July 26, 1938. L. P. KONGSTED 2,124,528

ELECTRIC IGNITION SYSTEM

Filed Feb. 6, 1937

Fig. 3.

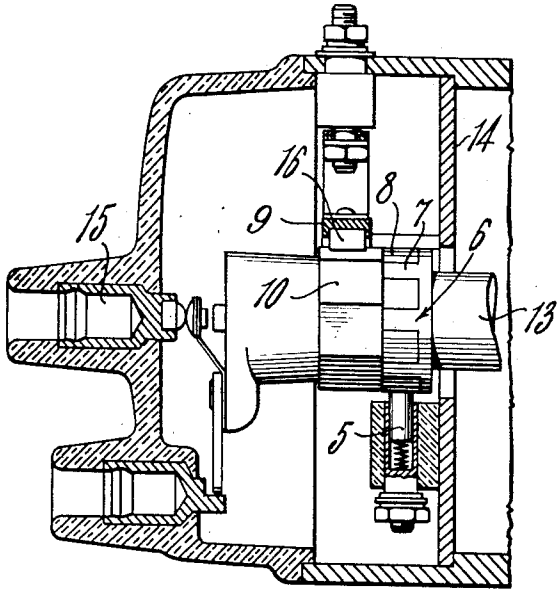


Fig. 4.

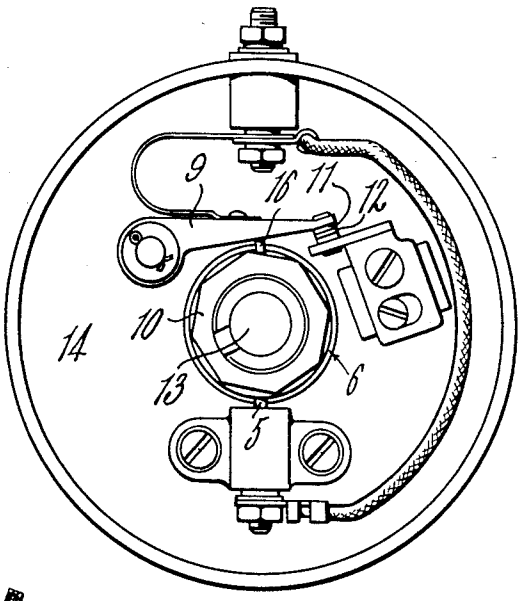
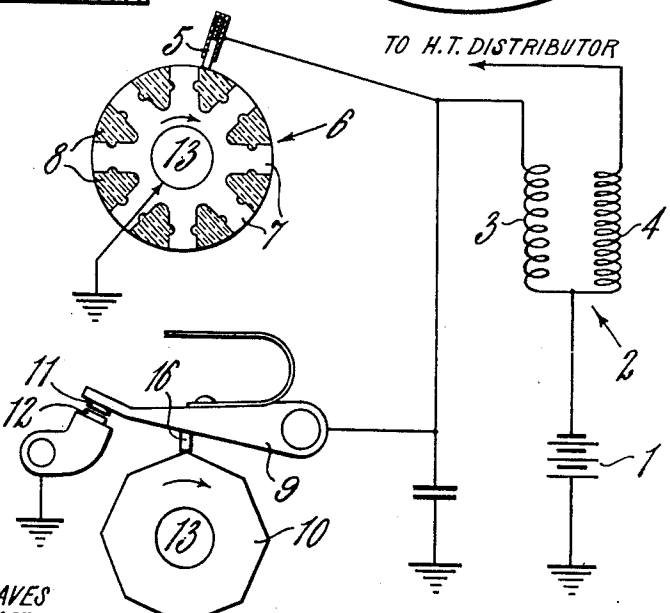


Fig. 1.



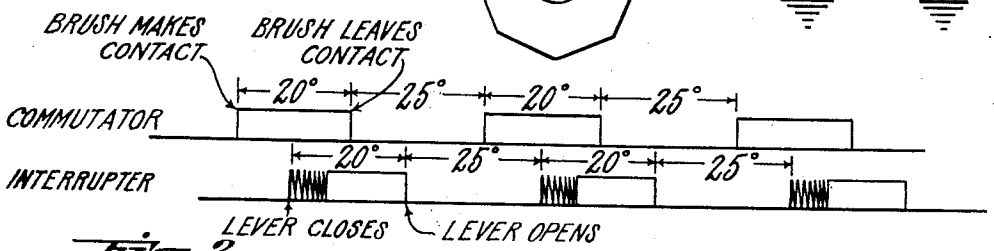


Fig. 2.

INVENTOR.
Ludvig P. Kongsted
BY
ATTORNEY.

Patented July 26, 1938

2,124,528

UNITED STATES PATENT OFFICE

2,124,528

ELECTRIC IGNITION SYSTEM

Ludvig P. Kongsted, Longmeadow, Mass., assignor to United American Bosch Corporation, Springfield, Mass., a corporation of New York

Application February 6, 1937, Serial No. 124,519

4 Claims. (Cl. 123—148)

This invention relates to an ignition system and has for its principal object to provide a system capable of functioning efficiently at high speeds without undue wear or burning of the electrical interrupting elements and without undue wear of the mechanical elements operating them.

In high speed ignition systems of the conventional type it is generally the mechanical limitations of the interrupter lever which limit the high speed operation. In magnetos, in which the energy is generated by the rotation of a generating coil, magnet or flux distributor, the energy at first increases with the speed and thereafter becomes fairly constant, due to the electrical characteristics of the generating circuit including as one factor the time period of closure of the circuit. In battery ignition systems, in which the current source is maintained at substantially constant voltage at all speeds of operation, the energy available decreases as the speed increases due to a decrease in the time interval available for building up the primary current in the generating coil. In case the interrupter lever chatters upon closing, the effective period of closure of the primary circuit of the generating coil of either the magneto or the battery ignition system is decreased thereby decreasing or tending to decrease the available energy delivered by the ignition system. Two interrupter levers have been used for high speed operation to increase this effective period of closure or saturation, the first lever closing the primary circuit before the second one closes and the second one opening the circuit after the first one has opened.

Whether one or two interrupter levers are used, either lever on making contact is subjected to a certain amount of chattering or bouncing of the contact points as these come together. This chattering may be too small to be seen with the naked eye or with a stroboscope but can readily be observed by means of an oscillograph. The harmful effect of this chattering is not usually appreciated. The mechanical effect of the chattering, resulting in chipping of the contact points, is not nearly as serious as the sparking and oxidizing action which takes place at the contact points. This is particularly true in the case of magnetos where the points frequently engage at a time when there is still a rapid change of flux in the generating coil and therefore a comparatively high voltage present across these points. If the points chatter as they engage, bad arcing and oxidizing is the result. Furthermore, chatter of the lever of a single lever interrupter system upon closing the circuit, or of the first closing lever of a two-lever system, shortens each period of closure or saturation of the ignition system by the time interval of that chattering period.

It is among the primary objects of my invention to avoid the above mentioned defects in ignition systems in which any chattering that occurs does not open the primary circuit, thereby preventing arcing and oxidizing of the contact points. In the preferred form of my invention, the full period of closure of the circuit is insured also. In order to accomplish these results, I use a commutator or other rotary switch in combination with a conventional cam-operated interrupter lever, the two having overlapping periods of operation. The commutator and cam may be located on the same or different timer shafts in fixed or variable relationship, as desired.

The above and other objects and features of the invention will in part be obvious and in part be more fully set forth in the following detailed description taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a circuit diagram showing the multiple control devices connected in electrical parallel in a battery ignition system for an eight cylinder, four cycle engine; Fig. 2 is a timing diagram showing the overlapping relation of the periods during which the commutator and interrupter are open and closed; Fig. 3 is a longitudinal section with parts in side elevation of a timer distributor constructed in accordance with the invention; and Fig. 4 is a plan view of the control devices in the timer distributor of Fig. 3.

Referring to Fig. 1, reference numeral 1 indicates a source of current which in the instance shown is a storage battery, one terminal of which is suitably grounded and the other terminal of which is connected to a conventional ignition coil having a primary winding 3 and a secondary winding 4. The secondary winding is connected to the distributing terminal 15 (Fig. 3) of the high tension distributor. The primary winding is connected to a stationary brush 5 of a commutator which has a plurality of copper conducting segments 7 having intervening insulating segments 8. The conducting segments 7 are suitably grounded to complete the parallel branch path through brush 5 and commutator 6. An interrupter lever 9 is provided with a lead connected in the circuit at a point between the primary winding 3 and the brush 5. It is actuated by a suitable cam 10 adapted to make and break the branch path through a contact point

11 on the interrupter lever and a fixed contact point 12 which is suitably grounded to complete the interrupter branch in parallel with the commutator. This cam has eight lobes and the commutator likewise has eight conducting segments.

In the operation of the device so far described, assuming that the commutator 6 and cam 10 are rotating at the same speed in the direction of the arrows in Fig. 1, it will be obvious that the brush 5 will contact with one of the conducting segments 7 of the commutator to complete the branch path therethrough at a time somewhat in advance of the closure of the path through interrupter contacts 11, 12. Since the brush and the conducting segments of the commutator form a rotary switch, there is no chatter or bounce upon engagement thereof. The timing of the two control devices will be more clearly seen in connection with Fig. 2 which shows that the brush 5 makes contact with one of the conducting segments 7 about 10 degrees ahead of the initial closure of the interrupter lever 9. It will thus be seen that at the time the interrupter closes, the circuit through the primary winding has already been established by way of the commutator. Therefore, if the interrupter lever bounces upon contact, as it will at high speed operation, there is no tendency to draw an arc between the contact points 11 and 12 because of the closure of the branch path of far less resistance through the commutator. It will further be seen from Fig. 2 that the commutator brush 5 leaves a conducting segment 7 about 10 degrees prior to the opening of the circuit through the interrupter. Thus there will be no tendency to draw an arc between the brush 5 and the conducting segment as the branch path through the commutator is broken, because the current will continue to have a free path of low resistance through the interrupter. Approximately 10 degrees after the brush 5 has left the conducting segment of the commutator, the interrupter lever will be abruptly opened by the interrupter cam 10. Since at this point the path through the commutator is opened, the primary circuit is thus abruptly opened at the interrupter contacts 11, 12, thus inducing the high tension current in the secondary winding 4.

It will be seen that by the above arrangement, the advantage of freedom from the electrical effects of bouncing or chatter of the interrupter lever upon closure thereof is provided by having the primary circuit then closed through the commutator, while freedom from drawing an arc between the brush and the conducting segment of the commutator upon disengagement thereof is provided by having the primary circuit then closed through the interrupter. While the interrupter lever will bounce or chatter upon closure thereof, as will be seen from the diagram, this is of no consequence since it does not alter the current flow in the primary circuit and since no sparking then occurs between contact points 11 and 12. Furthermore, the period of saturation of the coil 3, 4, or the period of closure of the primary circuit, is not reduced by the chattering of the interrupter but extends in each period from the instant of closure through the commutator until the instant of separation of the interrupter contacts. Also by this arrangement the primary circuit is abruptly interrupted by the separation of cam-operated interrupter contacts, as in conventional systems.

The structure results in a further advantage in that the spring behind the interrupter lever does not have to be as stiff and strong as otherwise would be required to reduce the bouncing or chattering, and therefore the striking block 16 of the interrupter lever is not worn so greatly by the cam.

In practice I prefer to mount the commutator 6 and the interrupter cam 10 together on the timer distributor shaft 13, as shown in Fig. 3. Variations in the timing of the cam will simultaneously effect variations in the timing of both commutator and interrupter. By mounting the brush 5 and interrupter lever 9 on the plate 14, adjustment thereof will time the interrupter and commutator simultaneously and to the same extent.

While I have herein shown but a single embodiment of my invention it will be understood that other embodiments may be constructed by those skilled in the art without departing from the spirit and scope of the appended claims. In particular, while I have shown the interrupter and commutator connected in parallel or shunt branch paths, it will be readily understood that these two control devices can be connected in series to effect the desired operation. In such a case the interrupter will first make contact and, after a period sufficient to insure that any chatter of the interrupter lever has subsided, the commutator brush will make contact with a conducting segment of the commutator to complete the circuit. Thereafter the interrupter contacts will be separated, thereby opening the circuit prior to the moment the commutator brush leaves a conducting segment. The circuit being already open, no spark can be drawn when the brush leaves the conducting segment. The series circuit therefore possesses many of the advantages noted in connection with the parallel circuit illustrated as the preferred embodiment of this invention and is therefore embraced in the broader of the appended claims. It does not permit however the same long period of saturation of the coil and is therefore less desirable than the parallel circuit.

In the appended claims it will be understood that the term "generating coil" is intended to embrace coils of the type commonly called ignition coils and used in battery ignition systems as well as the windings of magnetos.

Having thus described my invention, what I claim is:

1. In an ignition switch, a source of current, a circuit interrupter comprising a rotary switch connected to said source, an oscillating switch connected to said source in parallel with said rotary switch adapted to close during the closed period of said rotary switch and open after the opening point thereof, and ignition means energized through said switches.

2. In an electrical ignition system for internal combustion engines, a generating coil, means generating a current in said coil, and multiple control devices and connections for the energization of the coil from the current supply, one of which control devices comprises a sliding contact commutator and the other of which comprises a cam-operated interrupter, the sliding contact of said commutator being disengaged ahead of said cam-operated interrupter.

3. In an electrical ignition system for internal combustion engines, a generating coil, a source of current supply, and mutiple control devices and connections for the energization of the coil from the current source, one of which control devices comprises a sliding contact commutator and the other of which comprises a cam-operated interrupter, said commutator and said interrupter opening and closing in overlapping relation, the

sliding contact of said commutator being engaged ahead of said cam-operated contact of said interrupter.

4. In an electrical ignition system for internal combustion engines, an ignition coil, a source of current supply, and multiple control devices and connections for the energization of the coil from the current supply, one of which control devices comprises a sliding contact commutator and the other of which comprises a cam-operated interrupter, the sliding contact of said commutator being engaged and disengaged ahead of said cam-operated interrupter.

LUDVIG P. KONGSTED.