No. 847,876. PATENTED MAR. 19, 1907.

V. G. APPLE.

SPARK TIMING DEVICE FOR IGNITION SYSTEMS.

APPLICATION FILED NOV. 9, 1903.

2 SHEETS—SHEET 1.

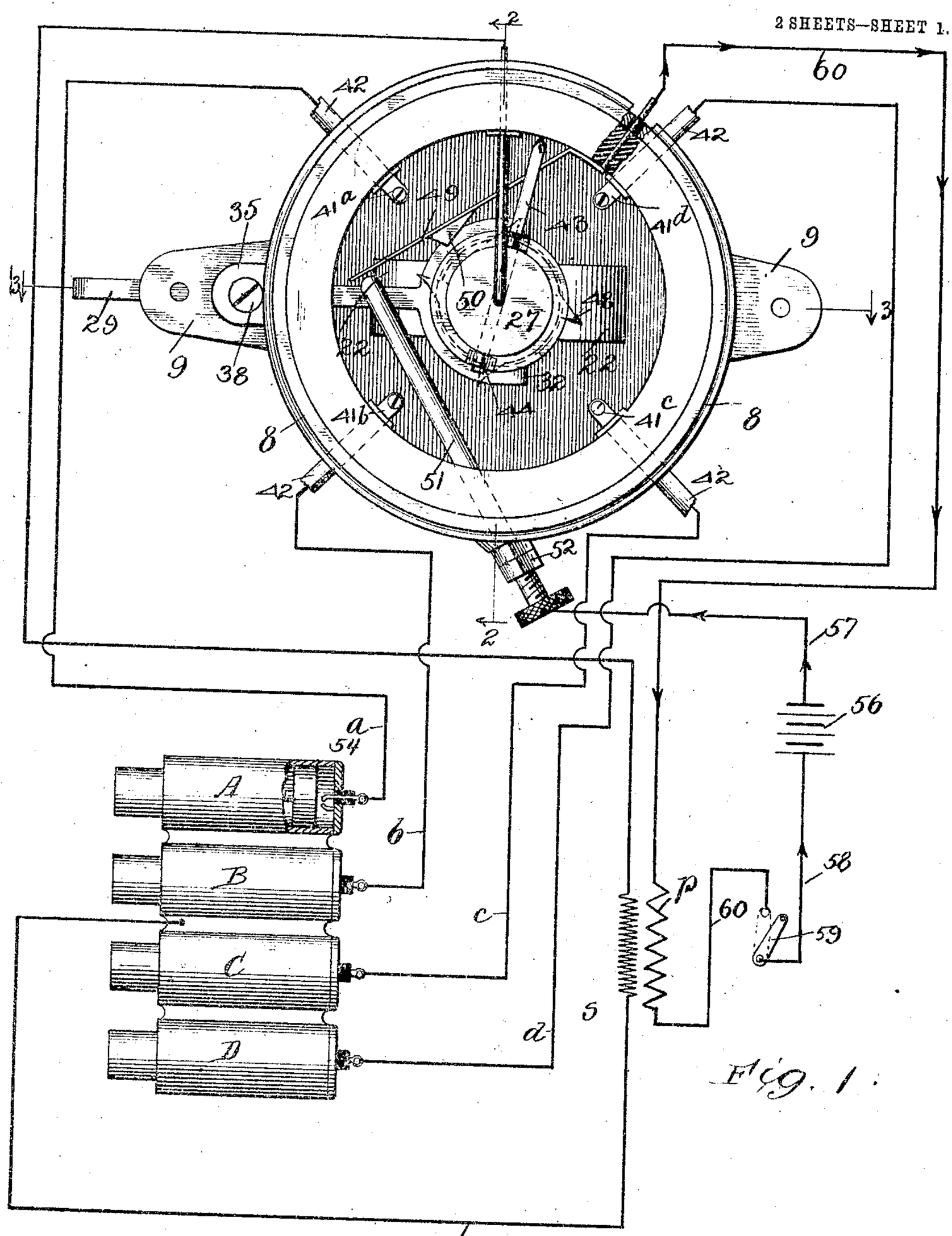


Fig. 1.

Witnesses:
Ray White.
Henry R. Hazelton

Inventor:
Vincent G. Apple.
By Jones Bain
Atty

No. 847,876. PATENTED MAR. 19, 1907.

V. G. APPLE.

SPARK TIMING DEVICE FOR IGNITION SYSTEMS.

APPLICATION FILED NOV. 9, 1903.

2 SHEETS—SHEET 2.

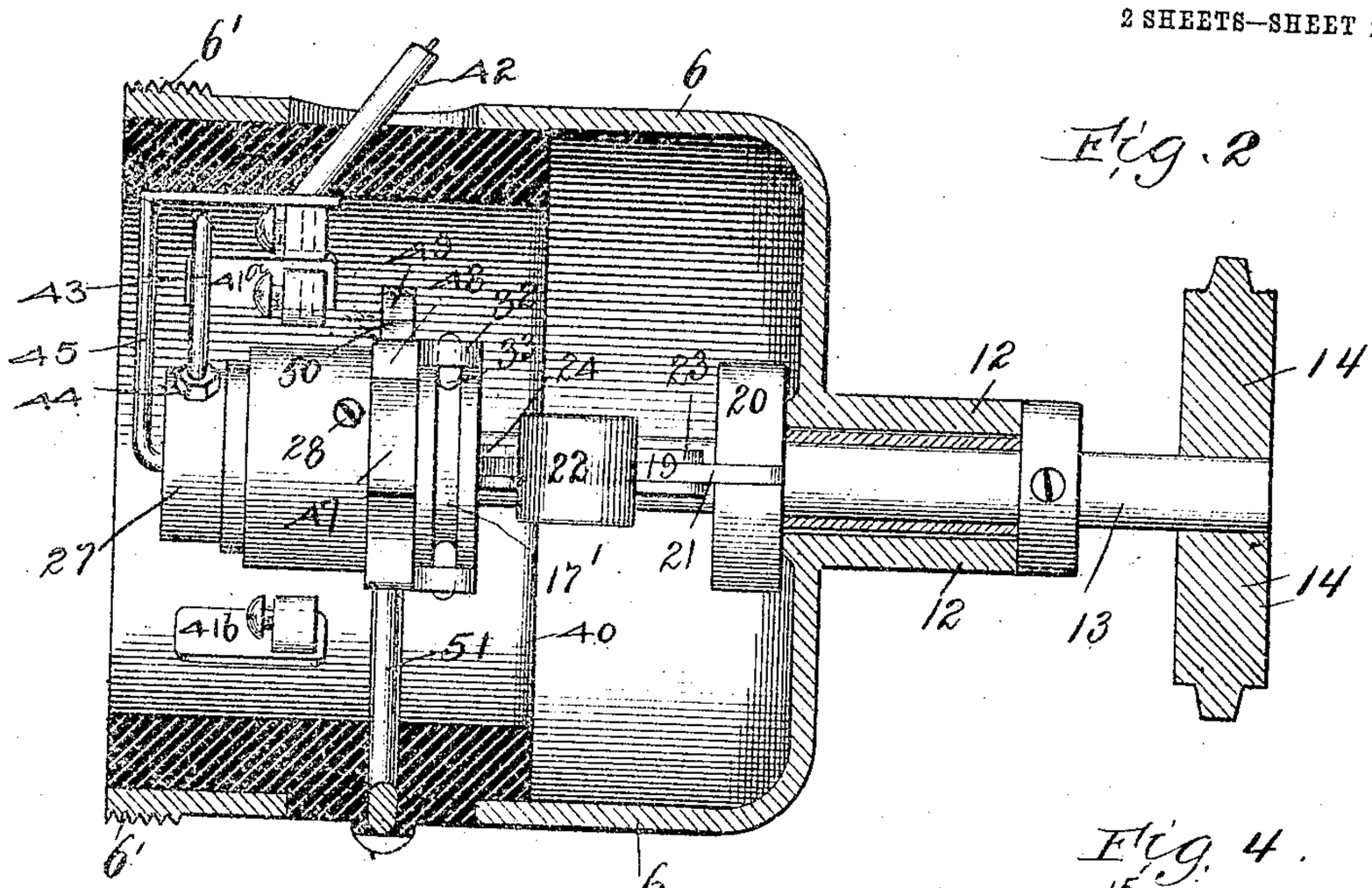


Fig. 2

Fig. 4.

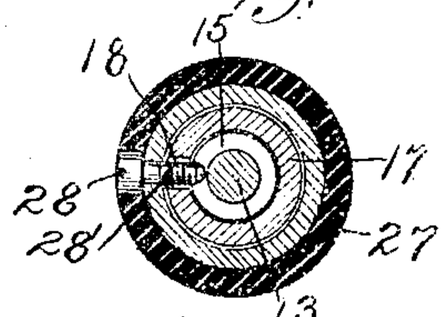
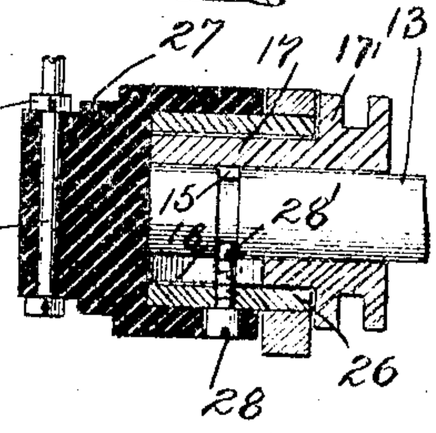


Fig. 3

Fig. 5.



Witnesses
Harry R. Hutchinson
Ray White

Inventor
Vincent G. Apple
By Foster Bain Atty.

UNITED STATES PATENT OFFICE.

VINCENT G. APPLE, OF DAYTON, OHIO.

SPARK-TIMING DEVICE FOR IGNITION SYSTEMS.

No. 847,876. Specification of Letters Patent. Patented March 19, 1907.

Application filed November 9, 1903. Serial No. 180,466.

To all whom it may concern:

Be it known that I, VINCENT G. APPLE, of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Spark-Timing Devices for Ignition Systems; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to spark-timing devices for ignition systems designed to be employed in conjunction with variable-speed gas-engines to automatically regulate the "lead" of the spark consistently with the speed of the engine.

One of the objects of my invention is to provide in such a timing device adjusting means for changing the speed rate at which the automatic regulation of the spark-lead will be commenced and to so arrange said adjusting means that they may be conveniently actuated while the timing device is in operation.

A further object of my invention is to provide manually-operable means for controlling the spark-lead independently of the automatic devices for the same purpose.

Another object of my invention is to provide a construction of the timing device whereby the entire exterior of the casing containing the mechanism is thoroughly insulated from the electrical conductors embodied in the device to obviate the possibility of the user of the device receiving shocks in the handling thereof.

A further object of my invention is to provide an improved means for adjusting the position of the rotating conductor consistently with the speed rate of the driven shaft.

A still further object of my invention is to provide a generally-improved construction of timing device and improved means for securing it to a support.

In the drawings, Figure 1 is a front elevation of my improved timing device associated with a diagram illustrating the manner of its electrical connections in an ignition system for gas-engines. Fig. 2 is a vertical section on line 2 2 of Fig. 1. Fig. 3 is a similar section on line 3 3 of Fig. 1. Fig. 4 is a cross-section on line 4 4 of Fig. 3. Fig. 5 is a longitudinal section on line 5 5 of Fig. 3.

Throughout the drawings like numerals of reference refer to like parts.

6 indicates a casing generally cylindrical in form and having its front end open and exteriorly screw-threaded, as indicated at 6'.

7 indicates a glass face-plate covering the open end of the casing 5 and positioned by an annular cap-rim 8, interiorly screw-threaded to engage the screw-thread 6' of the casing.

9 9 indicate ears projecting from the casing 5 and abutting against the rear face of a support 10, such as the dashboard of a motor-vehicle or other suitable relatively thin sustaining member, which is suitably apertured to receive the casing 6. The rim 8 affords a corresponding abutment on the opposite side of the support and serves to retain the device in the support.

11 11 indicate bolts extending through the support 10 and the ears 9 of the casing and forming additional means for securing the timing device in position. The rear or closed end of the casing 6 is provided with an extended boss or hub 12, designed to afford an extended bearing for the driven shaft of the device.

13 is the driven shaft connected with some engine-driven part, so that it rotates consistently with the speed of the engine-shaft.

14 indicates a sprocket-wheel suitable to receive a chain for connection to some engine-driven member.

15 indicates a circumferential groove cut into the shaft 13, near the extremity thereof within the casing 6.

17 indicates a sleeve splined or otherwise mounted to slide longitudinally upon said grooved extremity of the shaft 13 and at its rear end provided with a grooved collar 17', preferably integral therewith. The slidable sleeve 17 is slotted, as indicated at 18, said slot being arranged diagonally or at an angle relative to the axis of the sleeve to constitute, in effect, a cam.

19 indicates generally the centrifugal governor device mounted upon the shaft 13 and connected with the slidable sleeve 17 to shift the same longitudinally of the shaft proportionally to the spread of the governor-levers.

In the specific embodiment herein illustrated, 20 indicates a collar fixedly mounted on the shaft 13 adjacent the closed rear end of the casing 6.

21 21 indicate governor-levers, each at one end pivotally mounted in the collar 20 and at its other end bearing a weight 22.

23 23 indicate links, each at one end pivoted to the corresponding governor-lever 21

and at its other end pivoted to an ear 24, secured to and preferably formed integral with the collar 17′ of the sliding sleeve 17.

26 indicates a wearing-sleeve surrounding the sleeve 17 in front of the collar thereof and arranged for rotation relative to the sliding sleeve 17.

27 indicates a cap of insulating material fitting over the sleeve 26 and the subjacent parts and projecting a suitable distance beyond the shaft 13 toward the front end of the casing. The sleeve 26 and cap 27 form, in effect, one member of the device and will be referred to together as an "adjustable" carrier.

28 indicates a screw taking through the insulating-cap 27 and the wearing-sleeve 26 to secure the same together and provided with an extended shank 28′, which passes through the diagonal slot 18 in the slidable sleeve 17 and engages in the groove 15 of the shaft 13. It will be apparent now that as the shaft 13 is rotated the weighted governor-levers 21 are correspondingly spread, and the connection of said arms with the slidable sleeve 17 serves to withdraw said sleeve axially rearward with reference to the shaft. The superposed adjustable carrier being held in longitudinally stationary relation to the shaft 13 by reason of the engagement of the screw 28 with the circumferential groove 15 of the shaft is turned circumferentially relative to the sleeve 17 in virtue of the engagement of the screw 28 with the cam-slot 18 of the said sleeve 17. The cam-slot 18 being straight, the circumferential movement of the adjustable carrier relative to a given point upon the sleeve 17 will be proportionate of the degree of spread of the governor-levers 21 under the influence of centrifugal action.

In addition to the automatic means just described for effecting a rotative adjustment of the insulating-cap 27 relative to the shaft 13, I provide manually-operable means for effecting the same adjustment.

29 indicates a lever extending through an aperture 30 in the side of the casing 6 and pivoted, as at 31, adjacent the aperture 30. The end of the lever 29 within the casing terminates in a fork 32, arranged to partially embrace and overlie the collar 17′ of the sleeve 17.

33 33 indicate pins carried by the fork-arms and engaging in the groove of the collar 17′.

The exterior end of the lever 29 may be brought into position suitable for manual operation, or, as herein illustrated, may be provided with a connection 34, extending to a position conveniently accessible for operation. It will be apparent that movement of the lever 29 in virtue of its engagement in the grooved collar 17′ of the sleeve 17 will serve to actuate the slotted slidable sleeve 17 to rotarily adjust the cap 27 of the device Associated with the lever 29 I provide an adjustable spring, adapted to resist the movement of the sleeve 17 from its normal position.

35 indicates an offset portion of the casing 6, preferably integral therewith and adapted when fitted in a properly-shaped aperture in the support 10 to hold the casing against rotation relative to said support. The offset portion 35 is provided with a bore 36, extending therethrough and screw-threaded at its upper end.

38 indicates an adjusting-screw threaded into the threaded end of the bore 36 so as to be accessible from the front of the device.

39 indicates a helical spring arranged within the bore 36, at one end abutting against the adjusting-screw 38 and at its other end bearing on the lever 29. The spring 39 operates to normally hold the sleeve 17 at its forward position of movement and resists the efforts of the governor device to move said sleeve rearwardly along the shaft 13. The tension of the spring 39 may be readily controlled at any time by adjustment of the screw 38, so that the speed of rotation at which the governor will act upon the sleeve 17 to advance the adjustable carrier may be varied at will without interfering with the action of the device. The front area of the interior casing 6 is thoroughly insulated, as by an insulating-cylinder 40, vulcanized or otherwise properly secured to the interior of the casing. Spaced evenly around the interior of the cylinder 40 are arranged terminal plates 41ª 41ᵇ, &c., equal in number to the number of cylinders of the engine with which the timing device is to be employed and each provided with a terminal clamping-screw 41′. The wires employed in connecting the device with exterior electric circuits are all led in through suitable insulating-coverings 42, so that to the exterior of the device no uninsulating portions of any of the electric conductors are presented.

43 indicates a rotating conductor mounted in the insulating-cap 27 and arranged during the rotation of said cap to sweep past the terminal plates 41ª 41ᵇ, &c., in close proximity thereto, but not in contact therewith. The rotary conductor and the terminal plates form circuit-controlling devices for the various exterior circuits. The conductor 43 may be secured in the cap 27 in any suitable way, as by means of the nuts 44. To provide means for including the conductor 43 in an electric circuit, a connection 45 is employed, comprising a conductive rod or wire at its outer end secured to the insulating-cylinder 40 and at its inner end bent sharply inward and having a point 45′, penetrating the cap 27 and connecting with the rotating conductor 43 at the axis of rotation thereof. The terminal plates 41ª 41ᵇ, &c., and the ro-

tating conductor 43 are arranged to be included in the secondary circuit of the system, as will be hereinafter more fully described. Means are provided in the timing device for varying the time of closing the primary circuit (to be hereinafter more fully described) synchronously with the establishment of operative spark-producing conditions in the secondary circuit.

In the construction herein shown, 47 indicates a cam mounted upon the wearing-sleeve 26 for movement therewith and provided with a series of teeth 48 equal in number to the contact-plates 41^a 41^b, &c., and equally spaced about the periphery of the cam.

49 indicates a contact-spring mounted on the inner periphery of the insulating-cylinder 40 and extending over the path of rotation of the cam 47, substantially tangentially thereto.

50 indicates a block having an inclined face mounted on the spring 49 and arranged in the path of movement of the teeth 48 of the cam for coaction therewith.

51 indicates a contact-pin projecting through the casing 6 and arranged to form a contact-stop for the end of the spring 49. The exterior end of the pin 51 is screw-threaded for adjustment relative to the casing, and suitable nuts 52 are provided to secure the pin in proper adjustment. The pin is so adjusted that its free end is slightly separated from the end of the spring 49.

Referring now to Fig. 1, I will describe the connections of my device in an ignition system as therein diagrammatically illustrated.

A, B, C, and D indicate the cylinders of a four-cylinder gas-engine, each of said cylinders being provided with a jump-spark igniter of any preferred construction, one point whereof is grounded in the engine-frame and the other point of which is insulated. The insulated points of the igniters of engines A, B, C, and D are connected by wires 54^a 54^b, &c., with the terminal plates 41^a 41^b, &c., respectively. A wire 55 connects the frame of the engine with the conductor 45 and includes the secondary winding *s* of induction-coil in its path.

56 indicates a battery, (for which any other suitable source of electric power may be substituted,) one terminal of which is connected by wire 57 with the contact-post 51 of the timing device. The other terminal of the battery is connected by wire 58 with a switch 59, whence extends a wire 60, connected at its other end to the contact-spring 49 and including therein the primary *p* of the induction-coil. The circuit including the primary of the induction-coil I will refer to as the "primary" circuit, and the circuit including the sparking secondary winding of the coil I will refer to as the "secondary" circuit.

The general operation of my device in the ignition system will be as follows: The switch 59 being thrown to closed position, the primary circuit is made dependent for its opening or closing upon the contact of the spring 49 and the post 51. The engine being set in motion in the usual way, the shaft 14 of the timing device through its connection (not shown) with the engine is rotated consistently with the speed of rotation of the engine-shaft, and the mechanism carried by the shaft 13 is rotated accordingly. As the teeth of the cam 47 successively pass beneath the block 50 upon the spring 49, the spring is elevated and suddenly released, causing it to vibrate and make a series of momentary contacts with the post 51, closing the primary circuit during each contact. The parts are so positioned that actuation of the spring 49 by the cam occurs during the period of time when the rotating conductor 43 is in radial alinement with one of the plates 41^a 41^b, &c., so that the current impulses occasioned in the primary circuit by the action of the spring 49 induce impulses in the secondary circuit and cause sparks to jump the gap between the igniter-terminals of one of the engines and between the corresponding terminal plate within the timing device and the rotating conductor 43. As the rotative speed of the engine-shaft increases the proportionate increase of speed of the shaft 13 of the timing device causes the governor-levers 21 to fly out to more spread position, thereby effecting the withdrawal of the slotted sleeve 17 relative to the wearing-sleeve 26 of the adjustable carrier, as hereinbefore described, and rotatively adjusting said carrier in a forward direction. Consequently both the cam 47 and the rotating conductor 43 are advanced relative to their initial positions, establishing their operative condition earlier in the engine-cycle than initially, or, in other words, advancing the lead of the spark. The beneficial effect of thus varying the lead of the spark to suit the engine-speed conditions are too well known to need discussion.

While I have herein described minutely the construction which I deem most advantageous, it will be apparent that slight departures may be made therefrom without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a device of the character described, the combination with a casing of a driven shaft extending thereinto, circuit-controlling devices within the casing including a rotating conductor, a rotatively-adjustable carrier for said conductor mounted on the shaft, a governor, associated with the shaft, means for adjustively rotating the carrier, controlled by the governor, a pring arranged to resist the action of the governor, and means disposed relative to the casing to be accessi-

ble from the exterior thereof, for adjusting the tension of said spring to vary its resistance to the action of the governor.

2. In a device of the character described, the combination with a casing, of a shaft projecting thereinto, circuit-controlling devices arranged within the casing and including a rotatable conductor, a carrier for said conductor, rotatively adjustable on the shaft, a governor mounted on the shaft, means for adjusting the carrier actuated by the governor, and manually-operable means for adjusting said carrier extending to the exterior of the casing.

3. In a device of the character described, an actuating-shaft, circuit-controlling devices comprising a rotatable conductor, a longitudinally-slidable sleeve on the shaft, a connection between said sleeve and the conductor whereby longitudinal movement of the sleeve positively effects the rotary adjustment of the conductor relative to the shaft, a governor mounted on said shaft, and connected with the sleeve to longitudinally move the same, and a manually-operable means for moving said sleeve independently of the governor.

4. In a device of the character described, a casing, a shaft to be driven mounted therein, circuit-controlling devices within the casing including a rotating conductor, a rotatively-adjustable carrier for said conductor, a centrifugal governor operatively associated with the shaft, means arranged to be actuated by the governor for adjusting the carrier, a lever extending to the exterior of the casing, a connection between said lever and the carrier, adjusting means whereby the carrier may be manually adjusted, a spring arranged to bear upon the said lever to resist the adjusting movement of the carrier, and means accessible from the exterior of the device for adjusting the tension of the spring.

5. In a device of the character described, the combination with a casing, of a circumferentially-grooved shaft extending thereinto, a sleeve slidably mounted on the shaft and provided with a cam-slot therein, a conductor-carrier mounted on the slidable sleeve, a pin secured to the carrier and taking through the cam-slot into the groove of the shaft, a rotative conductor carried by the carrier, coacting circuit members arranged within the casing, and means for sliding the sleeve longitudinally of the shaft whereby the rotative conductor is rotatively adjusted.

6. In a device of the character described, a shaft to be driven, circuit-controlling devices including a rotating conductor, a carrier for said conductor rotatively adjustable on the shaft, a cam device associated with the carrier for adjusting the latter, an automatic governor operatively associated with the shaft, and a manually-operable device, said governor and manually-operable device being both operatively associated with the cam device to actuate the latter.

7. In a device of the character described, a shaft to be driven, circuit-controlling devices including a rotating conductor, a rotatively-adjustable carrier for said conductor, a movable sleeve having a cam-slot and pin engagement with said carrier for adjusting the latter, a centrifugal governor operatively associated with the shaft and a manually-operable device, said governor and manually-operable device being operatively associated with the movable sleeve to actuate the same.

8. In a device of the character described, a casing having an offset portion provided with an aperture therethrough, a rotatable shaft projecting into the casing, circuit-controlling devices within the casing including a rotatable conductor, a rotatively-adjustable carrier for said conductor, means for adjusting the carrier including a sliding sleeve, a lever associated with said sliding sleeve extending to the exterior of the casing, and arranged for manual operation, a spring arranged in the recess of the offset portion of the casing, tending to hold said lever normally in one position, and a centrifugal governor carried by the shaft arranged when in operation to oppose the action of said spring upon the lever.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

VINCENT G. APPLE.

In presence of—
FORÉE BAIN,
L. M. ARNOLD.