

Jan. 6, 1959

W. E. McCOLLOUGH

2,867,197

IGNITION CONTROL FOR AN INTERNAL COMBUSTION ENGINE

Filed Feb. 11, 1957

Fig. 1

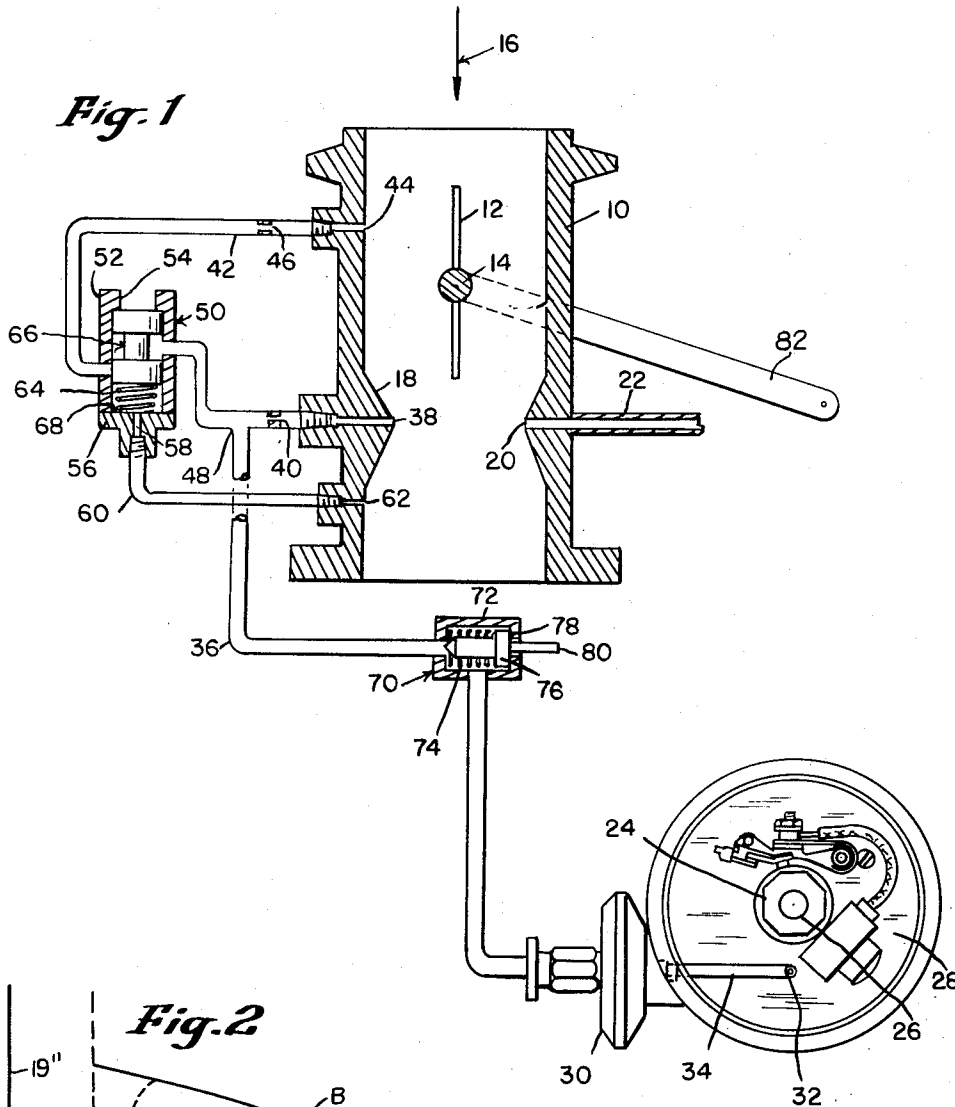
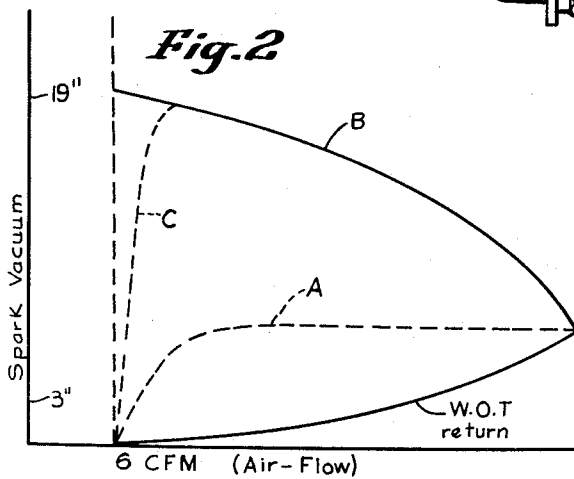


Fig. 2



INVENTOR.

WILLIAM E. McCOLLOUGH

BY *Whittemore*
Nulbert & Belknap
ATTORNEYS

1
2,867,197

IGNITION CONTROL FOR AN INTERNAL COMBUSTION ENGINE

William E. McCollough, Detroit, Mich., assignor to Holley Carburetor Company, Van Dyke, Mich., a corporation of Michigan

Application February 11, 1957, Serial No. 639,319

6 Claims. (Cl. 123—117)

The present invention relates to ignition control for an internal combustion engine, and more particularly, to vacuum spark advance mechanism employed in conjunction with an internal combustion engine in which the throttle plate is located upstream from the venturi.

It is an object of the present invention to provide means for controlling the application of vacuum or sub-atmospheric pressure to motor means for effecting adjustment of an ignition distributor including means for applying reduced venturi pressure to the motor and bleed means under the control of manifold pressure for varying the proportion of reduced venturi pressure applied to the adjusting motor.

It is a further object of the present invention to provide a system as described in the preceding paragraph including means automatically operated in response to movement of the throttle plate to idling position to interrupt the application of modified venturi pressure to the motor means.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawing, illustrating a preferred embodiment of the invention, wherein:

Figure 1 is a diagrammatic view illustrating the ignition control system.

Figure 2 is a graph illustrating the results obtainable with the present invention.

The internal combustion engine includes an air intake passage 10 having a throttle plate 12 carried by throttle shaft 14 for controlling the flow of air through the air supply passage. In the present case the flow of air is downward as indicated by the arrow 16. Located downstream from the throttle plate 12 is a venturi 18 having a fuel inlet port 20 connected to a fuel supply passage 22.

The internal combustion engine is provided with an ignition system including a distributor comprising a rotary cam 24 connected to a shaft 26 driven at a rate in accordance with engine speed. Associated with the cam 24 is an angularly adjustable plate 28 carrying the usual breaker arm having contact points adapted to be opened and closed by rotation of the cam 24. In order to advance and retard the spark in accordance with engine conditions, the plate 28 is mounted for angular adjustment and has connected thereto a pressure responsive motor 30 illustrated as connected to a pin 32 on the plate 28 by a connecting link 34. The motor 30 may be in the form of a collapsible bellows having spring means therein and subjected at its exterior to atmospheric pressure. The interior of the bellows 30 is subjected to sub-atmospheric pressure by reason of a pressure passage 36.

The present invention is concerned primarily with a control of the sub-atmospheric pressure or partial vacuum effective at the interior of the bellows or motor means 30 for controlling the position of the distributor plate 28.

The pressure passage 36 communicates with the throat of the venturi at a port 38. A variable calibrated re-

2
striction 40 is provided in the passage 36. A bleed passage 42 is connected to the interior of the air supply passage 10 at a port 44 and air flow through the bleed passage 42 is controlled by the variable calibrated restriction 46. The bleed passage 42 connects to the pressure passage 36 at a point 48 located between the restriction 40 and the motor 30.

A regulating valve indicated generally at 50 is provided in the bleed passage and comprises a cylindrical valve housing 52 having an annular shoulder 54 at one end. The end of the valve housing 52 opposite the shoulder 54 is closed by a fitting 56 having an opening 58 therethrough connected to a passage 60 which communicates with a port 62 located downstream from the throat of the venturi 18. By this arrangement the sub-atmospheric pressure or partial vacuum existing within the manifold of the internal combustion engine is effective within the lower end of the valve chamber 64 located within the housing 52.

Movable longitudinally in the valve chamber 64 is a balanced spool valve 66 which in the position shown, is adapted to close the bleed passage 42. The valve 66 is urged toward the closed position illustrated in the figure by a calibrated coil spring 68.

When manifold pressure falls to a value sufficient to overcome the spring 68, the valve 66 moves downwardly and partially opens or regulates the effective opening in the bleed passage 42. A partial opening of the bleed passage 42 admits air at atmospheric pressure or at substantially atmospheric pressure to the pressure passage 36, thus increasing the pressure applied to the motor means 30. The effectiveness of the restrictions 40 and 46 is selected in accordance with the particular engine to give the required operating characteristics, as is well understood in the art.

It is desirable to close pressure passage 36 under idling conditions when relatively low manifold pressures prevail. In the present case this is accomplished by means automatically operated in response to movement of the throttle plate 12 to substantially closed or idling position. This means is diagrammatically illustrated as the idling valve assembly 70 including the valve housing 72 having a coil compression spring 74 and a slidable valve element 76 therein. The spring urges the valve element to the right in the figure or toward open position, such movement being limited by engagement with an annular abutment 78 on the housing. The valve includes a stem 80 projected outwardly from the housing into position to be engaged by a mechanical operating lever 82 extending from the throttle shaft 14. Thus, when the operator moves the throttle plate 12 to its nearly closed idling position the valve element 76 is mechanically moved to closed position and hence, interrupts the communication of controlled sub-atmospheric pressure to the adjusting motor of the ignition distributor.

The present invention is adapted to control the vacuum applied to the motor 30 so as to cause it to conform closely to the desired curve. In the past, and primarily in conjunction with internal combustion engines employing a choke upstream from the venturi and a throttle plate downstream therefrom, it has been possible to obtain close regulation of the vacuum applied to the motor for effecting spark adjustment and it has been determined that a partial vacuum variable in accordance with the curve A in Figure 2 is desirable.

When however, fuel is supplied to the engine through an air passage having a venturi and in which the flow of air is controlled by a throttle plate upstream from the venturi, the usual connections to the carburetor do not produce the required variation in vacuum. It may be mentioned that the carburetor illustrated in Figure 1 may for example be a propane carburetor.

3

If the motor 30 were connected directly to the throat of the venturi with the valves 50 and 70 omitted the curve B would be produced, this being the resultant of venturi depression as modified by pressure variation resulting from partial restriction of air flow by the throttle plate 12. Such a variation in vacuum applied to the motor 30 would of course fail to produce the required control of spark advance. If the valve 70 alone were added to the system it would produce the curve C which merges with the curve B, as soon as the valve element 76 was released for opening movement by the throttle lever 82. This would eliminate the undesirable high vacuum applied to the motor 30 at idle but still falls far short of the vacuum or pressure regulation along the curve A which is desired. However, when the valve 50 is added to the system the higher vacuum represented by the portions of the curves B and C lying above the curve A are modified and specifically reduced by bleeding controlled amounts of atmospheric air through the conduit 42 into the vacuum conduit 36. By a proper selection of constants such as port areas, restrictions, and spring values, the arrangement described herein may be caused to produce a vacuum curve substantially coincident with the desirable curve A as seen in Figure 2.

The drawing and the foregoing specification constitute a description of the improved ignition control for an internal combustion engine in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. An internal combustion engine having an air supply passage provided with a venturi therein, a fuel inlet at the throat of said venturi, a throttle plate in said passage upstream from said venturi, an ignition distributor including a pressure responsive motor for adjusting said distributor, a pressure passage connecting said motor to the throat of said venturi, a first calibrated restriction in said pressure passage, a bleed passage connecting a portion of said pressure passage between said first restriction and said motor to atmosphere, a second calibrated restriction in said bleed passage, and valve means located in said bleed passage and responsive to pressure in said air supply passage downstream from said venturi effective to regulate air flow through said bleed passage.

2. An internal combustion engine having an air supply passage provided with a venturi therein, a fuel inlet at the throat of said venturi, a throttle plate in said passage upstream from said venturi, an ignition distributor including a motor responsive to subatmospheric pressures developed by said engine during operation for adjusting said distributor, a pressure passage connecting said motor to the throat of said venturi, a first calibrated restriction in said pressure passage, a bleed passage connecting a portion of said pressure passage between said first restriction and said motor to atmosphere, a second calibrated restriction in said bleed passage, and valve means located in said bleed passage and responsive to pressure in said air supply passage downstream from said venturi effective to regulate air flow through said bleed passage.

3. An internal combustion engine having an air supply passage provided with a venturi therein, a fuel inlet at the throat of said venturi, a throttle plate in said passage upstream from said venturi, an ignition distributor including a motor responsive to sub-atmospheric pressures developed by said engine during operation for adjusting said distributor, a pressure passage connecting said motor to the throat of said venturi, a first calibrated restriction in said pressure passage, a bleed passage connecting a portion of said pressure passage between said first restriction and said motor to said air supply passage upstream from said throttle plate, a second calibrated restriction in said

4

bleed passage, and valve means located in said bleed passage and responsive to pressure in said air supply passage downstream from said venturi effective to regulate air flow through said bleed passage.

4. An internal combustion engine having an air supply passage provided with a venturi therein, a fuel inlet at the throat of said venturi, a throttle plate in said passage upstream from said venturi, an ignition distributor including a motor responsive to sub-atmospheric pressures developed by said engine during operation for adjusting said distributor, a pressure passage connecting said motor to the throat of said venturi, a first calibrated restriction in said pressure passage, a bleed passage connecting a portion of said pressure passage between said first restriction and said motor to atmosphere, a second calibrated restriction in said bleed passage, valve means located in said bleed passage and responsive to pressure in said air supply passage downstream from said venturi effective to regulate air flow through said bleed passage, said valve means comprising a valve chamber, a balanced valve movable in said chamber, a calibrated spring in said chamber urging said valve toward closed position, and a passage connecting a portion of said chamber to said air supply passage downstream from said venturi to apply sub-atmospheric pressure to said valve to bias said valve against said spring.

5. An internal combustion engine having an air supply passage provided with a venturi therein, a fuel inlet at the throat of said venturi, a throttle plate in said passage upstream from said venturi, an ignition distributor including a pressure responsive motor for adjusting said distributor, a pressure passage connecting said motor to the throat of said venturi, a first calibrated restriction in said pressure passage, a bleed passage connecting a portion of said pressure passage between said first restriction and said motor to atmosphere, a second calibrated restriction in said bleed passage, valve means located in said bleed passage and responsive to pressure in said air supply passage downstream from said venturi effective to regulate air flow through said bleed passage, an idle valve in said pressure passage, and means operated upon movement of said throttle plate to idling position to close said idle valve.

6. An internal combustion engine having an air supply passage provided with a venturi therein, a fuel inlet at the throat of said venturi, a throttle plate in said passage upstream from said venturi, an ignition distributor including a pressure responsive motor for adjusting said distributor, a pressure passage connecting said motor to the throat of said venturi, a first calibrated restriction in said pressure passage, a bleed passage connecting a portion of said pressure passage between said first restriction and said motor to atmosphere, a second calibrated restriction in said bleed passage, valve means located in said bleed passage and responsive to pressure in said air supply passage downstream from said venturi effective to regulate air flow through said bleed passage, an idle valve in said pressure passage, and mechanical means actuated automatically by the operator upon moving the throttle plate to idling position to close said idle valve.

References Cited in the file of this patent

UNITED STATES PATENTS

2,274,316	Arthur	Feb. 24, 1942
2,317,885	Colvin	Apr. 27, 1943
2,381,610	Mallory	Aug. 7, 1945
2,381,611	Mallory	Aug. 7, 1945
2,455,594	Mallory	Dec. 7, 1948

FOREIGN PATENTS

853,146	France	Nov. 18, 1939
---------	--------	---------------