July 4, 1967 J. G. CADIOU 3,329,136

IGNITION CONTROL APPARATUS

Filed Aug. 3, 1965

Fig. 1

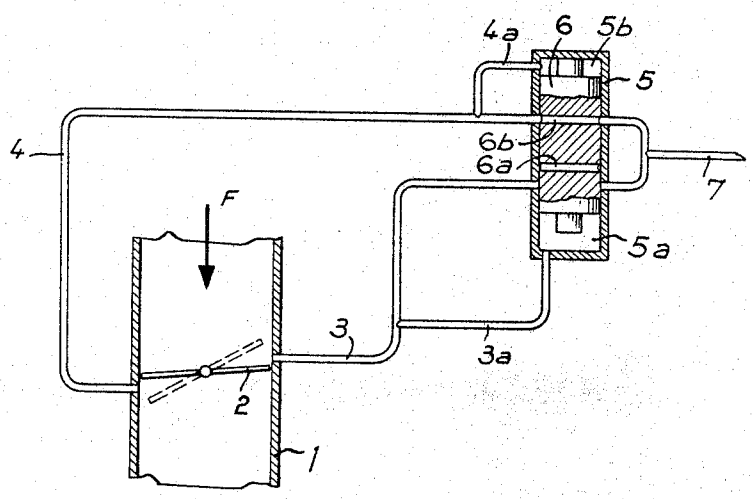
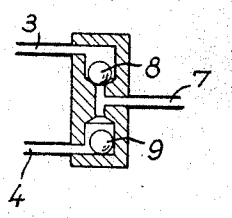


Fig. 2



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IGNITION CONTROL APPARATUS

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It is known that engines having controlled ignition, and in particular gasoline engines, require the ignition to be advanced in dependence on the load and the speed of the engine. As a rule the origin of the variation of advance at full load is the value of the advance, known as "initial advance," necessary for the lowest speed compatible with correct operation. If provision is made for correction of the advance at partial loads, for example by means of a vacuum device, this vacuum is detected at a point outside the idling slow speed vacuum zone.

Consequently, whatever the device used for correction, the engine works at idling slow speed with the initial advance in all cases.

It has however been found that at idling slow speed the initial advance may not be sufficient to ensure complete combustion of the fuel mixture, so that considerable production of carbon monoxide may result; this phenomenon has serious consequences, particularly where town traffic is concerned.

The present invention therefore has for its object to improve combustion in an engine having controlled ignition at idling slow speeds, and for that purpose provides means by which, at such speeds, the advance of ignition is increased automatically in relation to its "initial value." Just as in the case of the adjustment of the advance of ignition at partial load, or at full load, it will be advantageous to control the regulation of ignition at slow speeds by means of the vacuum produced in the intake manifold through which the carburetor throttle-valve feeds the fuel mixture.

The invention may have various embodiments, but there will be described below, with reference to the accompanying drawings, some advantageous embodiments, the particular characteristics of which naturally form part of the invention.

In the drawings:

FIGURE 1 shows a diagrammatic view of a device in accordance with one embodiment of the invention, and

FIGURE 2 shows a diagrammatic view of an alternative embodiment of the invention.

Referring first to FIGURE 1, **1** designates a fuel mixture supply tube, which in an entirely conventional manner is provided with an adjusting throttle-valve **2** shown in solid lines in the closed position thereof, that is to say the position corresponding to idling slow speed conditions; with the direction of flow of the gases represented by the arrow F.

In the conventional manner the ignition advance adjustment system for partial load conditions comprises a vacuum pipe **3** to be connected through a pipe **7** to the vacuum chamber of a distributor of the diaphragm type (not illustrated). The pipe **3** is connected to supply tube **1** slightly upstream of the throttle **2** when the latter is in its closed position. When the quantity of fuel admitted into the engine is increased, by operating the throttle **2** which then assumes a position such as that shown in broken lines, vacuum is produced downstream of the throttle and is transmitted through pipe **3** to the distributor for the purpose of advancing the ignition or spark to an extent determined by the value of the transmitted vacuum.

According to the invention, a second vacuum pipe **4** is provided and is likewise adapted to be connected through

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pipe **7** to the vacuum chamber of the distributor. Pipe **4** is connected to tube **1** so as to be located downstream of the throttle **2**, preferably in the immediate proximity of the latter, when the throttle valve is in the closed position, as illustrated in solid lines.

The two pipes **3** and **4** are connected to the vacuum chamber of the distributor through a device provided in accordance with this invention for blocking or closing the pipe **3** or **4** in which the higher pressure exists, that is the pipe which is not subjected to the vacuum. In the embodiment illustrated in FIGURE 1, such device **5** comprises a slide valve **6** having two annular grooves ***6a***, ***6b*** adapted to come selectively opposite the pipes **3** and **4** in order to bring one or the other of them into communication with the pipe **7** connected to the vacuum chamber of the distributor. In the device **5**, at the two ends of the slide valve **6**, there are provided chambers ***5a***, ***5b*** which are respectively in communication with the pipes **3** and **4** through the branches ***3a*** and ***4a***.

The device **5** then operates in the following manner: when the engine is running at idling speed, that is to say when the throttle **2** is in the position shown in solid lines, only the pipe **4** is subjected to the vacuum formed by the passage of the gases in the supply passage **1**. As a result, the chamber ***5b*** of the distribution means is likewise under vacuum in relation to the chamber ***5a***, so that the slide valve **6** is displaced in the upward direction and brings the pipe **4** into communication with the pipe **7** connected to the vacuum chamber of the ignition distributor. The diaphragm or other similar device in such vacuum chamber then sets a suitable advance of the ignition.

As soon as a load is applied to the engine and the throttle **2** is turned to bring it into the position illustrated in broken lines, the pipe **4** ceases to be subjected to the vacuum, while the pipe **3** is then in the vacuum zone of the supply passage. Under the influence of the vacuum produced in the chamber ***5a*** of device **5**, the slide valve **6** falls and brings the pipe **3** into communication with the pipe **7** of the ignition distributor, while disconnecting the pipe **4** therefrom.

The ignition advance is then controlled in the entirely orthodox manner, that is, with the advance increasing in proportion to increasing engine speed.

Referring now to FIGURE 2, an alternative form of construction is there illustrated for the device for selectively isolating the two pipes **3** and **4**. Upstream of the junction of these pipes to the pipe **7** of the ignition distributor there are disposed non-return or check valves **8** and **9** for example of the ball type. These valves **8** and **9** open under the effect of the vacuum set up in the corresponding pipe **3** or **4**, respectively, and close when the vacuum is produced in the opposite pipe. Selective isolation of the pipe not corresponding to the running conditions of the engine at any given moment is thus obtained, so that, as will be readily understood, any circulation of gases from one to the other of the pipes **3** and **4** is avoided, which may be detrimental to the good operation of the ignition distributor.

The invention is obviously not restricted to the embodiments which have just been described, but on the contrary covers all modifications thereof. In particular, as has already been stated, it will be possible to utilise any suitable means of control of ignition advance when the engine is idling, whatever the type of advance regulation for partial load and full load conditions.

I claim:

1. In an apparatus for controlling the spark advance of an internal combustion engine having a tube for supplying combustible gases to the engine intake manifold with a throttle valve mounted in said tube to pivot about a substantially diametrical axis from a substantially closed

idling position and a distributor with a vacuum chamber to effect spark advance in accordance with the degree of vacuum acting in said chamber; the combination of a first pipe opening from said tube at one side of said axis at a location which is adjacent, and downstream with respect to said throttle valve in said idling position and past which the respective side of said throttle valve is displaced upon pivotal movement of the latter from said idling position, a second pipe opening from said tube at the other side of said axis at a location which is upstream with respect to said throttle valve in the idling position thereof and past which the respective side of said throttle valve is displaced upon pivotal movement of the latter from said idling position, a common pipe for selectively connecting said first and second pipes to the vacuum chamber of the distributor, and valve means interposed between said first and second pipes and said common pipe and being responsive to the relative pressures in said first and second pipes to establish communication of said common pipe with the one of said first and second pipes in which the relatively lower absolute pressure exists.

2. An apparatus according to claim **1**; wherein said valve means includes a valve housing to which said first and second pipes are connected and from which said common pipe extends, a valve member slidable in said housing to selectively communicate said first and second pipes with said common pipe, said housing having first and second chambers also connected with said first and second pipes and being defined in part by the opposite ends of said valve member so that the relative pressures existing in said first and second pipes also serve to position said valve member.

3. An apparatus according to claim **1**; wherein said valve means includes first and second check valves interposed between said first and second pipes, respectively, and a junction of said first and second pipes with said common pipes, each of said first and second check valves being opened when the absolute pressure in the respective one of said first and second pipes is lower than the absolute pressure in the other of said first and second pipes.

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