United States Patent

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[54] **INSTALLATION FOR THE ADVANCE OF THE IGNITION POINT**

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[51] **Int. Cl.**.....**F02p 5/04,** F02n 17/00

[58] **Field of Search**.....123/117, 117.1

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[57] **ABSTRACT**

An installation for advancing the ignition instant in internal combustion engines, in which the control actuator for the ignition-distributor normally controlled by the suction pipe vacuum and itself controlling the ignition distributor, for the purpose of advancing the ignition point during the drive of the vehicle with a cold engine, can be selectively connected with a vacuum reservoir or tank with is present in the vehicle.

24 Claims, 3 Drawing Figures

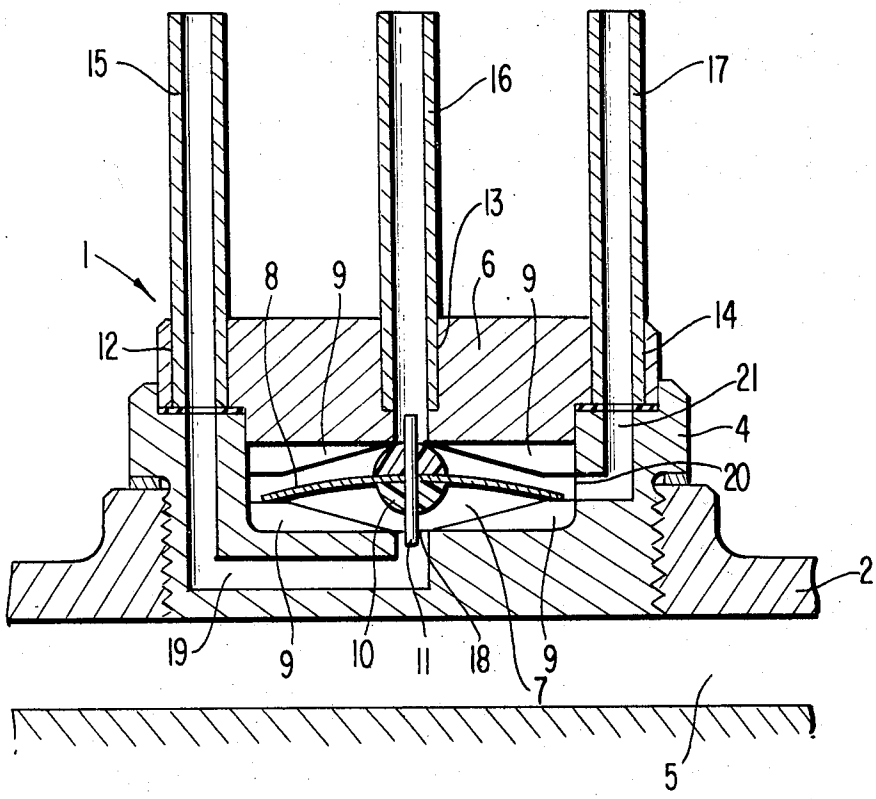


FIG. 1

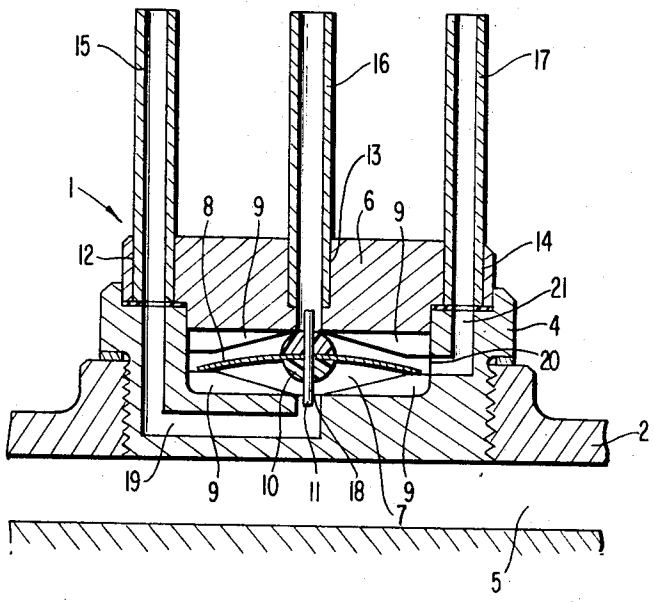


FIG. 3

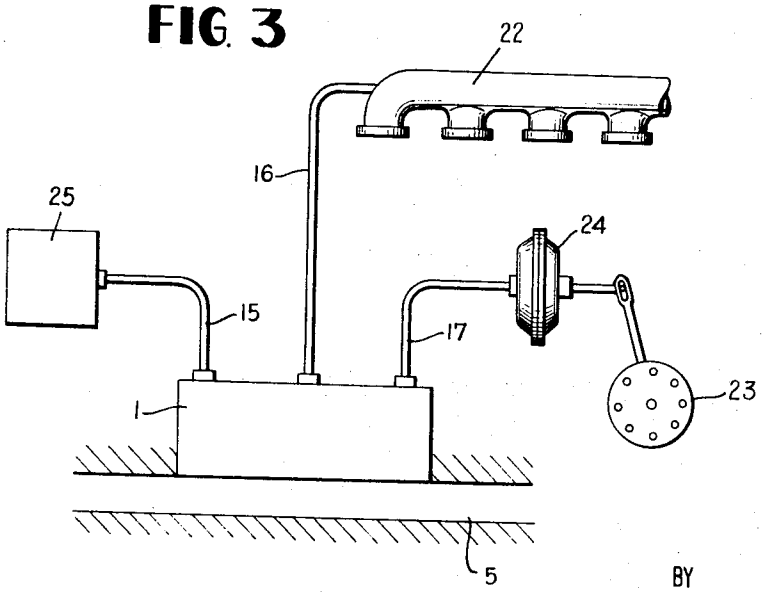
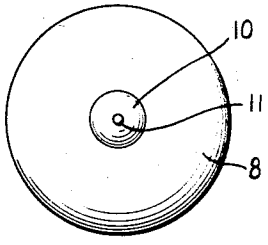


FIG. 2



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INSTALLATION FOR THE ADVANCE OF THE IGNITION POINT

The present invention relates to an installation for the advance of the ignition point or ignition instant of an Otto-internal combustion engine in motor vehicles with a vacuum-operated control actuator controlled by the suction pipe and acting on the ignition distributor.

In motor-vehicle Otto-internal combustion engines with carburetors, only a small portion of the supplied fuel evaporates during the cold start and during the heating-up of the engine after the cold start with still cold intake paths and combustion space walls. In order to obtain nonetheless at least a still ignitable and sufficiently rapidly burning mixture from the fuel vapor and air, a disproportionately large amount of fuel has to be supplied whose largest portion then passes over into the exhaust either incompletely combusted or not combusted at all.

Since the boiling point and atomization of the fuel are pressure-dependent, the fuel vapor-air ratio may become particularly unfavorable if, during the drive of the vehicle with a cold internal combustion engine, a relatively large amount of fuel vapor is needed for the purpose of acceleration while the relatively high idling-speed vacuum collapses more or less suddenly. This will then lead to disturbances in the operation of the internal combustion engine because the cold mixture then burns or combusts excessively slowly.

It is possible to improve the progress of the reactions in a non-stoichiometric mixture in that one initiates the ignition earlier, as is already realized with most internal combustion engines for the purpose of achieving a more favorable consumption in the partial load range. The vacuum operated actuator mounted for that purpose at the ignition distributor becomes effective, however, only at relatively high suction-pipe vacuums and only with an already slightly opened throttle valve.

The present invention is concerned with the aim to utilize the advanced ignition for the improvement of the combustion with a cold internal combustion engine, especially also during the acceleration with fully opened throttle valve.

This is achieved according to the present invention in that for the advance of the ignition point during the drive of the vehicle with a cold internal combustion engine, the connection of the vacuum-operated actuator box is connected to a vacuum tank or reservoir, already present in the vehicle, for example, is connected to the brake-force amplifier or brake-servo system.

It is achieved by the present invention that also with a cold internal combustion engine, an advanced ignition is initiated by the vacuum-operated actuator over the entire rotational speed range. A favorable progress of the combustion results therefrom. The advantage of the better combustion also permits a reduction of the excessive fuel feed and reduces therewith the exhaust of poisonous exhaust gas components during the heating-up operating period.

In a preferred embodiment according to the present invention, a valve may be provided which responds either directly or indirectly to the temperature of the internal combustion engine, for example, to the temperature of the lubricating oil or of the cooling water.

A further feature of the present invention resides in that a prestressed bimetallic plate is arranged in the valve which switches over suddenly in order not to impair the operation of a brake-force amplifier in case the latter serves as vacuum tank or reservoir.

The present invention also proposes for the aforementioned shifting-over that a preferably ball-shaped closure body is arranged at the small bimetallic plate which opens and closes two mutually opposite bores and connects the control actuator of the ignition distributor either with the suction pipe vacuum or with the vacuum tank or reservoir.

The present invention additionally proposes that the bimetallic plate can operate with large hysteresis in a conventional manner. It is to be achieved thereby that after an operation of the engine at rated temperature and with a not-yet completely cooled off internal combustion engine, an advanced ignition is adjusted over the entire operating range.

According to a still further feature of the present invention, the necessary vacuum may be produced by an auxiliary pump.

Accordingly, it is an object of the present invention to provide an installation for the adjustment of the ignition point in internal combustion engines which avoids by simple means the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in an installation for advancing the ignition point of Otto-type internal combustion engines which obviates the need for relatively large amounts of fuel during cold start of the engine and during the warming-up operation thereof.

A further object of the present invention resides in an installation for the adjustment of the ignition point of internal combustion engines which not only improves the combustion of the fuel during cold start and warming up operation of the engine but which additionally minimizes the amount of harmful components, due to incomplete combustion, which are present in the exhaust gases.

Still another object of the present invention resides in an internal combustion engine in which an ignition advance is also assured over the entire rotational speed range by the vacuum with a cold internal combustion engine.

Another object of the present invention resides in a valve structure for achieving the aforementioned aims and objects which is simple in construction, reliable in operation and easy to assemble and disassemble.

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, one embodiment in accordance with the present invention, and wherein:

FIG. 1 is a somewhat schematic cross-sectional view through an installation in accordance with the present invention for the advance of the ignition point;

FIG. 2 is a plan view of the bimetallic plate with a closure body according to the present invention; and

FIG. 3 is a schematic view illustrating the installation in relation to the various parts of an internal combustion engine.

Referring now to the drawing wherein like reference numerals are used throughout the two views to designate like parts and more particularly to FIG. 1,

reference numeral 1 generally designates in this figure a valve which is so mounted at the cooling water jacket 2 of an internal combustion engine that the bottom 3 of the lower portion 4 of the valve 1 is in direct contact with the cooling liquid in the cooling water space 5. Between the valve upper section 6 and the valve lower section 4 which are secured to one another is disposed a disk-shaped hollow space 7 in which is supported on radial ribs 9 a small bimetallic plate 8 of shell shape. The radial ribs 9 are provided at the lower section 4 of the valve and at the upper section 6 of the valve. The height of the radial ribs 9 increases from the inside toward the outside according to a linear function from zero up to a predetermined value shortly prior to reaching the walls of the hollow space 7 and then remains constant at this value.

As can be seen from FIG. 2, a closure body 10 consisting of two half-balls or spheres is mounted with the aid of a guide pin 11 at the bimetallic plate 8 in the center of the bimetallic plate 8.

Three vertical bores 12, 13 and 14 for the connection of three lines 15, 16 and 17 are provided in the valve upper section 6. The bore 13 with the line 16, which is connected with the suction pipe, is located centrally and is closed by the closure body 10 in the illustrated position of the bimetallic plate 8. Underneath the closure body 10 is disposed an aperture 18 which leads by way of a channel 19, that extends through the valve lower section 4 to the outer wall and thereafter upwardly to the bore 12, to the connection of the line 15 leading to the vacuum reservoir or tank of the internal combustion engine while another communication formed by the space intermediate the radial ribs 9, past the outer right edge of the bimetallic plate 8, through a bore 20 in the side wall of the hollow space 7 and thereupon through a channel 21 to the bore 14 receiving line 17 establishes a connection to the vacuum-operated control actuator of conventional construction for a distributor.

FIG. 3 illustrates schematically the various connections of the valve 1 with the suction pipe 22 by way of line 16, with the vacuum tank or reservoir 25 by way of line 15 and with the vacuum-operated actuator 24 controlling an ignition distributor 23 to advance or retard the ignition instant. Since the various parts 22, 23, 24 and 25 are known as such and form no part of the present invention, a further detailed description and showing thereof is dispensed with herein.

With a cold internal combustion engine, the bimetallic plate 8 assumes the position shown in FIG. 1 whereby the control actuator 24 of the ignition distributor 23 is connected with the vacuum reservoir 25 of the internal combustion engine by way of line 17, channel 21, bore 10, space 7, bore 18, channel 19 and line 15, so that an advanced ignition is adjusted over the entire rotational speed range of the internal combustion engine. If, at a predetermined temperature, a hot-running condition of the internal combustion engine is reached, then the bimetallic plate 8 shifts over, closes with the closure body 10 the bore 18 and therewith the line 15 to the vacuum tank 25 of the internal combustion engine and at the same time establishes a communication between the control actuator 24 of the ignition distributor 23 box and the suction pipe 22 by way of the two lines 17 and 16 interconnected in the manner described above.

While I have shown only one embodiment 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 those skilled in the art, and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are within the scope of those skilled in the art.

I claim:

1. An installation for advancing the ignition point in internal combustion engines, which includes a vacuum-operated actuator means operatively connected with a suction pipe of the engine and normally controlled by the suction pipe vacuum, said vacuum-operated actuator means acting on a distributor means, characterized by valve means for closing the connection of the vacuum-operated actuator means to the suction pipe vacuum, when driving with a cold internal combustion engine, and for selectively connecting the vacuum-operated actuator means with a vacuum reservoir means to thereby advance the ignition instant in said distributor means over the entire range of throttle position of the engine while the latter remains cold.

2. An installation according to claim 1, characterized in that the engine is an Otto engine of a motor vehicle, and in that the reservoir means is located in a motor vehicle.

3. An installation according to claim 2, characterized in that the reservoir means is formed in effect by a brake-force servo means.

4. An installation according to claim 1, characterized in that a valve means is provided for controlling the connections of the vacuum operated actuator means which responds to the temperature of the internal combustion engine.

5. An installation according to claim 4, characterized in that the valve means responds directly to the temperature of the engine.

6. An installation according to claim 4, characterized in that the valve means responds indirectly to the temperature of the internal combustion engine.

7. An installation according to claim 4, characterized in that the valve means responds to the temperature of the lubricating oil.

8. An installation according to claim 4, characterized in that the valve means responds to the temperature of the cooling water.

9. An installation according to claim 4, characterized in that a pre-stressed bimetallic plate means operable to shift substantially instantaneously is arranged in the valve means.

10. An installation according to claim 9, characterized in that a closure body means is arranged at the bimetallic plate means which selectively opens and closes two mutually opposite bore means and which is operable to selectively connect the actuator means either with the suction pipe vacuum or with the vacuum reservoir means.

11. An installation according to claim 10, characterized in that said closure body means is of substantially spherical shape.

12. An installation according to claim 10, characterized in that said bimetallic plate means operates with large hysteresis.

13. An installation according to claim 12, characterized in that the necessary vacuum is produced by an auxiliary pump.

14. An installation according to claim 9, characterized in that said bimetallic plate means operates with large hysteresis.

15. An installation according to claim 1, characterized in that the necessary vacuum is produced by an auxiliary pump.

16. An installation according to claim 1, wherein said valve means includes a valve housing having three connecting means forming effectively three ports, two of said ports being disposed substantially opposite one another and being connected with the suction pipe and the vacuum reservoir means while the third port is connected with the vacuum-operated actuator means.

17. An installation according to claim 16, characterized by a single closure member selectively opening and closing said two ports in response to engine temperature.

18. An installation according to claim 17, characterized by temperature sensitive means for actuating said closure member and rigidly secured to the latter.

19. An installation according to claim 18, characterized in that said temperature sensitive means is a bimetallic element sensing directly the engine temperature.

20. An installation according to claim 1, wherein said valve means is provided with two ports and includes a closure member for said two ports and heat-sensing means directly sensing the engine temperature and directly and securely connected to said closure member for actuating the latter in dependence of engine temperature.

21. An installation according to claim 20, wherein said closure member is an approximately circularly shaped valve member with a bimetallic element extending as heat-sensing means through said valve member.

22. In an installation for advancing the ignition instant in an internal combustion engine, when the engine is cold, by selectively connecting a control means for an ignition distributor with a source of vacuum in lieu of a suction pipe until the engine reaches a predetermined temperature, the improvement comprising a valve adapted to be interposed between said control means, said suction pipe and said source of vacuum which comprises a valve housing provided with three ports, two of said ports being disposed substantially mutually opposite one another and being connected with said suction pipe and said source of vacuum, respectively, while the third port is in communication with a valve space, and a single closure member operable to selectively open one of said two ports while closing the other or opening said other while closing said one, and heat sensing means for actuating said closure member and directly coupled thereto.

23. The combination according to claim 22, wherein said closure member as well as said heat sensing means are arranged in said valve space.

24. The combination according to claim 23, wherein said heat sensing means is a bimetallic element.

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