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VACUUM IGNITION MECHANISM

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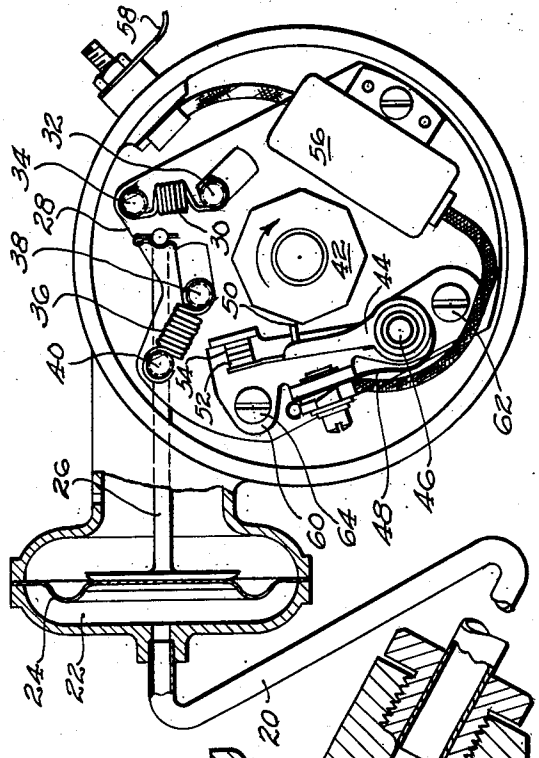


Fig. 1

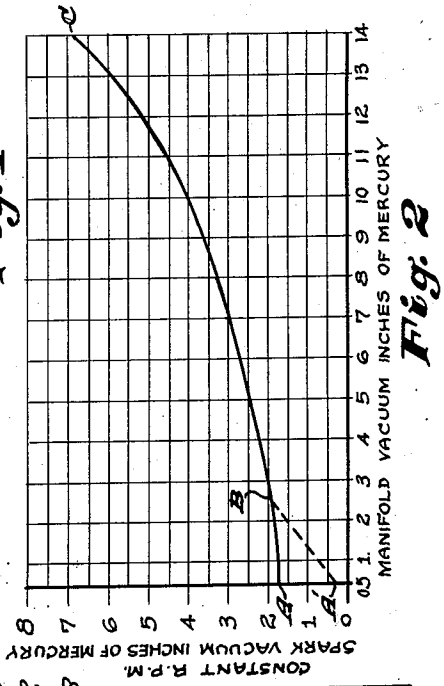


Fig. 2

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VACUUM IGNITION MECHANISM

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8 Claims. (Cl. 123—117)

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The object of this invention is to control the spark advance of an automobile by means of both inlet manifold vacuum and the vacuum created by the throat of the venturi of the plain tube carburetor in general use. Heretofore there have been two rival and partially successful commercial solutions, namely:

(1) To meter the two vacuums through two short restricted passages or jets so as to obtain a practical compromise between them so that as the engine throttle is opened and closed the two vacuums controlled thereby act against a diaphragm to rotate a circuit breaker plate against the restraining action of a loose spring and an initially tight tension spring to give correct spark advance.

(2) To provide a spring loaded check valve, normally seated, so as to prevent the low manifold vacuum which exists at wide open throttle from diluting the Venturi vacuum.

The objections to both systems are as follows:

(A) It is difficult with (1) to obtain sufficient vacuum especially at wide open throttle position to reliably operate the spark mechanism in view of the presence of dust and the undesirable effect of over lubrication on the life of the tungsten points.

Again, when closing the throttle from its wide open position to its road load position after attaining the desired road speed (direct gear) by accelerating the engine by opening the throttle; there was an objectionable sudden spark advance and an objectionable although temporary "knock" for a short, though appreciable, interval of time.

Specifically, as the throttle is closed from the wide open position after acceleration in order to maintain a constant speed (the normal maneuver when driving a car) the spark vacuum suddenly jumped from 0.35 inch Hg to 2 inches Hg as the manifold vacuum rose from ½ inch Hg to 2½ inches Hg. A smooth increase from 1¾ inches Hg at ½ inch Hg manifold vacuum to 7 inches Hg at 14 inches Hg manifold vacuum of this spark vacuum acting on the diaphragm is desired. If this increase is not exactly what is wanted a combination of a loose spring and a tight tension spring acting at the right angles will give the desired spark advance characteristics required for engines by moving the ignition circuit breaker plate. If this increase in "spark" vacuum is not smooth but is broken then it is practically impossible to obtain the right combination of springs to give the characteristic

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spark advance for the particular engine demanded by the customer.

With no check valve gasoline actually finds its way into the air chamber next to the diaphragm and the result is cumulative. This can be a very serious defect.

(B) The objection with (2) is that a spring loaded check valve when accelerating from road load with a wide open throttle the ball check snaps shut suddenly under the influence of the spring and thereby traps the high "road load" manifold vacuum inside the chamber next to the diaphragm so as to hold the spark in an advanced position. This high vacuum required some time to escape through the restriction leading to the throat of the venturi.

Hence, during this appreciable interval of time there is an objectionable "acceleration knock" which is sufficient to cause the customer to condemn the system in spite of any other advantages it might have.

I have discovered that the ideal solution is to use a gravity loaded small nylon ball with a free lift of from ½ inch to ¾ inch. This ball is in a larger passage so that during acceleration as the vacuum (suction) in the venturi overcomes the inlet manifold vacuum there is air friction which lifts the ball and causes an appreciable delay during which the high vacuum of road load escapes before the check valve reaches its seat. What is known as "tip in" or "acceleration knock" is thus avoided.

Gravity causes the ball to descend and to open the restriction between the diaphragm chamber and the inlet manifold whenever the inlet manifold vacuum is equal to or exceeds the Venturi vacuum.

This check valve being held in its open position only by gravity quickly ascends to its closed position whenever air friction, due to the flow of air past its sides due to the lower pressure in the venturi as compared with the manifold air pressure, overcomes the weight of this ball. The size of the first air restriction leading from the diaphragm chamber into the venturi, the clearance in the passage around the nylon ball, the second air restriction between the ball and the first restriction, the location of the lip of the throttle with reference to the connection of the manifold suction and the check ball passage are all critical if ideal conditions are to be obtained.

At all times when driving a car in traffic the throttle is moving, the load is changing and the speed of the engine is either decreasing or increasing. Static conditions are extremely rare as

the normal condition is one of change. If any changing condition creates a knock due to a too advanced spark or on the other hand if a too retarded spark causes sluggish operation and excessive fuel consumption the spark characteristics are condemned.

Fig. 1 shows the preferred form of my invention when idling with the spark fully retarded.

Fig. 2 shows what happens when the throttle is closed from its wide open position to maintain a constant speed as the load is decreased following acceleration.

In Fig. 1, 10 is the air entrance, 12 is the venturi into which discharges a small venturi. A nozzle, not shown, discharges into the small venturi. 14 is a restricted opening located immediately downstream of the throat of the venturi 12. 16 is the opening in the wall of the mixture outlet immediately above the upstream lip of the throttle 18 when the throttle 18 is closed for idle. 17 is an additional hole in the mixture outlet upstream of the opening 16 and parallel thereto. 20 is a pipe connecting the three openings 14, 16 and 17 with the chamber 22. The chamber 22 is bounded on the right by the diaphragm 24. This diaphragm is connected to the rod 26 with the circuit plate 28. A tight spring 30 connects the stationary pin 32 with the moving pin 34 mounted on the plate 28. The loose spring 36 mounted on the pin 40 connects with the stationary pin 38 to control the advance of the spark. 42 is a cam which engages with the lever 44 mounted on the pin 46. A conducting spring 48 rotates the lever 44 clockwise and thus brings the fiber rubbing block 50 into engagement with the cam 42 as the cam 42 rotates. In the position shown the rubbing block 50 has parted company with the cam 42 and the two tungsten points 52 and 54 are in contact with each other so that electricity flows from the electrical conductor 58 along the conducting spring 48 to the movable tungsten point 52 and so to the stationary tungsten point 54. Pin 46 and the stationary tungsten point 54 are both mounted on the bracket 60.

A slight adjustment on the bracket 60 is obtained by loosening the screws 62 and 64 in a well known manner.

A condenser 56 is provided to minimize the electrical heat that would otherwise burn the points 52 and 54.

68 is a pin which supports a nylon ball 70 in a passage 72. The nylon ball is just a little smaller than the passage 72 for a reason to be given in the description of Fig. 2. 74 is a slightly restricted opening connecting the passage 72 with the passage 76 immediately to the right of and below the restriction 14. The following dimensions have been found satisfactory:

The nylon ball 70 is preferably .125 inch in diameter
The passage 72 is .140 inch in diameter
The clearance between the nylon ball 70 and the passage 72 is thus .007 inch
Passage 16 is .070 inch in diameter
Passage 17 is .035 inch in diameter
Passage 14 is .038 inch in diameter
Passage 74 is .041 inch in diameter

Description of Fig. 2

In Fig. 2 ABC represents the characteristic I have been able to secure with the above arrangement of parts and selection of dimensions given above. It represents the rise of spark vacuum acting on the diaphragm 24 as the manifold vacuum rises at some constant speed (2000 R. P. M.) as the load is decreased from wide open throttle maximum load to road load.

Point B is critical because without the check valve the vacuum at A' would only be .035 inch Hg at 0.5 inch Hg manifold vacuum and when the manifold vacuum rose to 2½ inches Hg the spark vacuum would suddenly jump from 0.35 inch Hg to 2.0 inches Hg.

The distributor would have to be set for A' and as a result B would give too much advance too soon. This would create a "knock." If the distributor is set at A there is a gradual advance. Hence, without a check valve the point B was liable to cause a temporary knock to cure which the spark advance at A' would be lowered somewhat and the fuel mileage would suffer accordingly.

With the ABC characteristic, as shown, a very satisfactory fuel economy has been secured.

The curved nature of the line ABC is corrected by the spring arrangement as set forth in Westcott et al. Patent No. 2,503,645.

When the nylon ball having a specific gravity of ½ is replaced by an aluminum ball the clearance must be reduced to such an extent that the restriction 14 must be made smaller.

What I claim is:

1. An ignition timing device for an internal combustion engine comprising an ignition timer, an intake passageway of Venturi form, a throttle valve in said intake passageway downstream of said venturi, a pressure controlled mechanism connected to said timer for advancing and retarding the spark, said mechanism comprising an air chamber having a pressure responsive moving wall, a first passage from said chamber leading to the Venturi throat, a restriction in said passage, a second passage from said chamber to the air intake passageway adjacent said throttle and so located that it is substantially vertical and is progressively subjected to the engine suction at said throttle, a valve member having a specific gravity less than three in said second passage, a clearance between the valve member and said second passage so that the valve member is lifted by the air flow when the throttle is opened, a support member in said second passage adapted to support said valve member in a first position, a seat located in said second passage a substantial distance above said support member and above said valve member when said valve member is in said first position, said seat being adapted to be engaged by said valve member an appreciable interval of time after the throttle has been opened.

2. A device as set forth in claim 1 in which the valve member is spheroidal in form.

3. A device as set forth in claim 1 in which the valve member is a spheroid of nylon.

4. A device as set forth in claim 1 in which the valve member is a sphere of nylon.

5. A device as set forth in claim 1 in which the valve member when in said first position is located approximately ½ inch below said seat.

6. A device as set forth in claim 1 in which the throttle is of the butterfly type and in which there is a restriction in said second passage located at the place in the intake passageway where the upstream lip of the throttle creates the maximum suction during the initial stages of the opening movement of said throttle.

7. A device as set forth in claim 1 in which the throttle is of the butterfly type and in which there is a plurality of restrictions in parallel in

said second passage located at the place in said second passage where the upstream lip of the throttle creates the maximum suction during the initial stages of the opening movement of said throttle.

8. An ignition timing device for an internal combustion engine comprising an ignition timer, an intake passageway of Venturi form, a throttle valve in said intake passageway downstream of said venturi, a pressure controlled mechanism connected to said timer for advancing and retarding the spark, said mechanism comprising an air chamber having a pressure responsive moving wall, a first passage from said chamber leading to the Venturi throat, a restriction in said passage, a second passage from said chamber to the air intake passageway adjacent said throttle and so located that it is substantially vertical and is progressively subjected to the engine suction at said throttle, a light weight valve member in said second passage, a clearance between the valve member and said second passage so that the valve

member is lifted by the air flow when the throttle is opened, a support member in said second passage adapted to support said valve member in a first position, a seat located in said second passage a substantial distance above said support member and above said valve member when said valve member is in said first position, said seat being adapted to be engaged by said valve member an appreciable interval of time after the throttle has been opened.

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