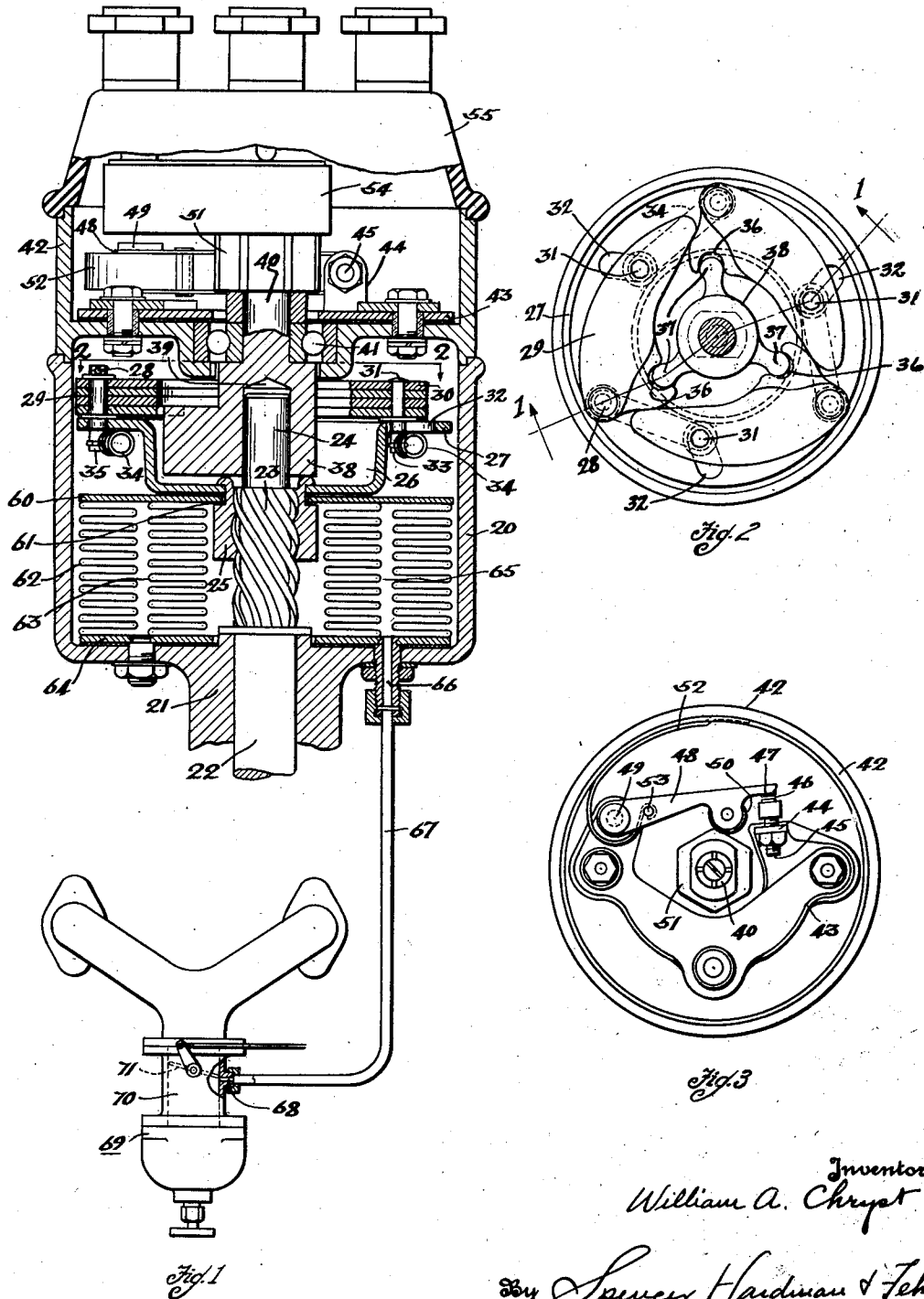


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IGNITION APPARATUS
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IGNITION APPARATUS

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This invention relates to ignition apparatus for internal combustion engines.

One of its objects is to provide for the control of ignition timing in response to engine operating conditions, so that a timing of the ignition will be advanced as the engine speed increases and will be retarded as the engine load increases and vice versa.

A further object is to provide an ignition timer and distributor unit including a centrifugal device for controlling the angular relation of the timer cam to the drive shaft and also a device responsive to engine suction for controlling this relation, each device being operable independently and capable of operating cumulatively to control the timing of ignition.

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 includes a longitudinal sectional view of an ignition timing apparatus embodying the present invention and a diagram on a smaller scale showing the manner of connecting the suction control with an engine intake fuel passage.

Fig. 2 is a plan view on the line 2—2 of Fig. 1, the timer housing and distributor being removed.

Fig. 3 is a plan view of the timer with the distributor rotor and head removed. Figs. 2 and 3 are drawn to a smaller scale than Fig. 1.

In the drawing, 20 designates a cup-shaped housing having a bearing 21 for supporting a drive shaft 22 having a helically splined portion 23 and a smooth portion of smaller diameter 24. The splined portion 23 is threadedly engaged by nut 25 drivingly connected with a dish-shaped plate 26 having a flange 27. The flange 27 supports studs 28 each providing a pivot for a weight 29. Each weight 29 comprises a plurality of laminations 30 secured by rivets 31, one of which extends through a slot 32 in the flange 27. This rivet 31 is provided with an extension

33 for receiving one end of a spring 34 attached at its other end to an extension 35 of one of the studs 28 as shown in Fig. 1. The spring 34 yieldingly urges the weights 29 toward the axis of the shaft 22. Each weight includes a notched portion 36 for receiving a finger 37 extending from a shaft 38 having a central bore 39 for receiving the smooth portion 24 of the shaft 22.

The shaft 38 has a portion of smaller diameter 40 journaled in a ball bearing 41 which is supported by a timer cup 42. The cup 42 insulatingly supports a breaker plate 43 having an upright ear 44 for supporting an adjustable screw 45 carrying a contact 46. The contact 46 is engaged by a contact 47 carried by lever 48 pivoted at 49. The lever 48 carries a roller 50 for following the cam 51 attached to the shaft 40. A spring 52 bearing against the timer cup 42 and connected by a pin 53 with the lever 48 urges the lever toward the cam and also provides a ground connection between the contact 47 and the timer housing. The cam 51 drives a distributor rotor 54 cooperating in the usual manner with a distributor head 55.

The shaft 22 rotates clockwise as viewed in Figs. 2 and 3. Hence as the speed of the shaft increases the weights 29 will move away from the shaft and will cause the shaft 38 and the cam 51 to be rotated clockwise relative to the shaft 22. Therefore the ignition timing will be advanced as the speed increases.

The device for retarding the timing of ignition as the engine load increases or as the suction of the carburetor increases, comprises a device which changes the angular relation between the nut 25 and the shaft 22 by moving the nut up and down along helically splined portion 23 of the shaft. This device therefore comprises a plate 60 which has a central aperture for receiving the nut 25 and which fits loosely in an annular groove 61 between the nut 25 and the bottom of the cup-shaped plate 26. The plate 60 is attached to an outer metal bellows 62 and an inner metal bellows 63 which in turn are attached to a bottom plate 64 supported by the bottom of the housing 20. The space between the

bellows 62 and 63 provides a suction chamber 65 which is connected by the pipes 66 and 67 and passage 68 in the carburetor 69 with a fuel intake passage 70 of the carburetor. As the engine load increases requiring the opening of the carburetor throttle 71, the suction in the carburetor passage 70 will increase and likewise the suction in the chamber 65. Therefore the plate 60 and nut 25 will be moved downwardly to cause the nut and parts driven thereby including the weights 29 to be moved in a counterclockwise direction as viewed in Fig. 2. Therefore the timing of the spark will be retarded with increase in suction in the carburetor due to increasing engine load.

As the engine load decreases and the throttle 71 is moved nearer to closed position to govern the engine, the suction in the carburetor anterior to the throttle will decrease, thereby permitting the bellows to move the plate 60 upwardly due to their own resiliency. This action will cause the rotation of the weights relative to the shaft 22 to be clockwise as viewed in Figs. 2 and 3, in order to advance the spark as the load decreases.

It will be noted that each device controlling the timing of ignition may operate independently of the other. The angular movement of the nut 25 relative to the shaft 22 does not affect the amount of angular movement of the cam 51 relative to the nut 25. For example, if both speed and load increase, the centrifugal device could operate to advance the spark while the suction responsive device could operate to retard the spark. If the speed be increased as the load decreases, both devices will operate to advance the spark, and the total amount of advance will be the sum of amounts of advance effected by each device separately.

Thus both control devices operate independently in order to effect a joint control of the spark timing.

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 comprising a circuit breaker operated by a rotatable cam, a drive shaft, an intermediate drive element through which rotation is transmitted from the shaft member to the cam member, means comprising an annular expansion chamber responsive to engine load conditions for varying the angular relation between the intermediate element and one of the members, and means responsive to engine speed for varying the angular relation between the intermediate element and the other of said members.

2. Ignition apparatus comprising a circuit breaker operated by a rotatable cam, a drive shaft having a helically splined portion, a

nut movable axially along said splined portion, speed responsive means for connecting the nut with the cam, while permitting the nut to move axially and to turn relative to the shaft, and means responsive to engine load conditions for moving said nut.

3. Ignition apparatus comprising a circuit breaker operated by a rotatable cam, a drive shaft having a helically splined portion, a nut movable axially along said splined portion, means for connecting the nut with the cam, while permitting the nut to move axially and to turn relative to the shaft, and means responsive to engine load conditions for moving said nut.

4. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a member movable axially along the shaft, means for connecting the member with the shaft so as to turn the member relative to the shaft as it moves along the shaft, means responsive to engine intake suction for moving said member and including an annular displacement chamber substantially coaxial with the drive shaft and having a movable wall connected with said axially movable member, said means being responsive to variations in engine load conditions for moving said member, and means responsive to variations in engine speed for connecting said member and cam and for changing the angular relation between them.

5. Ignition apparatus according to claim 4 in which the speed responsive means are supported directly by the axially movable member and are movable therewith.

6. Ignition apparatus according to claim 4 in which the axially movable member is a nut threadedly connected with the drive shaft.

7. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, a member movable along the shaft, means connecting the member and cam, means for connecting the member and shaft and for causing the member to rotate relative to the shaft as it moves along the shaft, and means responsive to variations in pressure in the engine intake for moving the member, and including a suction chamber provided by two spaced concentric metal bellows and an annular disc to which the ends of the bellows are fixed and to which the axially movable member is connected.

8. Ignition apparatus for internal combustion engines comprising, in combination, an interrupter, a cam for operating the interrupter, a drive shaft, an intermediate drive member surrounding the drive shaft and supported thereby for rotation relative thereto, a cam-carrying shaft surrounding the drive shaft and supported thereby for rotation relative thereto, means responsive to variations

in engine intake suction for connecting the intermediate drive-member with one of the shafts and for changing the angular relation between them, and other means for connecting the intermediate drive-member with the other of said shafts and for changing 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 drive member surrounding the drive shaft and supported thereby for rotation relative thereto, a cam-carrying shaft surrounding the drive shaft and supported thereby for rotation relative thereto, means responsive to variations in engine intake suction for connecting the intermediate drive-member with one of the shafts and for changing the angular relation between them, and means responsive to variations in speed for connecting the intermediate drive-member with the other of said shafts and for changing the angular relation between them.

10. Ignition apparatus comprising a circuit breaker operated by a rotatable cam, a drive shaft, an intermediate drive element through which rotation is transmitted from the shaft member to the cam member, means comprising an annular expansion chamber responsive to engine load conditions for varying the angular relation between the intermediate element and one of the members, and means movable axially of said shaft and responsive to engine speed for varying the angular relation between the intermediate element and the other of said members.

In testimony whereof I hereto affix my signature.

WILLIAM A. CHRYST.