

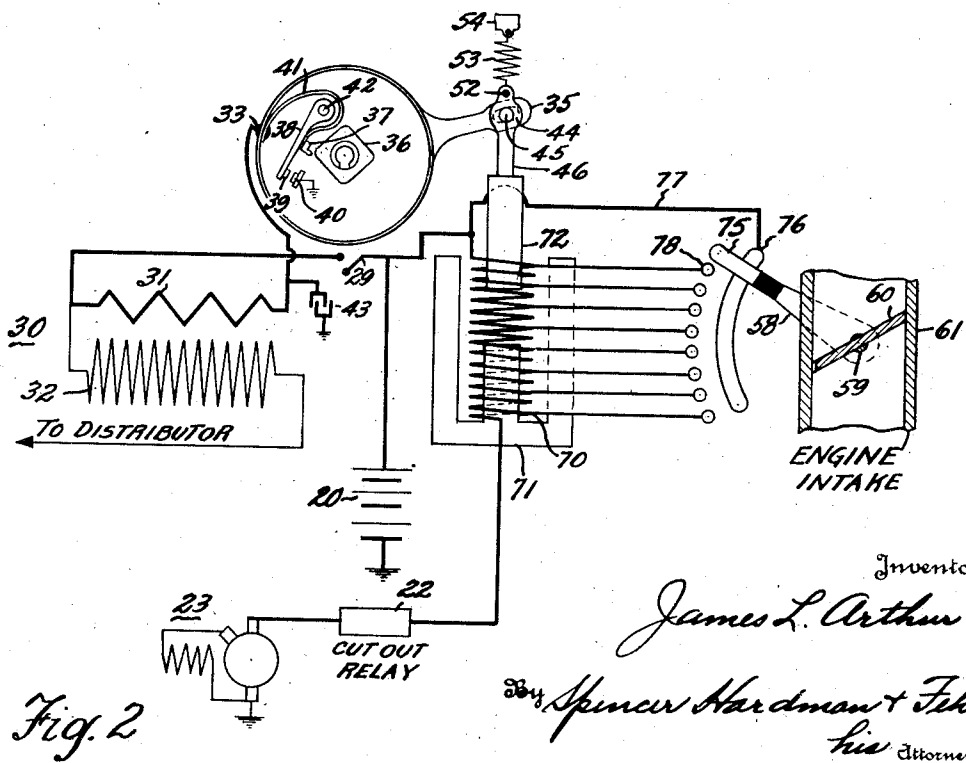
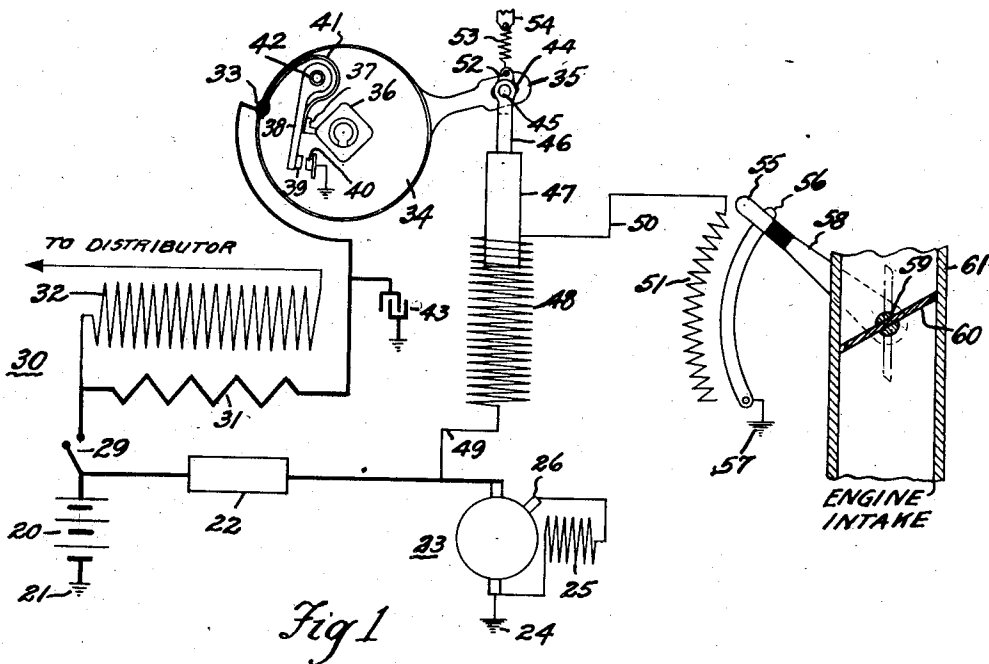
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J. L. ARTHUR

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IGNITION APPARATUS

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Inventor
James L. Arthur
Spencer Hardman & Fehr
his Attorneys

UNITED STATES PATENT OFFICE

JAMES L. ARTHUR, OF ANDERSON, INDIANA, ASSIGNOR TO DELCO-REMY CORPORATION,
OF ANDERSON, INDIANA, A CORPORATION OF DELAWARE

IGNITION APPARATUS

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This invention relates to ignition apparatus for an internal combustion engine and more particularly to apparatus for controlling the timing of the ignition in accordance with engine operation.

One of the objects of the present invention is to control the timing of the ignition so that relatively rapid spark advance will be obtained as the speed of the engine increases from idling speed, and retards the ignition as the engine load increases. This aim of the present invention is accomplished by providing electrical means responsive to the operation of the generator driven by the engine for effecting a relatively rapid spark advance of the ignition spark as the engine speed increases from idling under part load conditions. This electrical means is modified in accordance with the throttle position in order to effect a relative retard of the ignition as the engine throttle is opened to permit the engine to operate under increased load.

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 one form of the present invention is clearly shown.

In the drawing:

Figs. 1 and 2 are wiring diagrams illustrating different forms of the present invention.

Referring to the drawing 20 designates a storage battery which is grounded at 21 and which is connected by a cut-out relay 22 with an engine driven generator 23 grounded at 24 and having a shunt field 25 connected with a third brush 26.

The battery 20 is connected by a switch 29 with an ignition coil 30 having a primary 31 and a secondary 32, the latter being connected to an ignition distributor, not shown. The primary 31 is connected with terminal 33 of an ignition timer comprising a circuit breaker plate 34 which is provided with a lever 35 by which the plate 34 is shifted about the axis of a cam 36. The cam 36 cooperates with a rubbing block 37 attached to a lever 38 carrying a contact 39 which cooperates with a grounded contact 40. A leaf spring con-

ductor 41 conducts current from the insulated terminal 33 to the lever 38 and urges the rubbing block 37 toward cam 36 and the contact 39 into engagement with the contact 40. The lever 38 is provided at 42 upon the plate 34 and is insulated therefrom. Contacts 39 and 40 are in parallel with condenser 43.

The lever 35 has a slot 44 which receives a pin 45 carried by a rod 46 connected with an armature 47 cooperating with an electro-magnet 48 connected by wire 49 with generator 23 and connected by wire 50 with a rheostat 51. The rod 46 carries a clip 52 connected by a spring 53 with a stop 54. The spring 53 serves to move the lever 35 counterclockwise to retard the spark, the normal direction of rotation of cam 36 being counterclockwise. The rheostat 51 cooperates with a wiper 55 engaging an arcuate conductor 56 grounded at 57. The wiper 55 is insulatingly supported by a lever 58 attached to a shaft 59 which supports the engine throttle valve 60 within an engine intake passage 61. The lever 58 may be used as part of the means for operating the throttle valve 60 from the driver's seat.

As long as the valve 60 is in engine idling position the wiper 55 does not engage the rheostat 51, hence no current passes through the coil 48. As soon as the operator moves the valve 60 to permit the engine to increase its speed from idling speed, the wiper 55 engages the rheostat 51 and connects the same with ground thereby causing the voltage of the generator 23 to be applied to the coil 48. Instantly the armature 47 will be attracted to move the lever 35 clockwise to advance the ignition. When the engine is operating at part throttle, 15 miles per hour, on level road the throttle 60 will be only slightly open and therefore practically all of the turns or taps of the rheostat 51 will be short circuited by the wiper 55, contact 56 and ground 57. Also when the engine is operated at 15 miles per hour the generator 53 will be approaching full voltage. Under these conditions the coil 48 will be energized to nearly the fullest extent, hence will advance the spark to approximately the greatest degree of advance.

When the engine is required to carry a load and it is necessary to open the throttle 60 wider in order that the engine will receive the required amount of fuel, the lever 58 will move counterclockwise from the position shown in Fig. 1 to a position wherein a substantial number of turns or taps of the rheostat will be introduced into the circuit thereby cutting down appreciably the amount of current flowing in the coil 48 and thereby decreasing its strength. When this occurs the spring 53 will operate to move the lever 35 counterclockwise to retard the ignition in a manner commensurate with a position of the throttle 60 and hence commensurate with the torque being developed by the engine.

In the form of the invention shown in Fig. 2, the electro-magnet which controls the advance of the ignition is responsive to current in the battery charging circuit instead of being responsive to the voltage of the generator. In this form of invention the battery is connected to the generator through an electro-magnet 70 which is in series with the battery, cut-out relay and generator. The electro-magnet winding 70 cooperates with a stationary core 71 and a movable armature 72 having the same function and relative mechanical position as the armature 47 shown in Fig. 2. A rheostat is not used in Fig. 2 to control the excitation of the electro-magnet as was done in Fig. 1. In Fig. 2 the moving of the throttle 60 from idle position controls a wiper 75 which moves in contact with an arcuate conductor 76 connected by wire 77 with a storage battery 20. As the wiper 75 moves along from a position corresponding to the idle position of the throttle 60, it engages a series of taps 78 connected to certain turns of the magnet coil 70. When the throttle 60 is in engine idling position none of the turns of coil 70 are short circuited. As the engine load increases thus requiring the throttle 60 to be opened wider the wiper 75 is moved into engagement with certain of the taps 78 thereby short circuiting certain turns of the coil 70 and thereby reducing the ampere-turns effective to attract the armature 72 against the action of the spring 53. Thus the spring 53 operates to move the lever 35 into a spark retarding position as the load of the engine decreases.

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. An ignition apparatus for an internal combustion engine comprising in combination, a circuit interrupter, a cam driven by the engine for operating the interrupter, electrical means responsive to engine speed variations for causing relative movement between the interrupter and cam in order to

control the timing of the ignition, and means responsive to engine load conditions for modifying the action of said electrical means in order to retard the ignition as the engine load increases.

2. An ignition apparatus for an internal combustion engine comprising in combination, a circuit interrupter, a cam driven by the engine for operating the interrupter, electro-magnetic means responsive to engine speed variation for causing relative movement between the interrupter and cam in order to control the timing of the ignition, and means responsive to engine load conditions for varying the ampere-turns of said magnet in order to retard the ignition as the engine load increases.

3. An ignition apparatus for an internal combustion engine comprising in combination, a circuit interrupter, a cam driven by the engine for operating the interrupter, a generator driven by the engine, means including an electro-magnet responsive to generator voltage for causing relative movement between the interrupter and cam in order to control the timing of the ignition, and means responsive to engine throttle position for varying the current passing through said electro-magnet in order to retard the ignition as the engine load increases.

4. Ignition apparatus for an internal combustion engine comprising in combination, a circuit interrupter, a cam driven by the engine for operating the interrupter, a generator driven by the engine, a storage battery charged by the generator, means including an electro-magnet in series with the battery and generator for causing relative movement between the interrupter and cam in order to control the timing of the ignition, and means responsive to engine throttle position for varying the number of operative turns of said electro-magnet in order to retard the ignition as the engine load increases.

In testimony whereof I hereto affix my signature.

JAMES L. ARTHUR.