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W. A. CHRYST

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IGNITION TIMER

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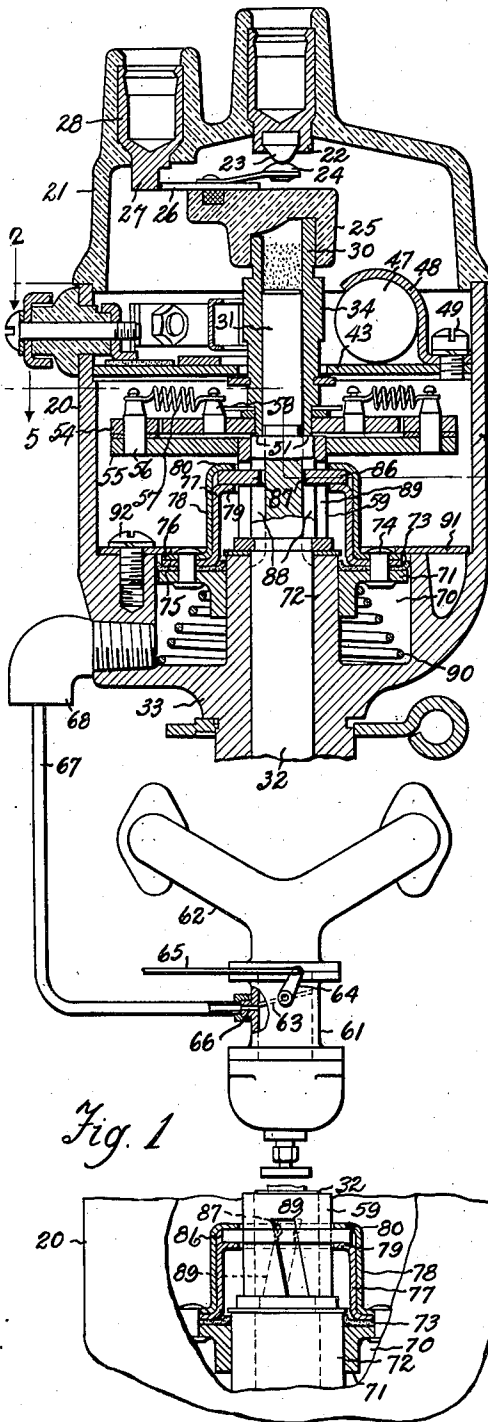


Fig. 1

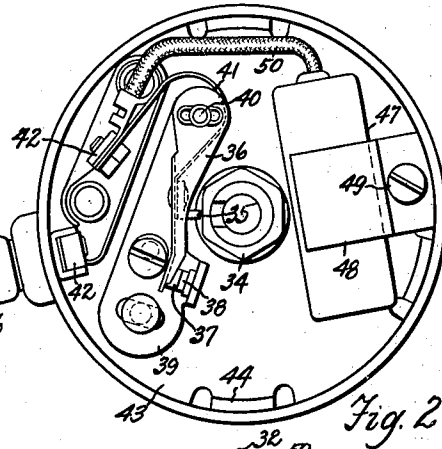


Fig. 2

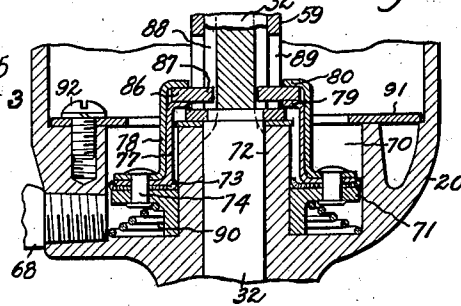


Fig. 3

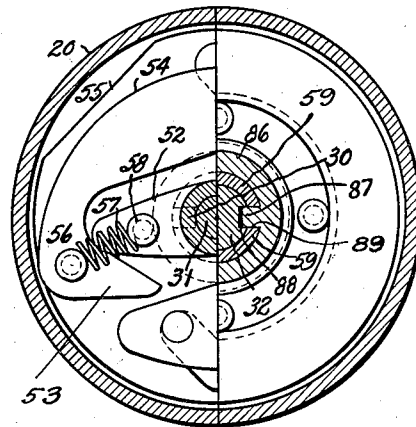


Fig. 4

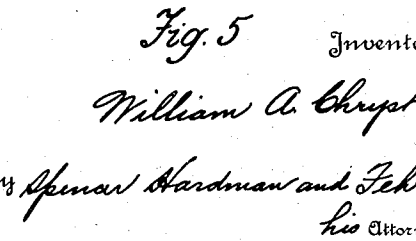


Fig. 5

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IGNITION TIMER

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This invention relates to ignition apparatus for internal combustion engines, and more particularly to the control of ignition timing in response to variations in engine speed and to variations in engine load.

One object of the present invention is to provide for the control of ignition timing by means cooperating with an annular piston sliding within an annular cylinder provided by the timer housing and located concentric with the axis of the timer driving shaft, the piston and cylinder cooperating to provide a suction chamber which is connected with the engine intake passage. In carrying out this object of the invention, I provide a cam carrying shaft which is journaled upon a portion of the timer driving shaft so that it may be rotated relative thereto, and I connect the shafts by a mechanism which can be confined within the timer housing and which is controlled by the suction operated piston referred to. A collar which is connected with the piston and moves axially of the two shafts is so connected with them as to vary the angular relation between these shafts in response to movements of the piston.

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 in part a vertical sectional view of an ignition timer embodying the present invention and in part a diagram showing the manner of connecting the suction chamber of the ignition timer with the engine intake passage.

Fig. 2 is a plan view of the timer with the distributor head removed, and is a view on the plane of the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary sectional view looking in the direction of the arrow 3 of Fig. 1.

Fig. 4 is a view similar to Fig. 1 showing certain parts in other operating positions.

Fig. 5 is a sectional view on the line 5—5 of Fig. 1.

In the drawings, 20 designates the housing of the timer which supports a conventional

distributor head 21 carrying a center terminal socket 22 having a contact 23 for engaging a contact 24 supported by a rotor block 25 carrying a distributor segment 26 electrically connected with the contact 24 and rotated adjacent to a plurality of distributor posts which are arranged in a circular row. One of these posts is shown at 27 and is integral with a socket 28 for receiving a plug or terminal connector (not shown) attached to a wire leading to an engine spark plug.

The rotor block is supported by and driven by a cam carrying shaft 30 which rotates loosely about an extension 31 of a timer driving shaft 32 which is supported by a bearing provided by the tubular shank 33 of the timer housing. The shaft 30 is provided with a cam 34 which co-operates with a rubbing block 35 of a circuit breaker lever 36 carrying a contact 37 adapted to engage a stationary contact 38 supported by an adjustable bracket 39 which is adjustable about the pivot stud 40 of the lever 36. A leaf spring 41 conducts current from a terminal 42 to the lever 36 and urges the contact 37 toward the contact 38 and the rubbing block 35 toward the cam 34. The lever 36, bracket 39 and terminal 42 are supported by a plate 43 having ears 44 by which the plate may be attached to the timer housing by screws 45. The terminal bracket 42 is insulatingly supported by the plate 43 and is connected with a terminal screw 46 which is insulated from the housing. A condenser which is contained within a case 47 is attached by clip 48 and screw 49 to the plate 43. One of the condenser foils is electrically connected with the condenser case 47 and hence with the plate 43, and the other foil is connected with the terminal bracket 42 by a conductor 50.

The lower end of the cam carrying shaft 30 rests upon a shoulder 51 provided by the shaft 32 and is attached to a plate providing arms 52 each of which is adapted to cooperate with an arm 53 of a weight 54. Each weight 54 is supported by weight plate 55 and swings around a stud 56 attached to the plate 55. A spring 57 connects a stud 58 carried by an arm 52 with one of the studs 56 and in this way tends to move the plate 54 toward the shaft 32. The plate 55 is attached to and is

driven by an intermediate tubular shaft 59 which is supported by a bearing 60 provided by a part of the housing 20 and which is loosely journaled upon the shaft 32.

5 The intermediate shaft 59 is drivingly connected with the shaft 32 by means responsive to variations in suction in the intake passage of the engine. This passage is represented diagrammatically by a carburetor 61 and an
10 intake manifold 62. The throttle 63 of the carburetor 61 is operated by a lever 64 and a rod 65. The carburetor is provided with a passage 66 which is anterior to the throttle when closed and which is on the engine side
15 of the throttle when the throttle is opened a substantial amount. The passage 66 is connected by a pipe 67 with an elbow 68 screwed into the timer housing 20 and communicates with an annular cylinder or suction chamber
20 70 having a movable wall provided by piston 71 which slides along an annular boss 72 providing a part of the bearing for the shaft 32. The cylindrical surfaces defining the annular cylinder 70 are engaged by an annular
25 piston packing member 73 which is attached by rivets 74 to the piston, and these rivets 74 also secure to the piston the flanges 75 and 76 of two nested cup-shaped members 77 and 78 respectively which are located concentric
30 with the shaft 32 and which are provided with inwardly extending flanges 79 and 80 respectively located in spaced relation. The space between the flanges 79 and 80 is occupied by a disc or collar 86, the thickness of
35 which is slightly less than the distance between the flanges 79 and 80 so that the collar 86 is free to rotate relative to the piston 71. The collar 86 is provided with inwardly extending lugs 87 which are received by
40 longitudinally extending grooves 88 provided in the shaft 32 and oblique slots 89 in the intermediate shaft 59. Normally a spring 90 urges the piston 71 upwardly until the flange 76 of the part 78 strikes an annular plate 91
45 attached by screws 92 to the housing 20.

The shaft 32 is driven by the engine in the usual manner and drives the intermediate shaft 59 through the lugs 87 of the collar 86. The intermediate shaft 59 drives the cam 34
50 through the cooperating weights 54 and lever arms 52. As the speed of the shaft increases, the weights 54 move outwardly due to centrifugal force and move the cam 34 clockwise relative to the shaft 32 in order to advance the
55 timing of the ignition, the normal direction of rotation of the cam 34 being clockwise. In this way the spark is advanced automatically as the speed of the engine increases.

While the engine is idling, the throttle 63
60 will be opened only a slight amount and the passage 66 will be practically cut off from the influence of suction in the intake manifold 62. Therefore the spring 90 will be free to maintain the collar 86 in the position shown in
65 Fig. 1 and the timing of the ignition will be

relatively retarded. As the throttle 63 is opened to permit the engine to increase its speed, the passage 66 will be placed in communication with the engine intake so that the pressure in the suction chamber 70 will be
70 sub-atmospheric. Therefore the piston 71 will be moved downwardly to move the collar 86 downwardly. The oblique slots 89 are so constructed that downward movement of the collar 86 will cause the shaft 59 to move clock-
75 wise as viewed from the top of the ignition timer. Therefore, the cam 34 will be rotated clockwise relative to the shaft 32 and the timing of the ignition will be advanced.

When the engine load is suddenly increased, 80 tending to reduce its speed, and the throttle 63 is opened to supply a greater amount of fuel to the engine, the suction in the intake 62 will be reduced; consequently the spring 90 will move the piston 71 upwardly to a po-
85 sition in which equilibrium is established between the spring pressure and the pressure differential tending to move the piston downwardly. Consequently the collar 86 will be moved upwardly a certain amount in order to
90 retard the ignition in amount corresponding to the load of the engine.

It is apparent that the speed responsive centrifugal device and the suction responsive
95 device for controlling the advancing and retarding of the timing ignition may operate cumulatively and differentially. As the speed of the engine increases, both devices may act cumulatively to rotate the cam 34 relative to
100 the shaft 32 in such direction as to advance the timing of the ignition and vice versa as the speed decreases. There may be conditions under which the speed of the engine is increased while its load is being increased.
105 The centrifugal device may tend to advance the position of the cam relative to the drive shaft while the suction control device may tend to retard it. Thus both devices may act differentially to control the position of the
110 cam 34 relative to the drive shaft 32 so that the ignition will be timed properly to correspond with the engine speed and load conditions.

One of the important features of the present invention is the provision for facilitating
115 the repairs and replacements of the devices which control the timing of the ignition.

The centrifugal device may be removed from the timer without disturbing the suction responsive device. After removing the
120 distributor head 21 and the timer supporting plate 43 the assembly of distributor rotor 25, cam shaft 30, intermediate shaft 59 and centrifugal device connecting the shafts may be removed from the shaft 32 in assembled rela-
125 tion without disturbing the shaft 32 or the collar 86. In case it is desired to remove the piston 71 and parts connected therewith including the collar 86, the screws 92 are removed in order to permit removal of the plate
130

91. After this has been done, the piston 71 and the spring 90 may be removed from the cylinder 70.

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 driven shaft connected with the cam and surrounding the drive shaft, means for connecting the two shafts and including a collar slidable along the driven shaft and having a lug extending into a longitudinal slot in one of the shafts and into an oblique slot in the other shaft, and a device for moving the collar along the shaft in order to change the angular relation between the shafts.

2. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a driven shaft connected with the cam and surrounding the drive shaft, means for connecting the two shafts and including a collar slidable along the driven shaft and having a lug extending into a longitudinal slot in one of the shafts and into an oblique slot in the other shaft, and a device responsive to variations in engine intake suction for moving the collar along the shaft in order to change the angular relation between the shafts.

3. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a driven shaft connected with the cam and surrounding the drive shaft, means for connecting the two shafts and including a collar slidable along the driven shaft and having a lug extending into a longitudinal slot in one of the shafts and into an oblique slot in the other shaft, and a device responsive to variations in engine intake suction for moving the collar along the shaft in order to change the angular relation between the shafts, said device comprising an annular suction chamber surrounding the drive shaft and having a movable annular wall, and comprising means for connecting the wall with the collar while permitting rotation of the collar.

4. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a driven shaft connected with the cam, means for connecting the shafts comprising a collar movable along the shafts and having a lug extending into grooves in the shafts, one of the grooves being oblique to the axes of the shafts, and means for moving the collar in response to variations in en-

gine intake suction comprising an annular suction chamber surrounding the drive shaft and having a movable annular wall and comprising means for connecting the movable wall with the collar while permitting rotation of the collar.

5. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a cam-carrying shaft and an intermediate shaft journaled upon the drive shaft, means for connecting the intermediate shaft with one of the other shafts and comprising a collar slidable along the shafts so connected and having a lug extending into grooves in the shafts so connected, one of the grooves being oblique to the axes of the shafts, a device for moving the collar along the shaft, and other means for connecting the intermediate shaft with another 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, a cam-carrying shaft and an intermediate shaft journaled upon the drive shaft, means for connecting the intermediate shaft with one of the other shafts and comprising a collar slidable along the shafts so connected, and having a lug extending into grooves in the shafts so connected, one of the grooves being oblique to the axes of the shafts, a device responsive to engine suction for moving the collar in order to vary the angular relation between the two shafts, and other means for connecting the intermediate shaft with another shaft and for varying the angular relation between them.

7. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a cam-carrying shaft, an intermediate drive shaft, a main drive shaft extending into the other shafts and providing bearings therefor, means for connecting the intermediate shaft with one of the other shafts and including a collar slidable along the shafts so connected and having a lug extending into grooves in the shafts so connected, one of the grooves being oblique to the axes of the shafts, a device responsive to engine intake suction for moving the collar in order to change the angular relation between the shafts, and a speed responsive device for connecting the intermediate shaft and another shaft and for varying the angular relation between them.

8. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a cam-carrying shaft, an intermediate drive shaft, a main drive shaft extending into the other shafts and providing bearings

therefor, means for connecting the intermediate shaft with the drive shaft, and including a collar slidable along the shafts so connected and having a lug extending into grooves in the shafts so connected, one of the grooves being oblique to the axes of the shafts, a device responsive to engine intake suction for moving the collar in order to change the angular relation between the shafts, and a speed responsive device 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.

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