod 68. Secured to the rear portion of this rod 68 is a bumper member 70. The upper end of this bumper member 70 includes a set screw 72. The front end of the set screw 72 is engageable with an

actuator button 74 which protrudes from the rear of the microswitch 50 when the accelerator pedal A is released. At such time as the accelerator pedal A is depressed, however, the set screw 72 will be withdrawn from contact with the microswitch button 74. This condition is represented by Figure 1. Referring now to Figure 2, at such time as the driver's foot pressure is released from the accelerator pedal A, the bumper member's set screw 72 will engage the microswitch button 74 so as to move the parts of the microswitch to an "on" position. The circuit breaker 58 should be so adjusted that unless the generator G is producing a predetermined amount of electric current, the circuit between the generator G and the input terminal 56 of the microswitch 50 will be broken. With this arrangement, during idling conditions of the engine, the generator G will not produce sufficient current to maintain the circuit between the generator and the input terminal 56 closed. During deceleration conditions of the engine, however, the vehicle's wheels will effect rotation of the engine at a speed which causes the generator to produce sufficient current as to maintain the circuit between the generator and the microswitch input terminal 56 closed.

In operation, and referring to Figure 1, assuming the vehicle's driver is exerting downward pressure upon the accelerator pedal A, the bumper member 70 will be retracted from the microswitch button 74. Accordingly, no electric current may pass between the generator C and the solenoid 36. The spring 38 will at this time be maintaining the fuel shut-off valve 20 in an open position, and the recycling valve 22 in a closed position. Referring now to Figure 2, and assuming that the vehicle is undergoing forward motion, when the driver releases the accelerator pedal A, the bumper member 70 will engage and depress the microswitch button 74. At this time, assuming the generator G is producing sufficient electric current to maintain the circuit breaker 58 in a closed position, current will flow from the generator through the circuit breaker 58, the microswitch 50 and then to the electric solenoid 36 so as to energize the latter. The solenoid's plunger 34 will then retract so as to urge the fuel shut-off valve 20 to a closed position and the re-cycling valve 22 to an open position. At this time, the flow of fuel from the carburetor C into the intake manifold I will cease. Concurrently, exhaust gases will be free to re-cycle from the exhaust manifold F into the intake manifold I. Under these conditions, the contaminants usually produced by conventional engines during deceleration due to the existence of an excess of fuel within the combustion chambers cannot be produced. Additionally, the intake manifold I will be maintained in a heated and dry condition by the re-cycled exhaust gases. Accordingly, when the fuel shut-off valve is again opened, the fuel flowing into the intake manifold will be sufficiently vaporized as to undergo immediate combustion. The introduction of exhaust gas within the intake manifold I below the fuel shut-off valve 20 also prevents the fuel from being drawn around the periphery of the fuel shut-off valve due to the high vacuum created within the intake manifold during deceleration of the engine.

Although the fuel shut-off valve 20 and the re-cycling valve 22 are shown as being biased towards their positions of Figure 1 by the spring 38 and as being moved to their positions of Figure 2 by the electric solenoid 36, it will be apparent that the operations of the spring and solenoid could be reversed whereby the spring would normally tend to bias these valves towards their position of

Figure 2 while the solenoid would be normally energized so as to retain them in their position of Figure 1. It will also be apparent that various other modifications and changes may be made with respect to the foregoing description, without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. Apparatus for preventing release of contaminants from the exhaust of an internal combustion engine during deceleration, said engine including an intake manifold, a carburetor and an accelerator, comprising: a fuel shut-off valve interposed between said carburetor and said intake manifold; conduit means interconnecting said exhaust and said intake manifold; a re-cycling valve interposed in said conduit means; spring means normally biasing said fuel shut-off valve open and said re-cycling valve closed; electric solenoid means directly connected to said valves whereby upon energization thereof said solenoid will close said fuel shut-off valve and concurrently open said re-cycling valve against the force of said spring means; and an electric switch operable by said accelerator for effecting energization of said solenoid means only during deceleration of said engine.

2. Apparatus for preventing release of contaminants from the exhaust of an internal combustion engine during deceleration, said engine including an intake manifold, a carburetor, a generator and an accelerator, comprising: a fuel shut-off valve interposed between said carburetor and said intake manifold; conduit means interconnecting said exhaust and said intake manifold; a re-cycling valve interposed in said conduit means; means normally biasing said fuel shut-off valve open and said recycling valve closed; electric solenoid means directly connected to said valves whereby upon energization thereof said solenoid will close said fuel shut-off valve and concurrently open said recycling valve; electric switch means operable by said accelerator for effecting energization of said solenoid means, said switch means being connected to said generator; and, a circuit breaker interposed between said generator and said switch means.

3. Apparatus for preventing release of contaminants from the exhaust of an internal combustion engine during deceleration, said engine including an intake manifold, a carburetor, a generator and an accelerator, comprising: a fuel shut-off valve interposed between said carburetor and said intake manifold; conduit means interconnecting said exhaust and said intake manifold; a re-cycling valve interposed in said conduit means; spring means normally biasing said fuel shut-off valve open and said re-cycling valve closed; electric solenoid means directly connected to said valves whereby upon energization thereof said solenoid will close said fuel shut-off valve and concurrently open said re-cycling valve; electric switch means operable by said accelerator for effecting energization of said solenoid means, said switch means being moved to an "on" position when said accelerator is released, and said switch means being connected to said generator; and a circuit breaker interposed between said generator and said switch means.

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