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IGNITION TIMING CONTROL MEANS FOR INTERNAL COMBUSTION ENGINES

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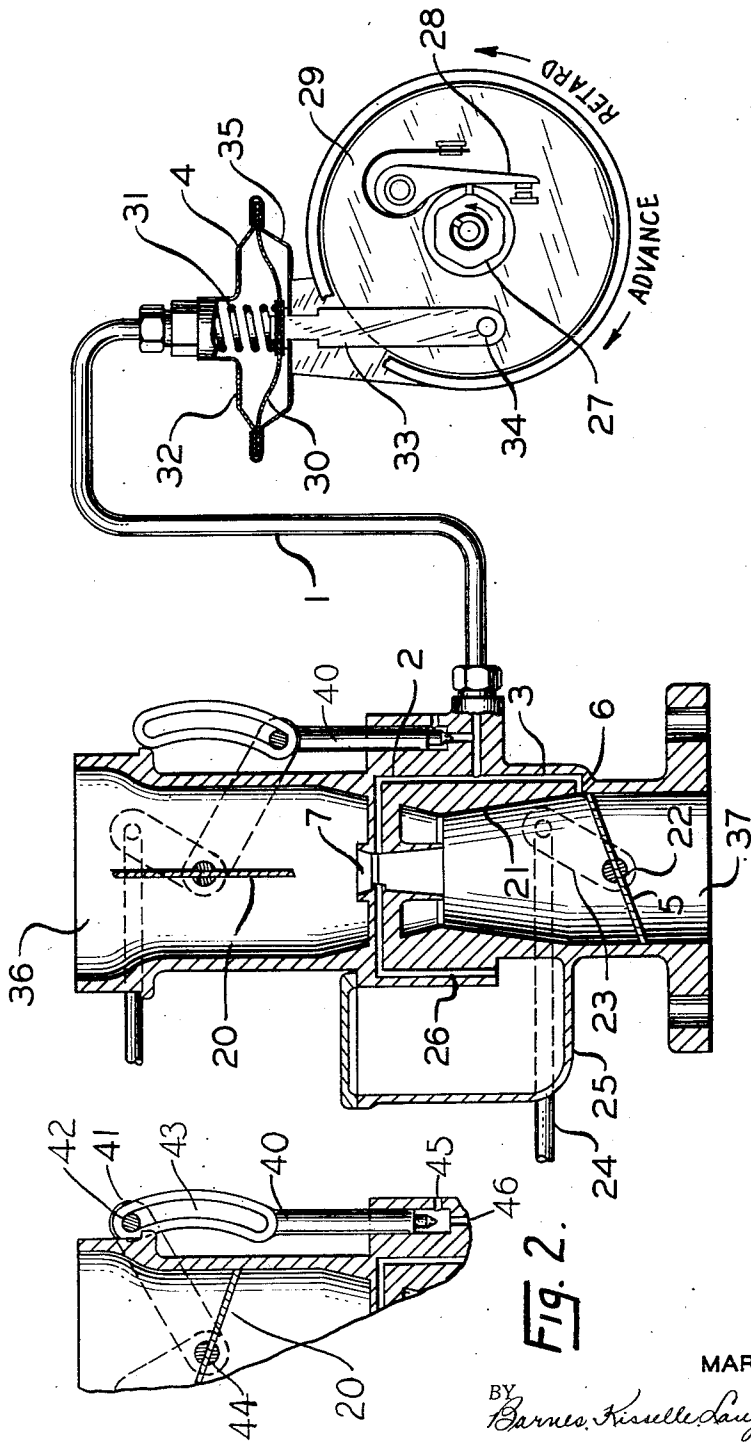


Fig. 1.

Fig. 2.

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IGNITION TIMING CONTROL MEANS FOR
INTERNAL COMBUSTION ENGINES

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10 Claims. (Cl. 123—117)

This invention relates to ignition timing control means for internal combustion engines.

The principal object of my invention is to control the pressures in the intake passageway of an internal combustion engine so that a single suction operated device will retard the spark timing when the engine is idling, advance the spark timing when the engine is working under light loads and reduce the advance of the spark timing when the engine is working under full loads; thereby eliminating the commonly known centrifugal governor used in present day ignition systems.

Fig. 1 is a sectional view partly in elevation showing the mechanism of my ignition timing control means for internal combustion engines.

Fig. 2 is a fragmentary section showing the suction air bleed opened.

The carburetor is provided with a throat or passageway 20 including venturi 21 and the usual butterfly throttle valve 5 mounted on shaft 22 which is swung open and closed by crank 23 and rod 24. The fuel float bowl is denoted 25. Fuel is drawn from the float bowl 25 through passageway 26 into the mixing chamber. For the purpose of description rather than by way of limitation, the fuel is drawn from passageway 26 into the booster venturi 7, which terminates in the venturi 21. The air inlet end of the carburetor is designated 36 and the fuel mixture outlet 37 which is connected to the engine intake manifold.

The timing mechanism is conventional and as shown consists of the usual rotatable cam 27 which operates the electrical circuit breaker 28. The circuit breaker 28 is mounted on the plate 29 which can be rotated clockwise to advance the spark and counterclockwise to retard the spark. A suction device 4 is utilized for advancing and retarding the spark. The suction device comprises a flexible diaphragm 30 backed up by a compression coil spring 31. The diaphragm 30 is mounted in the housing 32 which is connected to the carburetor by conduit 1. The diaphragm is connected to plate 29 by connecting rod 33, one end of which is pivotally connected as at 34 to the plate 29 and the other end of which is fixed to the diaphragm. The wall 35 of the housing is perforated so that the diaphragm is subjected on the outside to atmospheric pressure; whereas, on the inside of the housing 32, the diaphragm is subjected through line 1 to the booster venturi 7 and to orifice 6, located between the throttle and venturi 7.

Conduit 1 is connected in parallel by passageways 2 and 3 to venturi 7 and orifice 6.

The operation of my system is as follows:

Assuming that the engine is idling, the throttle 5 will be almost closed and orifice 6 will be located between the throttle and the venturi. Under such conditions, the suction device 4 will not be subjected to enough vacuum to advance the ignition timer against spring 31. Naturally, the spark will be in a retarded position when the engine is idling.

As the throttle 5 is moved towards an open position, orifice 6 will be placed into the manifold vacuum, but suction device 4 will never be subjected to the maximum manifold vacuum because orifice 6 will be air bled by conduit 2, which terminates in venturi 7.

The suction device 4 will be subjected to the highest vacuum at a point when the throttle has opened just above orifice 6, and the spark will be advanced to its farthest point under this condition, and it should be advanced the farthest under this condition because the engine is working under the highest load where more spark advance is required.

As the throttle 5 moves further towards an open position, the vacuum through orifice 6 decreases due to the opening of throttle 5 bleeding the manifold. This decrease in vacuum causes the spark advance to be reduced as the load is increased on the engine. However, as the throttle 5 is opened, the speed of air increases through venturi 7, which maintains enough suction to advance the ignition timing for wide open throttle or full load operation.

From the above explanation, it can be seen that in my system the suction in the carburetor is so controlled as to eliminate the suction on the diaphragm when the engine is idling so that the spark will be retarded, and to increase the suction on the diaphragm when the throttle is partly open or the engine working under light load to give the maximum spark advance, and to reduce the suction on the diaphragm when the throttle is wide open to give a lower spark advance.

Due to the fact that the suction through the venturi 7 is very low at the low engine speeds when the throttle 5 is wide open, it is necessary that the suction device 4 be large and powerful so that it will start to advance the spark at low engine speeds when the throttle is wide open, and the necessity for using a powerful suction device that will operate on the low venturi vacuums at wide open throttle makes it necessary to

reduce or bleed down the manifold vacuum when the engine is operating on part throttle. For example; if the suction device were connected into the system so that it would be subjected to the full manifold vacuum when the throttle 5 moved towards an open position, as is the case in other vacuum advance devices, it would be necessary to use a smaller suction device opposed by a much stronger spring, and, if such a device were used then it would not function on the low suction created by the air flow through venturi 7 when the throttle 5 was wide open.

To make this more clear, the vacuums that exist in the venturi and manifold of internal combustion engines are of great differences which produce a great difference in power. If the full power of the manifold vacuum were used to advance the spark for part throttle, the full load spark advance curve and part load spark advance curve would be too far apart. It is for that reason that I have reduced the manifold vacuum by air bleeding orifice 6 through venturi 7 so as to bring the suction powers at part and full open throttle acting on diaphragm 30 closer together. This makes possible the use of a powerful suction device that will advance the spark on low venturi vacuums, and, at the same time, not advance the spark too much when the manifold vacuum is high.

In my system, I can vary the powers of the two suctions in relation to each other by varying the size of orifice 6. In other words, the smaller the size of this orifice 6, the lower the suction will be on the suction device at part throttle and the higher it will be at wide open throttle because the conduit 2 that terminates in the venturi acts as an air bleed to orifice 6 when the throttle is partly open, and orifice 6 acts as a partial air bleed to conduit 2 which terminates in venturi 7 when the throttle is wide open.

In my system, I have shown a carburetor choke valve 20 to enrichen the mixtures for starting the engine. Naturally, the vacuum will be increased between the choke and engine for starting, and to prevent the high vacuum from advancing the spark when the engine is being started, the choke automatically bleeds conduit 1 when the choke is closed tightly enough to create a high vacuum in the carburetor. When the choke 20 is closed, as shown in Fig. 2, air bleed valve 40 is raised by means of crank arm 41. Crank 41 carries a pin 42 which engages valve 40 in the arcuate elongated slot 43. Crank 41 is fixed on the shaft 44 which supports the choke valve 20. When the choke valve 20 is closed, valve 40 is opened and conduit 1 is air bled through air inlet 45 and passageway 46. As choke valve 20 is swung towards open position, pin 42 travels downwardly in slot 43 thus permitting valve 40 to close air bleed 45, 46 as soon as the choke valve 20 is partly opened so that it no longer creates a high vacuum in the throat of the carburetor.

I do not wish to limit myself to this method of bleeding the suction device to prevent the spark from advancing when starting. Other methods could be used, such as an electro magnet connected to the starter switch, so that the suction device would be air bled when the starter was engaged.

Neither do I wish to be limited to the specific connections of the conduit 1 into orifice 6 or venturi 7, as shown in the drawing. If desired, conduit 2 can be connected into the large venturi 21 at the point of greatest restriction, that is, ad-

jacent the lower end of small venturi 7. In fact, I have found that the suction device 4 works somewhat better when connected into the large venturi 21. Apparently the gasoline being drawn into the small venturi 7 seems to expand the air and decrease the suction whereas this effect is not as great when the suction device is connected into venturi 21 which does not have the fuel nozzle in it. Furthermore, if it is not desired to have a high spark advance for part throttle and light load operations, conduit 3 and orifice 8 can be eliminated. In this case, the suction is created by the venturi alone.

I claim:

1. In an internal combustion engine the combination of an ignition timer, a fuel mixture intake passageway including a venturi, a throttle valve positioned in the passageway on the engine intake manifold side of the venturi, a single suction controlled means for varying the position of the timer, and a passageway connecting the suction means with the venturi, a second passageway connecting the first passageway with the intake passageway adjacent to the throttle valve and between the venturi and said throttle valve when closed for idling whereby the suction controlled means when the throttle is wide open is controlled principally by the venturi suction and when the throttle is partly open principally by the manifold vacuum to vary the position of the timer, said passageways being in continuous communication.

2. In an internal combustion engine the combination of an ignition timer adapted for operation to advance and retard the spark, a fuel mixture intake passageway including a venturi, a throttle valve positioned on the intake manifold side of the venturi, a suction chamber, a first passageway having an outlet in the venturi and connecting the suction chamber with the venturi, a second passageway connecting the first passageway with the intake passageway between the venturi and the throttle valve when closed and adjacent the throttle valve when closed whereby as the throttle valve is opened the second passageway is placed in the intake manifold vacuum, said first and second passageways being in continuous communication and means responsive to a predetermined suction in said chamber to control the position of the timer.

3. In an internal combustion engine the combination of an ignition timer, a suction device to advance and retard said ignition timer, a fuel mixture intake passageway having a venturi, an orifice in said venturi, a throttle valve for said passageway on the engine intake manifold side of said venturi, a second orifice into said passageway between the throttle valve and venturi when the throttle is near a closed position, a conduit connecting the first and second named orifices together, a conduit connected to the first conduit and to the suction device, the second named orifice located in a position between the venturi and throttle when the throttle is near a closed position and between the throttle valve and engine as the throttle valve moves towards an open position so that the first named orifice will act as an air bleed to the second named orifice when the second named orifice is placed on the engine intake manifold side of the throttle.

4. In an internal combustion engine the combination of an ignition timer, a suction device to advance and retard said ignition timer, a car-

buretor having a venturi, a throttle valve on the intake manifold side of the venturi, a choke valve on the other side of the venturi, a suction device including a conduit connected to the ignition timer and to said venturi whereby to advance the timer as the air flow increases through the venturi and retard the timer as the air flow decreases through the venturi, and air bleed means for said conduit including connections with said choke valve whereby the suction device is air bled to prevent the timer from advancing due to the suction created in the carburetor by choking the carburetor when the engine is being started.

5. In an internal combustion engine, the combination of an ignition timer and a carburetor having an intake passageway and two orifices located in said passageway, a throttle valve in the intake passageway, the said two orifices being positioned so that the throttle valve moves between the two orifices as it moves towards an open position thereby subjecting one of the orifices to the manifold suction when the throttle is opened and placing both of the orifices on the atmospheric side of the throttle when the throttle is closed or at idling position, a conduit connecting the two orifices together, and a single suction device, which controls an ignition timer, connected to said conduit.

6. In an internal combustion engine having a manifold, a carburetor having a throttle to vary the charge admitted to the manifold, a conduit having branches, said branches being in continuous communication with each other, one branch communicating with the manifold, a second branch communicating with the carburetor throat, and a suction controlled ignition timing device communicating with a third branch of the conduit whereby the sub-atmospheric pressure created in the conduit will be reduced by venting the higher pressure into the conduit at the carburetor throat and the suction controlled ignition device will advance and retard the timing of the engine ignition system as the throttle or charge is varied.

7. In an internal combustion engine, the combination of an intake manifold and ignition timer, a fuel mixture intake passageway including a venturi, a throttle valve positioned in the passageway, a conduit communicating with the venturi and manifold, means actuated by the operation of the throttle valve to reduce the suction in the conduit to a point much lower than the manifold suction, said means venting one end of the conduit into the carburetor or mixture intake passageway, and a suction controlled device connected to said conduit and ignition timer for controlling the advancing and retarding of the said timer.

8. In an internal combustion engine the combination of an ignition timer and a carburetor having an intake passageway including a venturi, a throttle valve on the engine side of the venturi, a conduit having an outlet in the venturi and communicating at all times with the venturi on the atmosphere side of the throttle valve, a suction device communicating with said above-

mentioned conduit coordinated with the relatively low vacuum set up in said conduit by said venturi whereby the suction device is operable to control said ignition timer by the said relatively low vacuum, and a second conduit continuously communicating with the first conduit at all positions of the throttle and with the intake passageway on the engine side of the throttle valve when the throttle valve is open whereby when the throttle valve is partly open the suction device is subjected to the engine intake manifold vacuum reduced by air bleeding into the conduit from the venturi and when the throttle valve is wide open the suction device is controlled by the vacuum set up in the conduit by the flow of air through the venturi modified by the action of the second-mentioned conduit which serves as a partial air bleed to the first-mentioned conduit.

9. In an internal combustion engine the combination of an ignition timer and a carburetor having an intake passageway and a throttle valve, a conduit communicating at all times with the intake passageway on the atmosphere side of the throttle, a suction device communicating with said above-mentioned conduit and operable to control said ignition timer by the relatively low vacuum in said above conduit caused by its communication with said passageway, and a second conduit continuously communicating with the first conduit at all positions of the throttle and with the intake passageway on the engine side of the throttle valve when the throttle valve is open whereby the suction device is subjected to the relatively high vacuum obtaining on the engine side of the throttle valve when partly open modified by air bleeding into the first-mentioned conduit from the intake passageway.

10. In an internal combustion engine including an intake passageway, the combination of an ignition timer adapted for operation to advance and retard the spark, a single suction device having a single suction chamber and being the sole means for retarding and advancing the spark, means for connecting the suction device to the engine intake passageway so that when the throttle is partly closed the suction device will not be subjected to the full manifold suction, said means comprising a conduit extending between the suction device and the engine intake passageway, said conduit having an outlet in the intake passageway on the engine side of the throttle when the throttle is opened further than idling position and another outlet in the intake passageway on the atmosphere side of the throttle valve so that the high manifold suction will be reduced by the latter outlet, said outlets being in continuous communication with each other and with the suction device whereby said suction device is in constant communication with the intake passageway at a point between the engine and the throttle and at a point between the throttle and atmosphere at all times when the throttle is opened to a degree further than engine idling speed.

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