Oct. 29, 1929. W. A. CHRYST 1,733,942

IGNITION TIMER

Filed Jan. 13, 1923

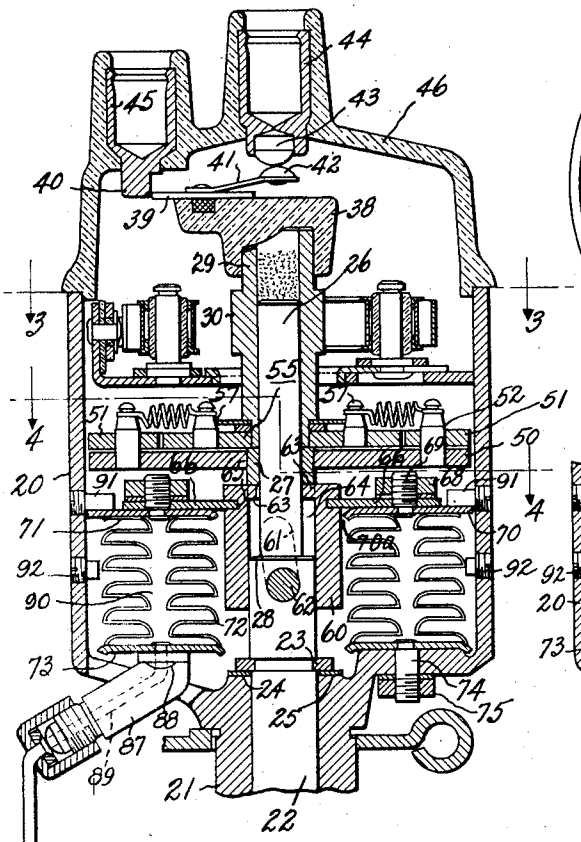


Fig. 1

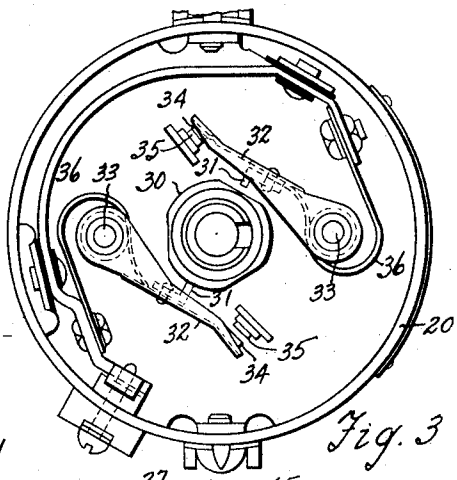


Fig. 3

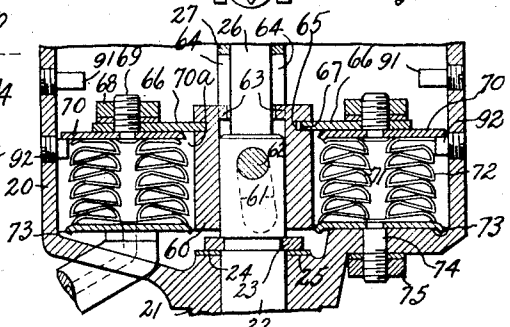


Fig. 2

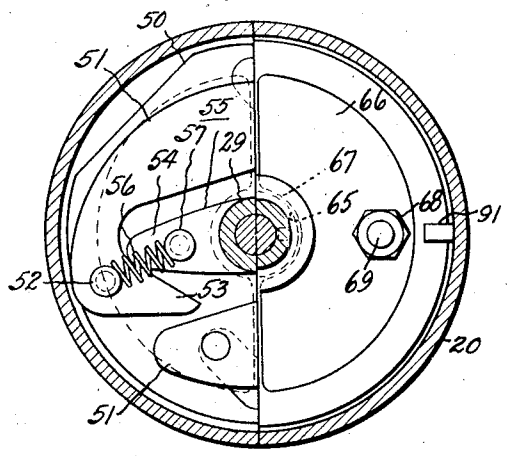


Fig. 4

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UNITED STATES PATENT OFFICE

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IGNITION TIMER

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This invention relates to ignition timers for internal combustion engines, and more particularly to ignition timers having means for controlling the timing of the ignition in response to variations in pressure in the intake passage of the engine.

One object of the present invention is to provide a simple and compact ignition timing device having means responsive to variations in engine speed and means responsive to variations in pressure in the engine intake passage for controlling the angular relation between the ignition timer cam and the ignition timer driving shaft in order to vary the timing of the ignition to suit the conditions of speed and load of the engine. In the present invention this object is accomplished by a construction comprising an intermediate shaft located between the timer cam and the timer driving shaft, means responsive to variations in pressure in the engine intake passage for connecting the timer driving shaft with the intermediate shaft and for varying the angular relation between these shafts in accordance with variations in pressure in the engine intake passage, and comprising means for connecting the intermediate shaft with the cam and responsive to variations in speed of the engine for varying the angular relation between the intermediate shaft and the cam. Each of the timer controlling devices acts independently of the other and they may act concurrently differentially or cumulatively, to control the angular relation between the driving shaft and the timer cam.

Another object of the present invention is to provide certain improvements in the type of pressure controlled ignition timing apparatus in which the pressure chamber, communicating with the engine intake passage, is located entirely within the ignition timer housing and surrounds the ignition timer shaft. This object is accomplished by providing a pressure chamber comprising two metal bellows concentrically arranged and connected with ring-shaped plates, which surround the timer shaft. One of the plates is fixed to the timer housing and the other moves along the shaft to change the angular relation between the shaft and the timer cam.

Further objects of the present invention is to provide an ignition timing device having the features referred to which may be manufactured at low cost and which may be inclosed by a housing which is compact and symmetrical in appearance.

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

In the drawings:

Fig. 1 is partly a vertical sectional view of an ignition timer embodying the present invention and is partly a diagram showing the connection between the engine intake passage and the device for controlling the ignition timer in response to variations in pressure in the engine intake. Fig. 1 shows the pressure chamber in the timer housing fully expanded.

Fig. 2 is a fragmentary sectional view similar to Fig. 1 but showing the pressure chamber contracted.

Fig. 3 is a plan view of the ignition timer, the plan being substantially on the plane of the line 3—3 of Fig. 1.

Fig. 4 is a composite sectional view on the line 4—4 of Fig. 1.

The ignition timing apparatus is enclosed by a cup-shaped housing 20 having a tubular shank 21 providing a bearing for an ignition timer driving shaft 22. Shaft 22 is provided with collar 23 which rests upon a washer 24 in turn resting upon a boss 25 provided by the housing 20. In this way the shaft 22 is supported vertically. The shaft 22 is provided with an extension 26 of less diameter than that portion of the shaft journalled within the shank 21. An intermediate shaft 27 is loosely journalled on the extension shaft 26 and is supported vertically by resting upon a shoulder portion 28 of the shaft 22. A sleeve 29 providing a timer cam 30 rests at its lower end upon the upper end of the intermediate shaft 27 and is also supported by the shaft extension 26 for rotation relative thereto.

The cam 30 cooperates with the rubbing blocks 31 to move the circuit breaker levers 32 about their pivot studs 33. Each lever 32 carries a contact 34 for engaging the interrupter contact 35. Leaf spring conductors 36 yieldingly urge the rubbing blocks 31 into contact with the cam 30 or the contacts 34 into engagement with the contact 35. As shown in Fig. 3, the pairs of interrupter contacts are connected in parallel and they are closed and separated alternately in order that an ignition coil cooperating therewith may produce sparking impulses. The sparking impulses are distributed in the usual manner by a distributing mechanism comprising a distributor rotor 38 supported by the cam sleeve 29 and driven thereby and carrying a segment 39 which rotates adjacent a circular row of distributor posts 40. A leaf spring conductor 41, attached to the segment 39, carries a button 42 which engages a button 43 carried by a metal sleeve 44 providing a socket for receiving a wire terminal clip for connecting the secondary terminal of an ignition coil. The posts 40 are each formed integral with a conducting socket 45 for receiving the terminal clips of wires for connecting the posts 40 respectively with spark plugs of an engine. The sockets 44 and 45 are insulatingly supported by a distributor head 46 formed of a moldable insulating compound. The head 46 is supported by the timer cup 20 and is clamped thereto in any suitable manner.

The mechanism which connects the intermediate shaft 27 with the cam carrying shaft 29 and which is responsive to variations in speed for varying angular relation between the shafts 27 and 29 comprises a weight carrying plate 50, supporting weights 51 which are pivoted about studs 52 attached to the plate 50. Each weight 51 has an arm 53 adapted to engage an arm 54 provided by a plate 55 which is attached to the lower end of the cam supporting shaft 29. When the weights 51 move outwardly from the shaft 29 with increasing speed, the shaft will be rotated clockwise relative to the shaft 27 in order to advance the timing of the ignition, the normal direction of rotation of the cam 30, being clockwise as viewed in Fig. 3. As the speed decreases springs 56 each connected with a pivot stud 52 and with a stud 57 carried by lever arm 54, will cause the arms 54 to be rotated counterclockwise to retard the ignition and to cause the weights 51 to approach the shaft 29.

The means which connects the timer drive shaft 22 with the intermediate shaft 27 and varies the angular relation between these shafts in accordance with variations in pressure in the intake passage of the engine, comprises a sleeve 60 which is slidable along the shaft 22 and which is provided with diametrically opposite oblique slots 61 for receiving the ends of a pin 62 extending diametrically through the shaft 22. The sleeve 60 is provided with lugs 63 which extend into grooves 64 provided by the intermediate shaft 27. By moving the sleeve endwise along the shaft 22, the angular relation between the shafts 22 and 27 will be changed. This structure provides a differential spline connection between the drive shaft and the intermediate shaft and consequently with the cam carrying shaft, since movement of the sleeve 60 along the drive shaft, will by reason of the interfitting engagement of the elements 61, 62, 63 and 64 operating through the elements 22, 27, 30 and 60 vary the angular relation of the contact opening cycle with the engine operating cycle. The sleeve 60 is provided with an annular groove 65 which receives the inner edge portions of plates 66 which may be described as being semi-circular and provided with a semi-circular notch 67 so that the portion of the plate may extend into a portion of the groove 65. The plates 66 are secured by nuts 68 and studs 69 to a circular plate 70 having a central opening 70^a for providing clearance for the sleeve 60. The studs 69 are riveted to the plate 70. The underside of the plate 70 is permanently connected to two concentric metal bellows 71 and 72. The lower ends of these bellows are permanently secured to a ring-shaped plate 73 carrying one or more studs 74 which pass through holes in the bottom of the timer cup 20 and cooperate with nuts 75 to secure the plate 73 within the timer cup.

Fig. 1 shows diagrammatically an engine intake manifold 80 to which is attached a carburetor 81 having a butterfly valve 82 operated by a lever 83 and a link 84. The carburetor is provided with a passage 85 which is located just below the edge of the valve 82 when the latter is in closed position. A pipe 86 connects the passage 85 with an elbow pipe 87 passing through the bottom of the housing 20 and attached by rivets 88 to the plate 73. Elbow 87 provides a passage 89 connecting the pipe 86 with a pressure chamber 90 enclosed by the concentric bellows 71 and 72 and by the plates 70 and 73. Due to the resiliency of the bellows the plate 70 is normally maintained in the upper position shown in Fig. 1 against stop screws 91 which limit the upward movement of the plate 70. As the pressure in the engine intake passage provided by the carburetor 81 and the manifold 80, falls below atmospheric or as the suction in this passage increases, the plate 70 will move downwardly thereby causing the sleeve 60 to move downwardly and to move the intermediate shaft 27 in a clockwise direction relative to the shaft 22 in order to advance the ignition. Stops 92 are engageable with the lower side of the plate 70 as shown in Fig. 2 in order to limit the downward movement of the plate 70 and the extent to

which the ignition may be advanced in response to increase in suction in the engine intake passage.

When the load of the engine is increased requiring the throttle 82 to be opened wider, the suction in the engine intake on the engine side of the throttle 82 will decrease thereby permitting the bellows to move the plate 70 upwardly in order to retard the ignition. Obviously the closing of the throttle to diminish the amount of fuel delivered to the engine when the load diminishes, will cause the suction in the intake to increase. This results in the downward movement of the plate 70 to advance the ignition. When the throttle 82 is in idling position, the passage 85 is anterior to the throttle and hence is not in communication with that part of the engine intake on the engine side of the throttle. Hence the pressure in the suction chamber 90 will be substantially atmospheric and the plate 70 will be maintained in its uppermost position. Hence, the timing of the ignition will be automatically retarded while the engine is idling.

Each of the devices for automatically controlling the ignition, may operate independent of the other and both devices may operate cumulatively or differentially to control the timing of the spark, that is, both devices may operate at the same time to advance the spark or one may tend to advance it while the other tends to retard it. For example, the power of the engine may be increased both by increasing its speed and by increasing its load. As the speed increases the centrifugal device will operate to advance the ignition, and as the load increases there may be a tendency for the suction in the engine intake passage to decrease and permit the plate 70 to move upwardly to retard the ignition.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a sleeve movable along the shaft, means for drivingly connecting the sleeve and shaft and including pin-and-oblique slot provisions whereby the sleeve will be rotated relative to the shaft as the sleeve moves axially along the shaft, means responsive to variations in pressure in the engine intake for moving the sleeve along the shaft and including a suction chamber provided by two spaced concentric bellows surrounding the shaft and an annular disc to which the ends of the bellows are fixed, and to which the sleeve is connected, and means for connecting the sleeve and the cam.

2. Ignition apparatus according to claim 1 in which the means which connects the sleeve and cam is responsive to variations in speed for changing the angular relation of the cam and sleeve.

3. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam-carrying shaft surrounding the drive shaft and fixed against axial movement, means for connecting the intermediate shaft with one of the other shafts and for changing the angular relation between them in response to variations in engine intake suction, and means for connecting the intermediate shaft with another shaft and for varying the angular relation between them.

4. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam-carrying shaft surrounding the drive shaft and fixed against axial movement, means for connecting the intermediate shaft with one of the other shafts and for changing the angular relation between them in response to variations in engine intake suction, and means for connecting the intermediate shaft with another shaft and for varying the angular relation between them in response to variations in engine speed.

5. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam-carrying shaft surrounding the drive shaft and fixed against axial movement, means for connecting the intermediate shaft with the drive shaft and for changing the angular relation between them in response to variations in engine intake suction, and means for connecting the intermediate shaft with the cam-carrying shaft and for varying the angular relation between them.

6. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam carrying shaft surrounding the drive shaft, a sleeve movable along the shaft and for drivingly connecting the intermediate shaft and one of the other shafts, means responsive to variations in pressure in the engine intake for moving the sleeve along the shaft and including a suction chamber provided by two spaced concentric bellows surrounding the shaft, and means for connecting the sleeve and the cam.

7. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a sleeve movable along the shaft, means for drivingly connecting the sleeve and shaft and including differential spline provisions between the cam and

the shaft whereby the sleeve will be rotated relative to the shaft as the sleeve moves axially along the shaft, means responsive to variations in pressure in the engine intake for moving the sleeve along the shaft and including a suction chamber provided by two spaced concentric bellows surrounding the shaft and an annular disc to which the ends of the bellows are fixed, and to which the sleeve is connected, and means for connecting the sleeve and the cam.

8. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam-carrying shaft surrounding the drive shaft and fixed against axial movement, means including differential spline connections between the drive shaft and intermediate shaft for changing the angular relation between them in response to variations in engine intake suction, and means for connecting the intermediate shaft with another shaft and for varying the angular relation between them.

9. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam-carrying shaft surrounding the drive shaft and fixed against axial movement, means including differential spline connections between the drive shaft and intermediate shaft for changing the angular relation between them in response to variations in engine intake suction, and a weight plate with speed responsive devices secured to said intermediate shaft for varying the angular relation between it and another of said shafts.

10. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate shaft and a cam-carrying shaft surrounding the drive shaft and fixed against axial movement, means for connecting the intermediate shaft with the drive shaft and for changing the angular relation between them in response to variations in engine intake suction, means for connecting the intermediate shaft with another shaft and for varying the augular relation between them, and means for connecting the intermediate shaft with the cam-carrying shaft and for varying the angular relation between them.

In testimony whereof I hereto affix my signature.

WILLIAM A. CHRYST.