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IGNITION APPARATUS

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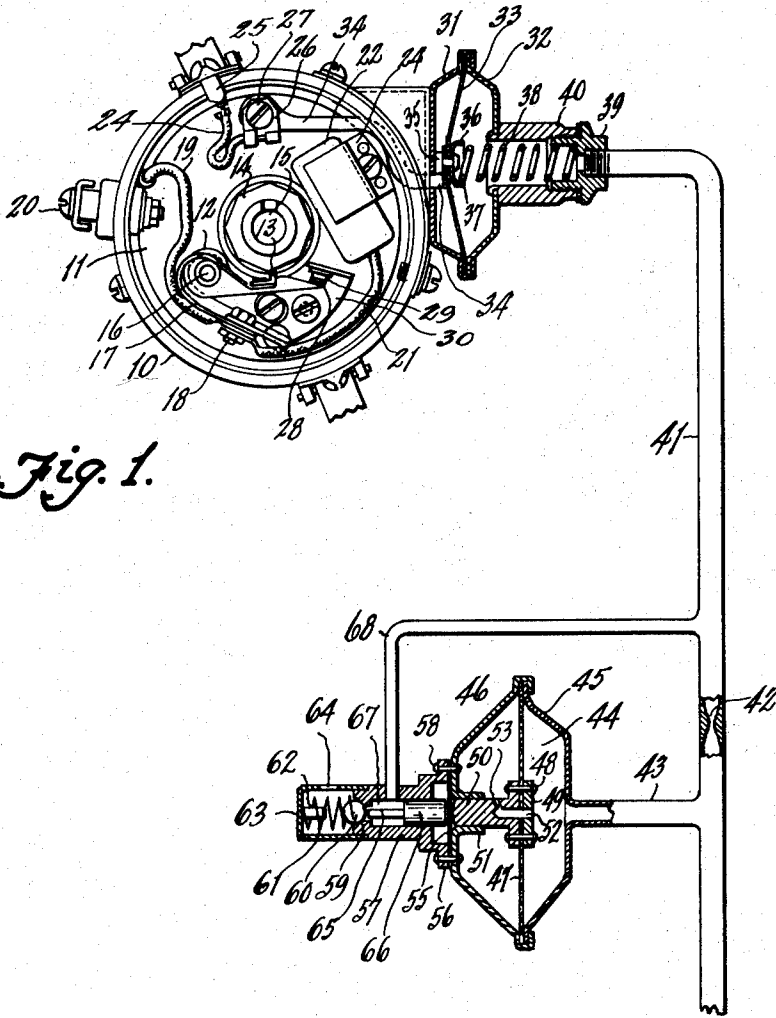


Fig. 1.

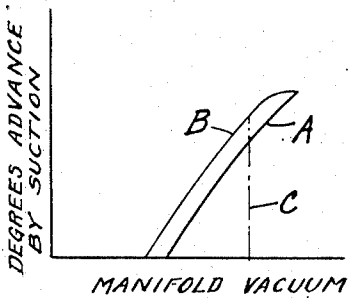


Fig. 2.

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IGNITION APPARATUS

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5 Claims. (Cl. 123—117)

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This invention relates to ignition apparatus having means for varying the timing of the ignition in accordance with engine suction as well as engine speed. It has been found desirable particularly with high compression automobile engines to retard the ignition momentarily during rapid acceleration. It is, therefore, an object of the present invention to provide for momentarily decreasing the effect of engine suction upon the control of the ignition timer during rapid acceleration while providing for the normal operation of the timer to retard the spark gradually with relatively gradual decrease of engine suction. In accomplishing this object, the engine provides for momentarily venting the pipe which connects the engine intake with a diaphragm chamber closed by a diaphragm which moves in accordance with variations of engine suction to control ignition timing.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

Fig. 1 is a diagram showing a plan view of the ignition timer with its suction controller partly in section and a sectional view of the auxiliary apparatus for momentarily venting the pipe leading to the diaphragm chamber during rapid decrease in engine suction.

Fig. 2 is a chart illustrating the operation of the device.

Referring to Fig. 1, a timer housing 10 supports a breaker plate 11 which supports a circuit breaker lever 12 carrying a rubbing block 13 for engagement by an ignition timer cam 14 which is connected with an engine driven shaft by a device responsive to engine speed for varying the angular relation of the cam 14 relative to the engine driven shaft which has an extension 15 on which the cam 14 is rotatable.

In the timer shown in Fig. 1, the direction of rotation of the cam 14 is counterclockwise, therefore the speed responsive device will effect displacement of cam 14 relative to shaft extension 15 in a counterclockwise direction as engine speed increases. The lever 12 is urged counterclockwise about a pivot post 16 attached to the plate 12 by a leaf spring 17 fixed to the lever and to a bracket 18 which a wire 19 connects with a terminal 20. Bracket 18 is connected also with a wire 21 connected with a condenser in a case 22, said condenser having one foil connected with wire 21 and the other foil with the case 22 which is grounded by a supporting bracket 23 which a screw 24 attaches to the plate 11 which in turn is connected to ground by a flexible wire 24 soldered or brazed at 25 to the housing 11 and connected with a terminal clip 26 in contact with a screw 27 threaded into the plate 11. Lever 12 which is insulated from post 16 and plate 11 carries

a contact 28 for engaging a contact 29 fixed to a bracket 30 supported by a plate 11. The condenser in case 22 is therefore in parallel with the contacts 28 and 29.

The suction controller 30 of the ignition timer comprises two shells 31 and 32, the flanges of which clamp the periphery of a diaphragm 33, the center portion of which is attached to a link 34, a washer 35, a cup 36 by a rivet 37. Link 34 is pivotally connected with plate 11 by the screw 27. A compression spring 38 is confined between the cup 36 and a bushing 39 which is threaded into a bushing 40 attached to the shell 32. The connection between the engine intake and the suction chamber between shell 32 and diaphragm 33 is provided by a pipe 41 having a restriction 42. As engine suction increases, the diaphragm 33 moves right and the plate 11, which is supported for rotation about the axis of cam 14, rotates clockwise to advance the ignition timing. When engine suction decreases, spring 38 pushes diaphragm 33 left and the ignition is retarded.

Between the engine intake and the restriction 42, pipe 41 is connected by pipe 43 with a suction chamber 44 located between a shell 45 and a diaphragm 47, the periphery of which is clamped between flanges of shell 45 and a shell 46. Rivets 48 connect diaphragm 47 with a washer 49 and a rod 50 guided for longitudinal movement by a flange 51 of shell 46. Hole 52 extends through washer 49 and diaphragm 47 and into the rod 50 and connects with a small bleed hole 53 leading into the chamber between shell 45 and diaphragm 47. The hole in shell 45, which receives a rod 50, is covered by a diaphragm 55, the periphery of which is clamped between the shell and the flange 56 of a bracket 57 secured by rivets 58. Shell 57 provides a valve seat 59 for a ball valve 60 retained on the seat by spring 61 which is located by a pin 62 attached to a shell 63 supported by bracket 57 and having a vent hole 64. The valve 60 is moved from its seat by left movement of a rod 65 attached to a plunger 66 received in a bore 67 of bracket 57, said bore being connected by pipe 68 with pipe 41 between restriction 42 and the suction device 30.

During moderate change in engine speed producing moderate change in engine suction, the diaphragm 47 remains practically in fixed position as shown, the bleed hole 53 providing for equalization of pressure on both sides of the diaphragm 47. Therefore, during relatively gradual increase in engine suction, the diaphragm 33 will move to advance ignition timing as indicated by curve A in Fig. 2; and, during relatively gradual decrease of engine suction, the ignition is retarded as indicated by curve B.

When engine speed is increased relatively rapidly on a relatively level road, the suction in pipe 41, between restriction 42 and the engine

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intake, will decrease relatively rapidly and the pressure on the right side of the diaphragm 44 will be greater than the pressure on the left side. Since the small hole 53 is too small to effect balance of pressure in a relatively short time, the diaphragm 47 will move momentarily toward the left. Therefore, rod 50 will press against diaphragm 55 and cause left movement of the plunger 66 to move ball valve 60 from its seat 59 thereby connecting pipe 41 with vent through the pipe 68, bore 67, shell 61 and vent hole 64. Therefore, there will be a reduction of suction at the right of diaphragm 33 thereby permitting the spring 38 to effect momentary or abrupt retard of engine suction as represented by line C in Fig. 2. Restriction 42 limits the rate of venting of that portion of pipe 41 between this restriction and the engine when ball valve 60 opens and hence the rate of venting chamber 44, so that the time required for equalization of pressure through the hole 53 will not extend unduly beyond the required interval of momentary spark retarding. At the end of the period of rapid acceleration, the suction on both sides of the diaphragm 47 will have become equalized so that diaphragm 47 will return to normal position to allow the spring 61 to force valve 60 on its seat 59.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. Ignition apparatus comprising a timer having an engine driven timer cam, a circuit breaker operated thereby for controlling ignition timing, a plate supported for rotation about the axis of the cam and supporting the breaker, a first suction operated device for rotating the plate and comprising a suction chamber connected with the engine intake and closed by a diaphragm connected with the plate and a spring opposing movement of the diaphragm with increasing engine suction to rotate the plate in a direction to advance ignition timing, said spring operating to retard ignition timing when suction decreases, and a separate suction actuated means operating in response only to sudden decrease in engine suction effective on said means for momentarily venting the suction chamber to obtain ignition retard during rapid engine acceleration.

2. Ignition apparatus comprising a timer having an engine driven timer cam, a circuit breaker operated thereby for controlling ignition timing, a plate supported for rotation about the axis of the cam and supporting the breaker, a suction operated device for rotating the plate and comprising a suction chamber connected with the engine intake and closed by a diaphragm connected with the plate and a spring opposing movement of the diaphragm with increasing engine suction to rotate the plate in a direction to advance ignition timing, said spring operating to retard ignition timing when suction decreases, and a device for venting the suction chamber and including a vent valve, a spring biasing the valve into normally closed position, a chamber having a movable partition and connected on one side of the partition with the engine intake, means connected with the partition and located on the other side thereof for transmitting motion to the valve to open it when pressure on the first mentioned side of the partition is greater than pressure on said other side there-

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of, and a duct through the partition providing for equalization of pressure on both sides of the partition within a time commensurate with relatively gradual rates of change of engine suction, said duct providing a restriction such that pressure equalization lags behind pressure increase on the first mentioned side of the partition when engine suction is suddenly reduced.

3. In combination with ignition apparatus movable to advance and retarding positions of timing; a suction operated device for actuating the apparatus and comprising a suction chamber connected with the engine intake and closed by a diaphragm connected with the apparatus and a spring opposing movement of the diaphragm with increasing suction to move the apparatus in a direction to advance ignition timing, said spring operating to retard ignition timing when suction decreases; a restriction in the connection between the device and the engine intake; and an independent suction operated means connected around the restriction and operating in response only to sudden decrease in the engine suction effective on said suction operated means for momentarily venting the suction chamber to obtain ignition retard during rapid engine acceleration.

4. In combination with an ignition apparatus movable to advance and retard positions of timing, a suction operated device connected with the engine intake and operable to move the apparatus to advance and retard positions of timing in accordance with engine suction, said device comprising a suction chamber connected with the engine intake and closed by a diaphragm connected with the apparatus and a spring opposing movement of the diaphragm with increasing engine suction to operate the apparatus to advance ignition timing, said spring operating to retard ignition timing when suction decreases; a restriction in the connection between the suction operated device and the engine intake; and a suction operated valve connected around the restriction for venting the suction operated device momentarily to atmosphere upon sudden decrease in the engine suction which is effective to control the operation of said valve.

5. In combination with an ignition apparatus movable to advance and retard positions of timing; a suction operated device connected with the engine intake and operable to move the apparatus to advance and retard positions of timing in accordance with engine suction, said device comprising a suction chamber connected with the engine intake and closed by a diaphragm connected with the apparatus and a spring opposing movement of the diaphragm with increasing engine suction to operate the apparatus to advance ignition timing, said spring operating to retard ignition timing when suction decreases; a restriction in the connection between the suction operated device and the engine intake; and a suction responsive by-pass means around the restriction for venting the suction operated device momentarily to atmosphere upon sudden decrease in the engine suction which is effective to control the operation of said by-pass means.

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