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PISTON ENGINE WITH THROTTLE VALVE REGULATION IN THE SUCTION PIPE

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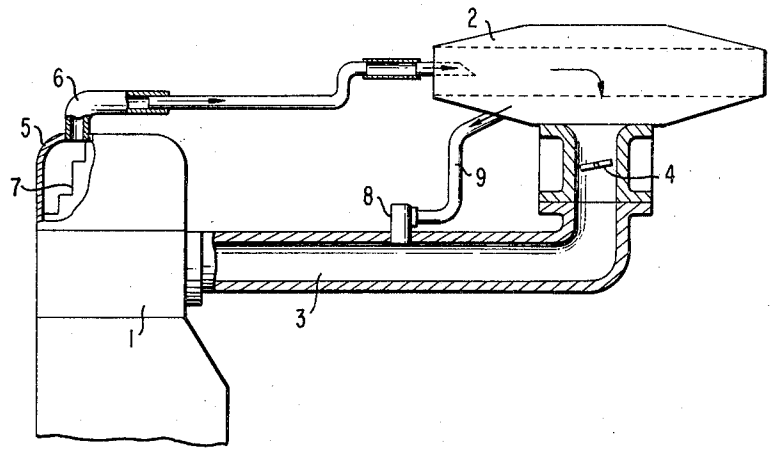


FIG. 1

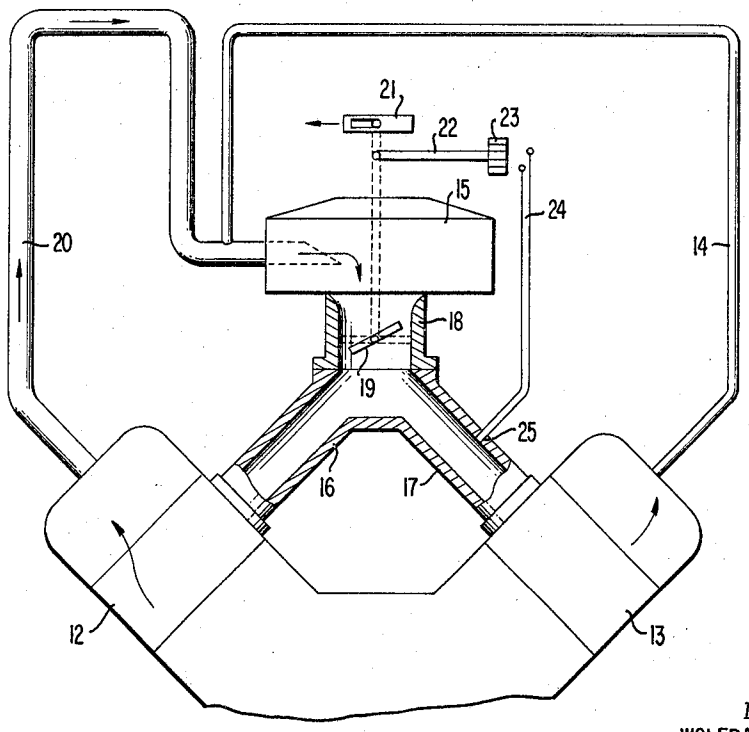


FIG. 2

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PISTON ENGINE WITH THROTTLE VALVE REGULATION IN THE SUCTION PIPE

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U.S. Cl. 123—97 2 Claims

ABSTRACT OF THE DISCLOSURE

A piston engine which includes a throttle valve regulation in the suction pipe and in which control means are provided for preventing an excess vacuum in the suction pipe when the engine becomes the load, i.e., when the vehicle pushes the engine with the throttle valve substantially closed. The control means includes a vacuum-responsive electric switch responsive to the vacuum downstream of the throttle valve and an electromagnet controlled by said switch. The electromagnet moves a lever which engages the throttle valve adjusting mechanism to partly open it when a high vacuum exists in the engine suction pipe.

Background of the invention

The present invention relates to a piston engine with a throttle valve regulation in the suction pipe or manifold.

Such types of piston engines, especially four-cycle engines, have, during operation with the vehicle pushing the engine, i.e., with brake effect of the engine, a very high vacuum in the suction pipe or intake manifold by reason of the closed throttle valve and therewith also in the combustion spaces during the suction stroke. As a result of this high vacuum, oil is sucked to an increased extent past the piston rings upwardly into the combustion spaces and is exhausted which leads to a considerable increase in oil consumption. Especially piston engines for motor vehicles are hit hard by this phenomenon because in present-day street-traffic, especially in city traffic, the driving has to take place up to 40% of the driving time with the vehicle pushing the engine.

Summary of the invention

The present invention aims at eliminating this increased oil consumption, and essentially consists in that a valve is arranged in the suction pipe or in the throttle valve which, in case of a vacuum in the suction pipe, permits the inflow of additional air into the suction pipe, or in that the throttle valve is so adjusted in the reverse load condition, i.e., when the vehicle pushes the engine, that no vacuum occurs in the suction pipe. In this manner the pressure differences between the piston top side and the piston bottom side are far-reachingly equalized; the suction effect is obviated and the oil consumption can be lowered correspondingly.

A conventional valve which automatically opens only at pressures below the idling speed vacuum, may thereby find application in an advantageous manner in the suction pipe or in the throttle valve.

With another type of construction of the present invention, an electric switch element responding to a predetermined vacuum may be arranged in the suction pipe or manifold which switch is operatively connected with an actuating stroke magnet that actuates by way of a lever the adjusting mechanism of the throttle valve.

Accordingly, it is an object of the present invention to provide a piston engine with throttle valve regulation in its suction pipe which eliminates in a simple and effective manner the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in a piston engine with throttle valve regulation in the suction pope or manifold which minimizes the increased oil consumption that might be caused otherwise when the engine is operated as load of the vehicle.

A further object of the present invention resides in a throttle valve regulation for use with piston-type combustion engines which are particularly suitable for motor vehicles operated in city traffic.

Still another object of the present invention resides in a piston-type internal combustion engine in which pressure differences between the piston top side and the piston bottom side are far-reachingly equalized.

These and further objects, features, and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, some embodiments in accordance with the present invention, particularly suitable for injection-type engines, and wherein:

FIGURE 1 is a somewhat schematic view, partly in cross section, of one control arrangement in accordance with the present invention for the pressure equalization in a four-cycle piston engine; and

FIGURE 2 is a somewhat schematic view, partly in cross section, of a modified control arrangement in accordance with the present invention, with a piston-type internal combustion engine having a V-arrangement of the cylinders.

Referring now to the drawing, and more particularly to FIGURE 1, the piston engine **1** of any conventional construction, sucks in its fresh air through a conventional filter **2** by way of a suction pipe or manifold **3**. A throttle valve **4** is arranged in the suction pipe **3** downstream of the filter **2**. The crankcase **5** is connected with the fresh air filter **2** by way of a venting line **6**. The venting line **6** commences in an advantageous manner downstream or to the rear of the oil separator **7** of the crankcase **5**. A valve **8** is arranged in the suction pipe **3** which is provided with a connection **9** to the fresh air filter **2**. The valve **8**, of any conventional construction, is automatically actuated by the vacuum in the suction pipe **3** and permits, for purposes of reducing the vacuum in the suction pipe **3**, the inflow of air with increased vacuum. The amount of vacuum required for opening the valve **8** is appropriately higher than the idling speed vacuum of the engine.

During idling speed, and in pulling operation of the piston engine **1** when the latter drives the vehicle as the load, the valve **8** is in its closed condition. By reason of the slight vacuum in the fresh-air filter **2**, the air sucked-off out of the crankcase **5**. During reversed-load or pushing operation when the vehicle drives the engine as the load, with a far-reachingly closed throttle valve **4** and with a high vacuum in the suction pipe **3**, the valve **8** responds and opens up the connection **9** to the suction pipe **3**. The piston engine **1** now sucks-in air through the connection **9** by way of the fresh air filter **2**. As a result thereof, the vacuum in the suction pipe **3** is decreased, whereby the pressure difference between the piston top side and the piston bottom side is far-reachingly equalized. The pressure difference can be kept so small that no oil is sucked to the piston top side by the same.

The same effect could also be achieved by a conventional valve, for example, flap-type valve, arranged directly in the throttle valve **4** which would open when the predetermined vacuum is again reached in the suction

pipe 3. However, such a type of construction is applicable only to injection-type engines.

With the piston-type internal combustion engine of FIGURE 2 having a V-arrangement of the cylinders **12, 13**, there is provided an additional venting line **14** which is constantly in communication with the fresh air filter **15**. Each piston is provided with a respective suction pipe **16, 17** which terminates in a common pipe piece **18** that in turn, is adjoined by the fresh-air filter **15**. The throttle valve **19** of conventional construction is arranged in the common suction pipe piece **18**. The main venting line **20** is also connected with the fresh air filter **15**. A lever **22** engages with the conventional adjusting mechanism **21** of the throttle valve **19**; the lever **22** is adjustable by way of a conventional stroke magnet **23**. The actuating magnet **23** is connected with its energizing winding by way of electric lines **24** with an electric switch element **25** of conventional construction that is arranged in the suction pipe **17** and responds to a predetermined vacuum.

During idling speed or in pulling operation of the piston engine when the latter drives the vehicle as the load, the adjusting mechanism **21** is in the illustrated position. The engine sucks-in the combustion air by way of the fresh air filter **15** whereas the crankcase is vented by the two venting lines **14** and **20**.

If the engine is regulated by way of the throttle valve, then a high vacuum results in the suction pipe **16, 17**. The electric switch element **25**, responsive to vacuum, then closes by way of the line **24** the energizing circuit of the stroke magnet **23** which actuates the lever **22** and at least partly opens thereby the throttle valve **19**. Also, with this arrangement the pressure differences between piston top side and piston bottom side are strongly reduced. The adjusting mechanism **21** of the throttle valve **19** which, for the most part, is actuatable in the direction of the arrow by means of a foot pedal in a conventional manner, is thereby so constructed that the adjusting movement caused by the vacuum in the suction pipe **17** can be realized independently of the adjusting mechanism **21**, i.e., without causing fuel to be injected into the combustion space of the cylinders **12** and **13**. This can be readily achieved by any conventional means, known per se in the art and therefore not described in detail herein.

While we have shown and described only some embodiments in accordance with the present invention, it is

understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to a person skilled in the art and we therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications.

We claim:

1. In a piston-type internal combustion engine having means for controllably supplying combustion air to the engine, including throttle valve means in the suction pipe, the improvement comprising control means, including electric switch means responsive to a predetermined level of vacuum pressure disposed within said suction pipe downstream of said throttle valve means, electromagnetic means operatively connected with said electric switch means and lever means movable by said electromagnetic means from a first, inoperative position to a position engaging with and actuating the adjusting mechanism of said throttle valve means to cause said throttle valve means to be opened to a predetermined extent when said predetermined level of vacuum pressure is sensed by said electric switch means, whereby maximum vacuum pressure in said suction pipe occurring when said engine is operating under reversed load conditions is effectively limited.

2. The improvement according to claim **1**, wherein said throttle valve means includes means facilitating adjustment thereof by said adjusting mechanism independently of fuel supply adjustment to the cylinders of said internal combustion engine.

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