R. VARLEY.

CIRCUIT CONTROLLER FOR EXPLOSION ENGINES.

APPLICATION FILED JULY 7, 1906.

915,388.

Patented Mar. 16, 1909.

2 SHEETS—SHEET 1.

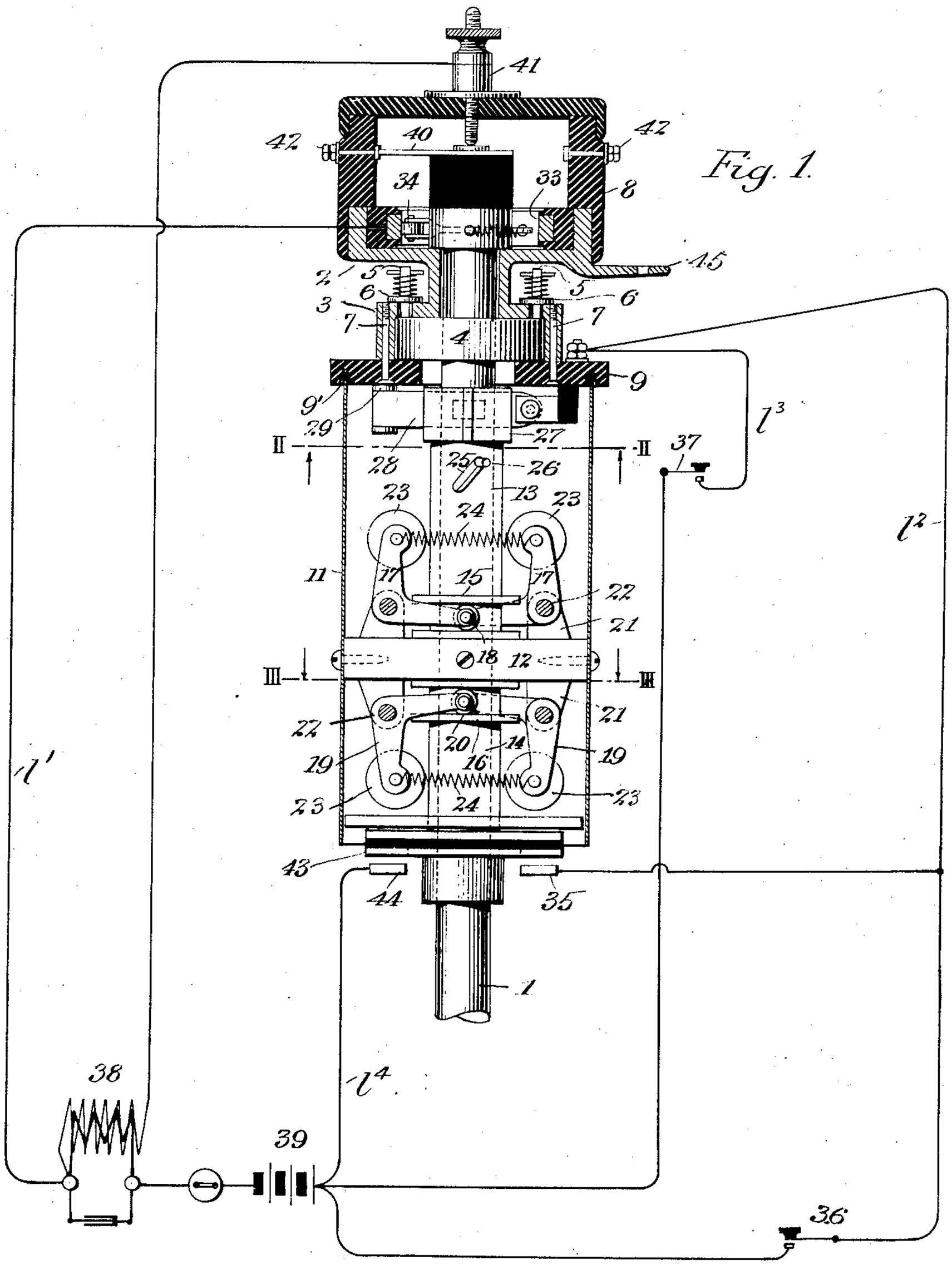

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

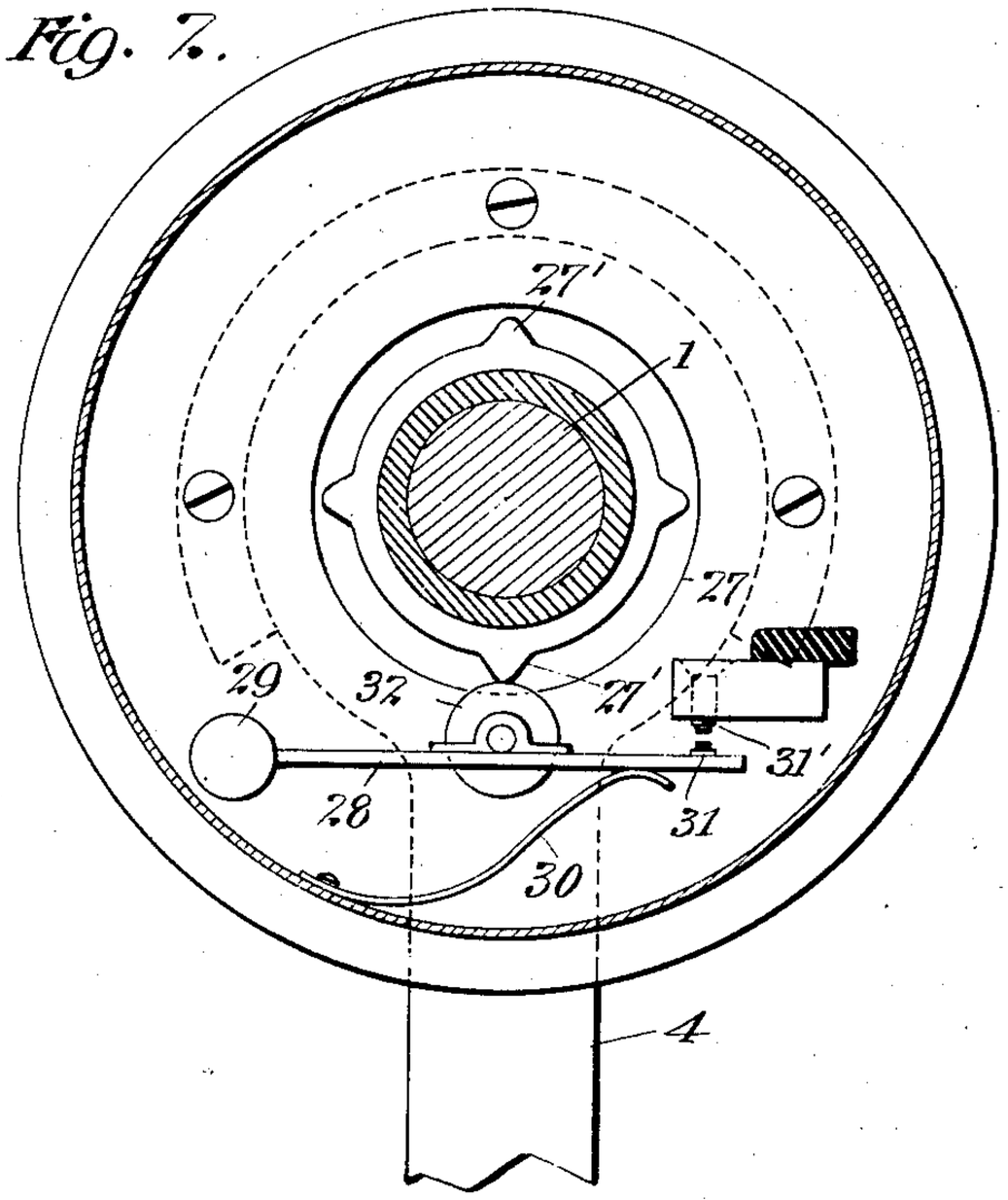
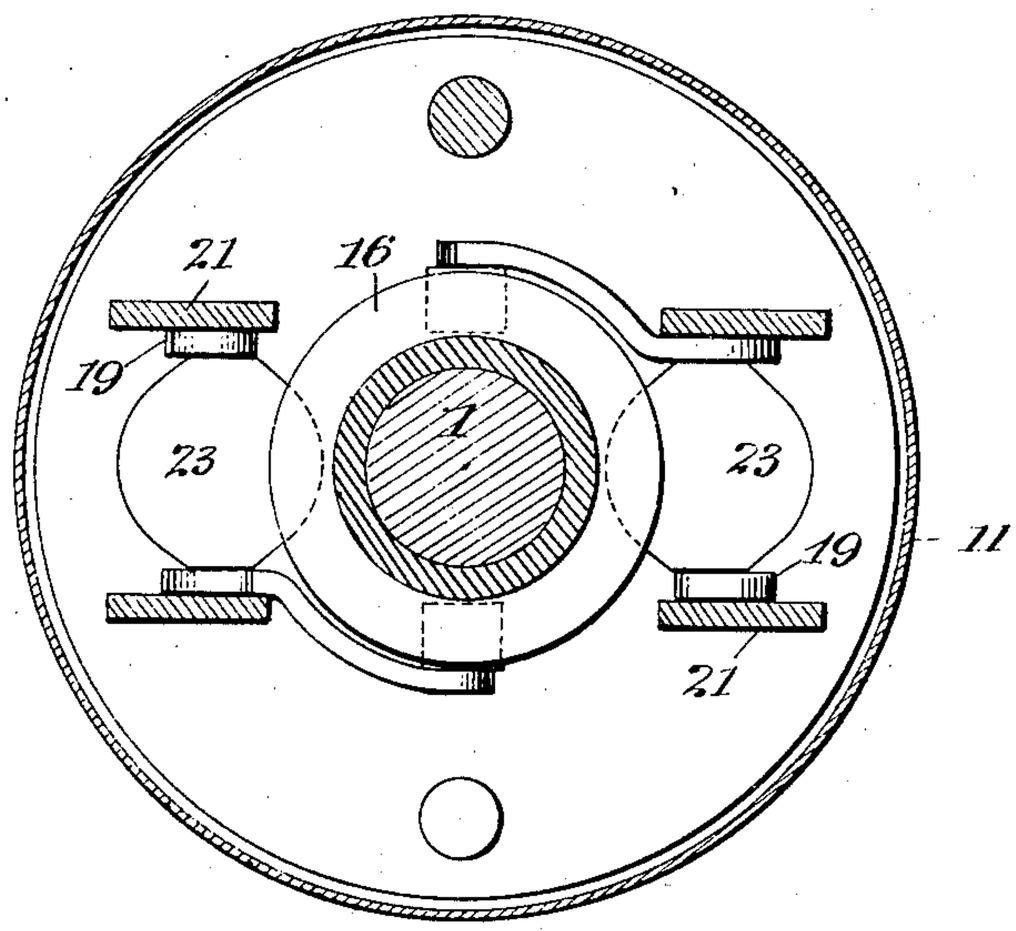


Fig. 3.



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UNITED STATES PATENT OFFICE.

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CIRCUIT-CONTROLLER FOR EXPLOSION-ENGINES.

No. 915,388. Specification of Letters Patent. Patented March 16, 1909.

Application filed July 7, 1906. Serial No. 325,056.

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Circuit-Controllers for Explosion-Engines, of which the following is a full, clear, and exact description.

My invention relates to ignition systems for explosion engines, and particularly those used on automobiles and motor vehicles and having a plurality of cylinders.

The principal object of the invention is to provide a means which will compensate for the varying time of dwell of the primary circuit closing device for different speeds of the engine. In other words, I aim to provide a means which shall insure a substantially constant duration of the spark cascade in the respective cylinders whether the engine is moving fast or slow.

A further object of the invention is to provide the above features in a simple mechanism, having a minimum number of parts liable to derangement, and in which the time of ignition is controllable in the several cylinders.

A still further object of the invention is to absolutely insure against the primary battery current being left on a closed circuit when the engine is not running.

With these and other objects in view, the invention consists in the construction, combination, in the location and in the arrangement of circuits and parts, as hereinafter set forth and shown, and finally particularly pointed out in the appended claims.

In the drawings: Figure 1 is a sectional view, with the circuits represented diagrammatically, of an ignition device or circuit controller embodying the principles of my invention; Fig. 2 is a section on the line II—II of Fig. 1, looking in the direction of the arrows; Fig. 3 is a sectional view on the line III—III of Fig, 1, also looking in the direction of the arrows.

Motor vehicles run at varying speeds, and since the electric ignition is timed and controlled by the rotation of the engine, it is apparent that there is a shorter duration of the ignition contact when the engine is moving at high speed than when the engine is running slowly. This is a serious disadvantage because if the duration of the ignition is properly timed for the slow speeds, it is too short for the high speeds. There is moreover a greater need of sufficient ignition at high speeds than at the low speeds, because the engine is using more gas and at higher compression values, and electric ignition does not operate quite as efficiently for high compression values as for lower compressions. This gives rise to objectionable "knocking" of the engine, and is a cause of considerable loss of power.

In carrying out my invention I aim to wholly overcome this defect, and to provide a centrifugally operated mechanism which gives a relatively longer dwell of the primary circuit closing devices at high speeds than at low speeds, so as to compensate for the rotation of the engine.

An additional feature of the invention relates to the provision of means by which it is impossible to close the circuit of the primary current unless the engine is running. It has been found in practice that batteries are frequently exhausted, and induction coils burned up by inadvertently leaving the battery circuit closed therethrough. This sometimes happens by reason of improper manipulation of the induction coil vibrators when the engine happens to be standing at a position to close the primary circuit through the circuit controller.

Referring now to the drawings in which like parts are designated by the same reference sign wherever they occur 1 indicates a shaft which rotates synchronously or commensurately with the engine and may be the usual half-time shaft thereof. This shaft is journaled, in addition to its usual bearings (not shown), in a support or frame 2, which has a portion 3, which is annularly recessed so as to frictionally surround and be guided upon a bracket 4. The bracket 4, shown best in dotted lines in Fig. 2, forms a swivel support for the portion 3, and permits of a certain range of relative movement thereof. In order to hold these parts together in proper frictional relation, I provide studs 5, which project upward from the bracket 4, through arcuate slots in the frame 2, and have downwardly spring pressed washers 6 thereon, which bear on the lower part 3 of the frame 2 so as to hold the frame against the bracket 4, with a certain predetermined friction, but in such a way as to permit relative rotation through a certain angle. The frame 2 carries the distributing switch box 8, and an insu-

lating plate 9, secured thereto by the screws 7. The plate 9 forms a support for the primary circuit breaking contacts as will be hereinafter described.

Referring now particularly to Fig. 1, I have shown a casing 11 revoluble in a groove 9′ in the plate 9, and attached to a web or diaphragm 12, which in turn is fixed to the shaft 1 so as to be rotated therewith. In this casing and loosely sleeved upon the shaft 1 are a pair of tubular parts or sleeves 13 and 14, each of which has collars 15 and 16 respectively. 17 indicate a pair of bell crank levers pivoted to the diaphragm 12, and having rollers 18, which are guided between the collars 15. 19 indicate another pair of similar bell crank levers, which have rollers 20, guided between the collars 16. All of these bell crank levers are pivoted on the diaphragm 12, as above stated, conveniently by means of lugs 21, extending therefrom, which have short pivot shafts 22 therein. All of the bell crank levers also carry weights 23, and each pair is drawn by springs 24, in a direction to oppose the centrifugal force of the weights 23 when these are impelled outward by the rotation of the diaphragm 12. From this construction it will be seen that when the shaft 1 is stationary, the weights 23 are drawn toward one another, and the two sleeves 13 and 14 are impelled toward one another into the relation shown. When, however, the shaft 1 rotates, the weights 23 fly outward, so that the two sleeves 13 and 14 separate from one another, the sleeve 13 moving upward and the sleeve 14 moving downward. The sleeve 13 is arranged to produce a relatively varying dwell of the primary circuit closing device, and to compensate for the speed of the engine. The sleeve 14 is arranged to insure against the primary circuit being closed when the engine is not running, as will be later described. The sleeve 13 is constrained in a certain relation upon the shaft 1 by means of an inclined slot 25, which is guided upon a pin 26, projecting from the shaft 1. In this way a certain longitudinal movement of the sleeve on the shaft is accompanied by a predetermined relative rotation. The primary circuit breaking cam 27 is formed in practice directly on the sleeve 13, and has projections 27′, the number of which correspond to the number of cylinders of the engine. 28 denotes a movable finger which may be pivoted at 29, and spring pressed inward by a spring blade 30, so as to normally close the primary circuit at the contacts 31, 31′. 32 indicates a roller carried by this finger and which lies in the path of the projections 27′ above mentioned. This finger, and the fixed contact 31′ are supported from the insulating plate 9, which forms a part of the frame 2, as above described.

Within the casing 8 above mentioned and forming part of the distributing switch there is provided an annular series of spaced contacts 33, and the shaft 1 carries a roller 34 spring pressed outward therefrom, and adapted to contact with the various segments 33, as it is rotated. In practice I make all of the segments 33 in electrical connection with one another, and with the primary of an induction coil 38, through a wire l'. By this arrangement the connection l' is grounded upon the shaft 1, during successive periods as said shaft is rotated. The contact 31′ has connections l^2 and l^3 therefrom, of which l^2 is joined to a contact plate 35, and to a switch 36. The wire l^3 is shown connected to a switch 37. These connections are merely shown for the purpose of example, it being merely necessary to connect the contact 31′ with the other side of the induction coil 38, through a battery 39, in order to secure the compensating features of the invention, above referred to. The secondary of the induction coil 38 is conveniently grounded on one side and connected with a distributing switch blade 40, through a binding post 41, on its other terminal. The switch blade 40 sweeps into proximity to the connections 42 leading to the various spark plugs in the usual way.

From the above description it will be observed that there is normally no direct connection between the contact 31′ and the battery 39. The contact is connected as above stated to the switches 36 and 37 and to the plate 35, but since the switches 36 and 37 are push buttons, or spring contacts of some sort, and the plate 35 is normally unconnected with any other part, it is evident that the primary circuit is normally not completed by any of these devices. If, however, either of the push buttons 36 or 37 is pressed, the circuit is completed, and it is also completed by the rotation of the engine when the switches are not depressed. This is accomplished by the sleeve 14 above described, which carries a metallic collar 43, insulated therefrom, and which is depressed by the sleeve 14, under the action of its centrifugal weights. When the collar 43 is depressed, it engages the plate 35, and also another plate 44, which is connected to the battery through wire l^4. It is, therefore, obvious that the primary battery circuit may be completed through either of the switches 36 or 37 at any time, but that when the engine is cranked, the primary circuit is automatically completed between the plates 35 and 44. The collar 43 is arranged to close the circuit between these plates at a very low speed of the engine, for example, 50 R. P. M., to mention a practical figure.

The operation is as follows: Under normal conditions the primary circuit is bound to be broken, as above described, but when desired it may be closed either through the

switches 36 or 37, or by cranking the engine. If desired, one of the switches may be located near the starting crank. When the engine starts and rotates slowly, the sleeve 13 is in the downward position shown, and the cam 27 occupies a certain relation on the shaft 1. Supposing that switch 37 for example is closed, the primary circuit is completed at successive intervals during the rotation of the shaft 1. This is accomplished by the roller 34 moving over the segments 33 and the vibrating finger 28. The length of the segments and the form of the cam 27 are such that the vibratory finger 28 moves the contacts 31, 31′, together, and the roller 34 thereafter contacts with one of the segments 33, thereby completing the primary circuit. This causes the usual cascade of sparks across one of the plugs of the engine determined by the arm 40, which spark cascade is terminated by the final rupture of the primary circuit at the contacts 31, 31′. Thereafter the primary circuit is additionally broken at the segments 33 before the contacts 31, 31′, have had time to come together. In this way the primary circuit is always completed or closed at the segments 33, and is always broken at the contacts 31, 31′. It is obvious that the duration of dwell of the primary circuit and of the spark cascade, will be determined by the angular relation of the cam 27 to the segments 33. This angular relation is, however, capable of being varied by the movement of the sleeve 13. As the speed of the engine increases, this sleeve moves upward and turns angularly on the shaft by reason of the inclined slot 25. This accomplishes an angular displacement of the cam 27 which thereupon breaks the primary circuit at the points 31, 31′, a little later than before, so that the spark cascade is of relatively longer duration so as to compensate for the increased speed of the engine. The cam 27 is of sufficient longitudinal extent so that its movement in this direction does not move it out of operative relation to the cam roller 32. The form of the slot 25 may be such as to give any desired absolute period of duration of the spark cascade for any speed of the engine. For example, the duration may be made absolutely uniform in point of actual time for all engine speeds.

While the above arrangement gives any desired period of duration for the spark cascade at all engine speeds, it does not interfere in any way, nor is it interfered with, the timing of the sparks in the cylinders with relation to the stroke. In other words, the time of ignition may be varied precisely as is now done, altogether independently and without interference with the means for fixing the spark duration. In the drawings I have illustrated an arm 45 projecting from the frame 2, and which may be connected to the usual links so as to provide for the desired adjustment. When the frame 2 is turned in this way, the segments 33 and the finger 28 are both moved over an equal angle with respect to the roller 34 and the cam 27 respectively. The time of the spark cascade with respect to the shaft 1 is therefore varied but the duration is not varied, because this is dependent only on a change in the relative position of the roller 34 and the cam 27, and such relation is not varied except by the governor weights 23. Therefore, the timing of the sparks in the cylinders with respect to the spark is dependent only on the adjustment through the arm 45, and the duration of the sparks in the cylinders is established and fixed by the original construction and adjustment of the mechanism, and is not thereafter altered by any manipulation or running the engine.

What I claim, is:—

1. In an ignition system for explosion engines, a shaft, a casing surrounding said shaft and having a diaphragm fixed thereto, a pair of sleeves on said shaft, one on either side of said diaphragm, weighted levers within said casing adapted to displace said sleeves longitudinally when the shaft is rotated, a cam fixed to one end of said sleeves, means whereby said cam is moved angularly when the sleeve is shifted longitudinally, a contact lever engaging said cam, a primary ignition circuit including said lever and cam, and means connected with the other sleeve for interrupting said primary ignition circuit when the shaft ceases to rotate,

2. In an ignition system for explosion engines, a shaft, a sleeve longitudinally movable thereon, centrifugal means for displacing said sleeve longitudinally when the revolving shaft rotates, a contact plate having a surface carried by said sleeve, an ignition circuit including a pair of contacts normally insulated from one another and adapted to be electrically connected through said plate, and a plurality of means for establishing circuits around said contacts independently of said plate, whereby the ignition circuit may be completed when said shaft is at a state of rest, and is automatically completed when said shaft rotates above a certain speed.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

RICHARD VARLEY.

Witnesses:
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HEZEKIAH BRITWHISTLE.