

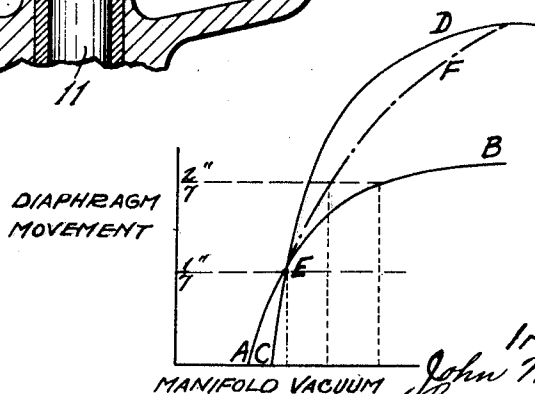
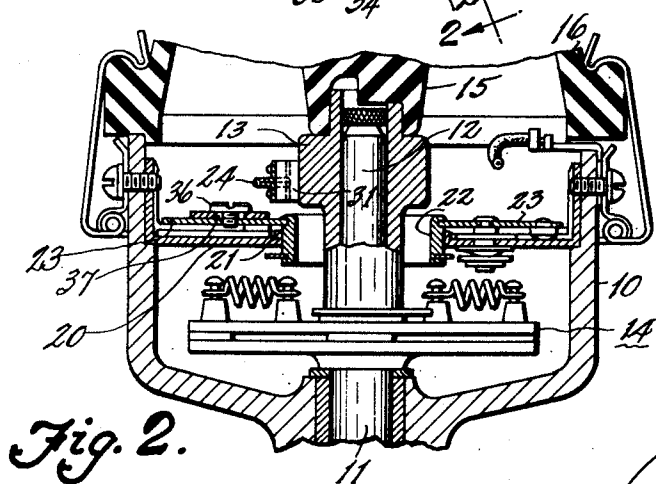
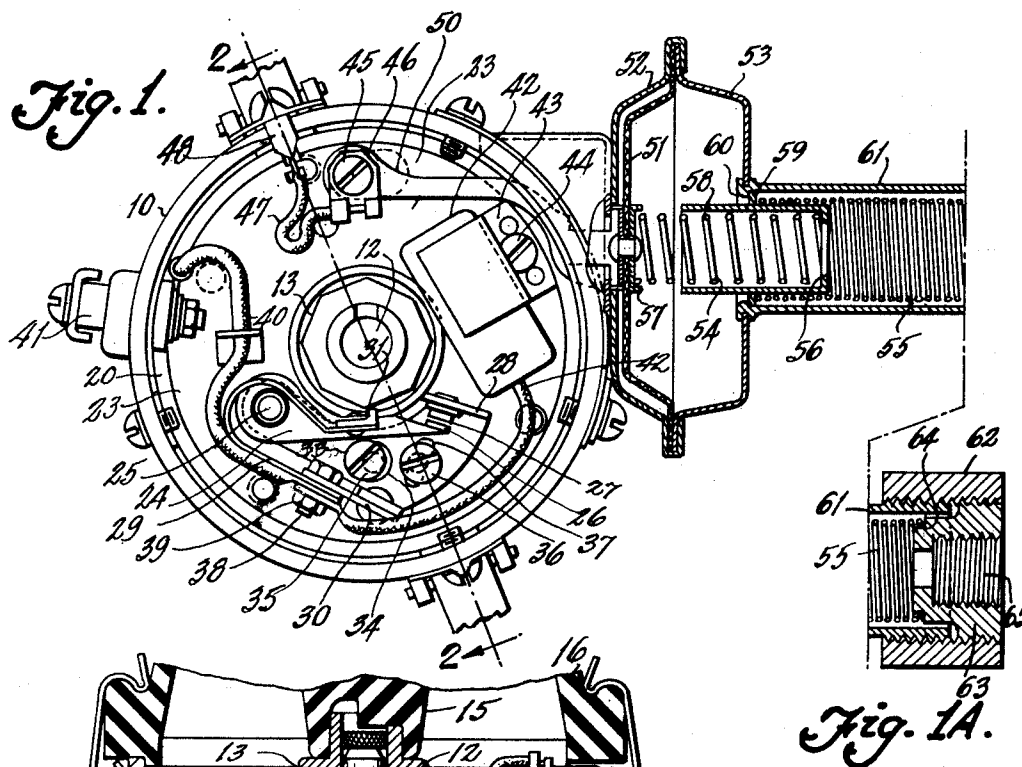
May 26, 1953

J. W. DYER ET AL

2,640,116

IGNITION TIMER

Filed Nov. 3, 1949



INVENTORS
John W. Dyer and
Raymond A. Wilkins
BY Spencer Handman & Sohn
their ATTORNEYS

UNITED STATES PATENT OFFICE

2,640,116

IGNITION TIMER

John W. Dyer, Pendleton, and Raymond A. Wilkins, Anderson, Ind., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application November 3, 1949, Serial No. 125,178

3 Claims. (Cl. 200—31)

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This invention relates to ignition timers having means responsive to engine suction for advancing ignition timing as engine suction increases. This means comprises a suction chamber connected with the engine intake and closed by a flexible, fabric diaphragm connected with a plate supported for rotation about the axis of the timer cam which controls a circuit breaker supported by the plate. As engine suction increases, the diaphragm moves toward a wall of the suction chamber to advance the ignition timing against the action of a spring which operates to retard ignition when suction decreases. As the diaphragm approaches the chamber wall, the effect of engine suction upon the diaphragm increases at a rate substantially less than the rate of increase of engine suction.

An object of this invention is to compensate for the decreasing in rate of suction of effect on the diaphragm with respect to rate of increase of manifold suction so that, for a given amount of engine suction, a greater diaphragm movement will be obtained. This is accomplished by the use of two helical coil springs in tandem relation for opposing diaphragm movement, one being a spring having a high build-up rate and initially deflected to a relatively small extent from free length, and the other spring having a lower build-up rate than the first spring and initially deflected to a relatively great extent from free length. As the diaphragm moves from position furthest from the suction chamber wall, the first spring has control until the compression force thereof increases to the value of the initial compression force of the second spring having the lower build-up rate. Thereafter the second spring has the principal control. In this way, the decrease in the rate increase in the effect of suction on the diaphragm is compensated for through the action of an opposing spring having relatively low build-up rate.

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 embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 shows a plan view of an ignition timer equipped with the timer control including the tandem spring arrangement shown in section in Figs. 1 and 1A.

Fig. 2 is a fragmentary sectional view on line 2—2 of Fig. 1.

Fig. 3 is a chart illustrating the operation of the timer control.

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The timer may be one of the type disclosed in the copending application of John T. Fitzsimmons Patent No. 2,487,231 patented November 8, 1949. This timer has a housing 10 supporting an engine driven shaft 11 having an extension 12 on which a timer cam 13 is journaled. Cam 13 is connected with the shaft 11 by a speed responsive device 14 which varies the angular relation of cam 13 and shaft 11 as speed changes. Cam 13 supports and drives a distributor rotor for distributing sparking impulses to terminals of a distributor cap connected with an ignition coil and with spark plugs. A fragment of the rotor is shown at 15 and a fragment of the cap at 16 in Fig. 2.

A fixed plate 20 supported within the housing 10 provides a bearing flange 21 within which there is journaled a tubular hub 22 of a plate 23 which carries a circuit breaker comprising (Fig. 1) a lever 24 pivoted on a stud 25 and insulated therefrom and carrying a contact 26 engageable with a contact 27 attached to a bracket 28 supported on plate 23 and pivoted on the stud 25 which is attached to plate 23. A leaf spring 29 attached to a fixed plate 30 and to lever 24 urges the lever counterclockwise so that a rubbing block 31 will be engaged by the cam 13 to separate contact 26 from contact 27 against the action of spring 29.

For adjustment of contact separation, bracket 28 can be adjusted about stud 25 by the turning of a slotted disc 33 received by a slot 34 in bracket 28 and having an eccentric shank 35 journaled in the plate 23. The bracket 28 is held in adjusted position by the tightening of a screw 36 passing through an arcuate slot 37 in bracket 28 and threaded into plate 23.

Plate 30 which is supported by bracket 28 is connected by screw 38 and nut 39 with a wire 40 connected with a terminal 41 and with a wire 42 connected with one foil of a condenser in a metal case 42 electrically connected with the other condenser foil and attached to a clip 43 which a screw 44 fastens to plate 23 which is grounded by a connection comprising screw 45, clip 46 and flexible wire 47 soldered at 48 to housing 10.

Screw 45 provides a pivotal connection between plate 23 and a link 50 connected with a diaphragm 51 whose periphery is clamped between flanges of shells 52 and 53 the latter providing the fixed wall of a suction chamber closed by the diaphragm and connected with the engine intake. Movement of the diaphragm 51 with increase of engine suction is opposed by two springs 54 and 55 in tandem and acting in sequence. Spring 54 is one having a relatively high rate of

build up and is initially deflected a relatively small amount. For example, spring 54 has about 9 turns, 7 active turns, free length about 2 inches and is initially deflected to $1\frac{1}{2}$ inches. Its build-up rate is 70 ounces per inch of deflection so that its initial compressive force is 35 ounces. Spring 55 is one having a relatively low rate of build up and a relatively great amount of initial compression. It has 36 turns, 34 active turns, free length about $9\frac{1}{2}$ inches, and is initially deflected to 2". Its rate is 6 ounces per inch of deflection. Therefore its initial compressive force is 45 ounces which is 10 ounces greater than the initial compressive force of spring 54.

Spring 54 is confined between a cupped washer 57 attached to a diaphragm 51 and an internal flange 56 of a tube 58 having an external flange 59 engaging the internal flange 60 of tube 61 attached to shell 53 and threaded into a nut 62 (Fig. 1A) into which a bushing 63 is threaded, said bushing providing a shoulder 64 and a tapped hole 65 for receiving a coupling connected with a pipe connected with the engine intake. Spring 55 is confined within tube 61 between flange 59 and shoulder 64.

When the center of the diaphragm 51 has moved right about $\frac{1}{4}$ inch under the influence of engine suction spring 54 will have built up to about 45 ounces compression. Further right movement of the diaphragm 51 will cause further compression of spring 55 initially compressed to effect 45 ounces resistance. While spring 55 is being further compressed, spring 54 is slightly additionally compressed but only about $\frac{1}{16}$ as much as spring 55. Therefore spring 55 then has principal control of diaphragm movement. The tube 58 moves right into the tube 61 without the spring 54 being compressed so much that cup 57 touches tube 58. Suction effect on the diaphragm had exerted 45 ounces before additional compression of spring 55 began after the diaphragm had moved $\frac{1}{4}$ inch. Thereafter each increment of $\frac{1}{4}$ inch diaphragm movement to the right adds to the 45 ounces about $\frac{1}{4}$ of an ounce.

Referring to Fig. 3, curve A—E—B represents the diaphragm movement in relation to engine suction if only one spring such as spring 54 is used. Curve C—E—D represents diaphragm movement in relation to engine suction if a spring such as spring 55 is used. Curve A—E—F represents diaphragm movement in relation to engine suction when both springs are used in tandem. Point E may represent the amount of manifold vacuum required to produce a suction effect on the diaphragm required to exert 45 ounces on spring 54 to deflect it $\frac{1}{4}$ inch. When the diaphragm has moved that far to the right it has begun to wrinkle and these wrinkles increase upon further movement to the right so that the rate of increase of suction effect upon the diaphragm is at a rate substantially less than the rate of increase of manifold suction. As shown by curve A—E—B, the amount of manifold vacuum required to obtain 55 ounces of suction effect on the diaphragm to cause the second $\frac{1}{4}$ inch of diaphragm movement would be much greater than the amount of manifold vacuum increase required for the first $\frac{1}{4}$ inch of diaphragm movement. As indicated by line E—F the present invention provides for the second $\frac{1}{4}$ inch of diaphragm movement in response to an increment of manifold vacuum increase about equal to the increment of manifold vacuum increase which effected the first $\frac{1}{4}$ inch of diaphragm movement. Thus the reduction in rate

increase of suction effect on the diaphragm as it wrinkles on approaching the suction chamber wall is compensated for by the use of the spring 55 having a relatively low build-up rate. For the first $\frac{1}{4}$ inch of diaphragm movement this movement bears almost a linear relation to manifold vacuum increase.

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, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An ignition timer having an engine driven cam, a circuit breaker operated thereby to time the ignition, a plate supported for rotation about the axis of the cam and carrying the circuit breaker, and an engine controlled suction device for moving the plate in one direction to advance ignition timing and including a flexible, fabric diaphragm connected with the plate and forming a deflectible wall of a suction chamber having a fixed wall adapted to be connected with the engine intake, two helical coil springs in tandem relation for opposing movements of the diaphragm to advance the ignition, the first spring having a relatively high rate of build-up and the second spring having a relatively low rate of build-up, a movable stop between which and the diaphragm the first spring is held under initial compression by relatively small amount of deflection from its free length, a fixed abutment against which the movable stop is maintained by the second spring, and a fixed stop between which and the movable stop the second spring is maintained under initial compression by a relatively great amount of deflection from free length the initial compression of the first spring being less than that of the second spring, whereby the first spring has control over the first part of diaphragm movement from initial position and thereafter, when compression of the first spring has been built up to equal the initial compression of the second spring, the second spring has principal control of diaphragm movement.

2. An ignition timer according to claim 1 in which the movable stop is provided by an internal flange of a tube enclosing the first spring, in which the movable stop has an external flange normally engaging the fixed abutment which is provided by an internal flange at one end of a second tube enclosing the second spring and attached to the fixed wall of the suction chamber, said second tube supporting the fixed stop between which and the external flange of the movable tube the second spring is confined under compression.

3. In combination with an ignition timer movable to advance and retarding positions of timing; a suction operated device for actuating the timer and comprising a suction chamber connected with the engine intake and closed by a diaphragm connected with the timer; spring means opposing movement of the diaphragm with increasing suction to move the timer in a direction to advance ignition timing, said spring means operating to retard the ignition timing when suction decreases, said spring means including a relatively weak spring and a relatively strong spring arranged in tandem and acting in sequence; a fixed abutment associated with the device; a movable stop associated with both springs with the stronger spring urging the stop against the abutment to provide the initial com-

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pression for the weaker spring and adjustable means for maintaining the initial compression of the stronger spring.

JOHN W. DYER.
RAYMOND A. WILKINS.

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