Sept. 4, 1928. 1,683,376

J. A. WILLIAMS ET AL

IGNITION APPARATUS

Filed Jan. 7, 1924 2 Sheets-Sheet 1

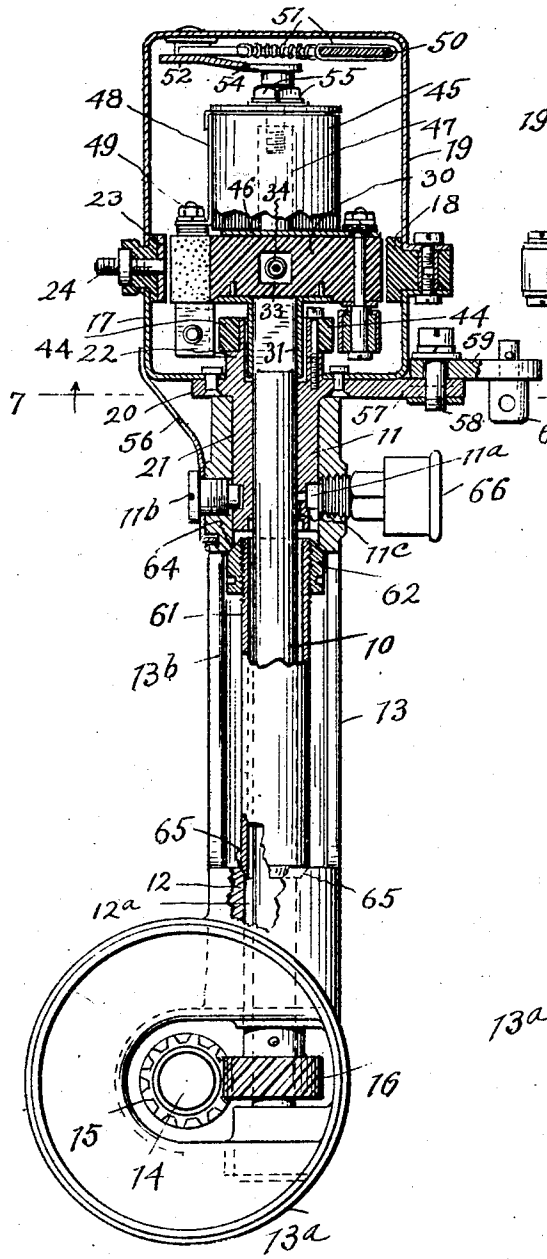

Fig. 2.

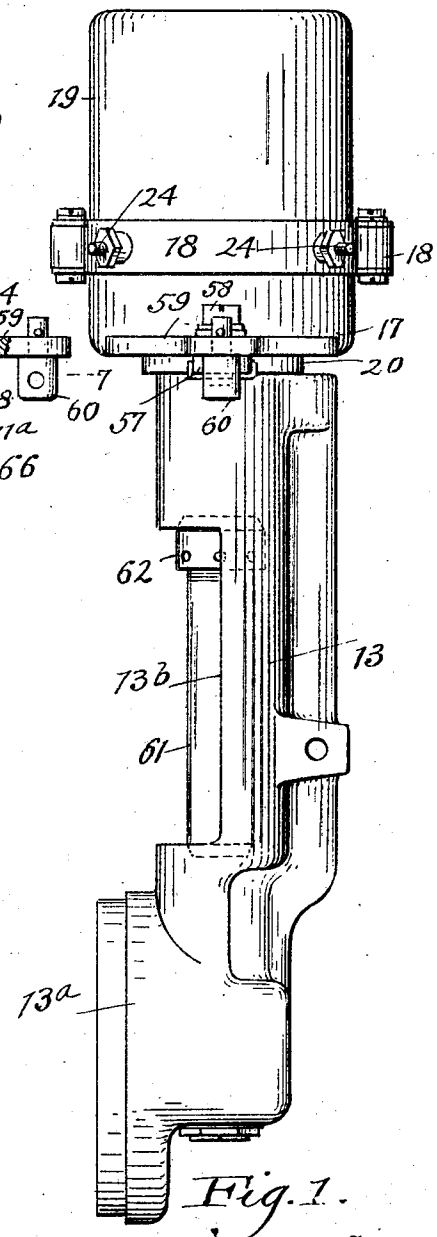

Fig. 1.

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Fig. 3.

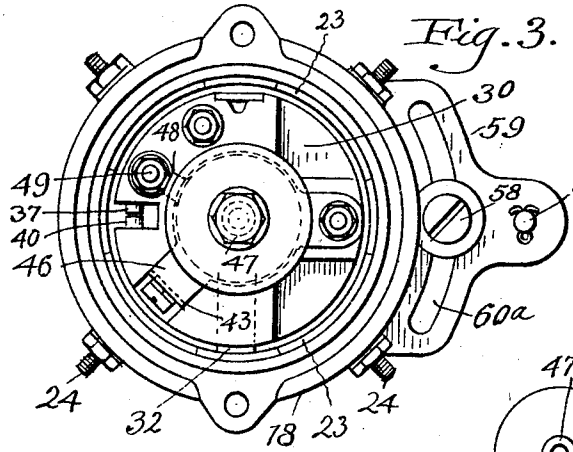
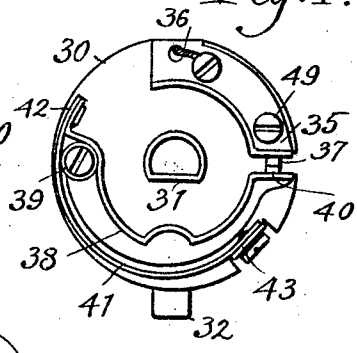


Fig. 4.



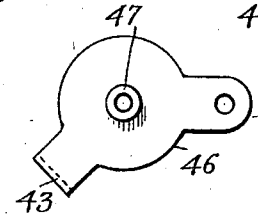


Fig. 6.

Fig. 5.

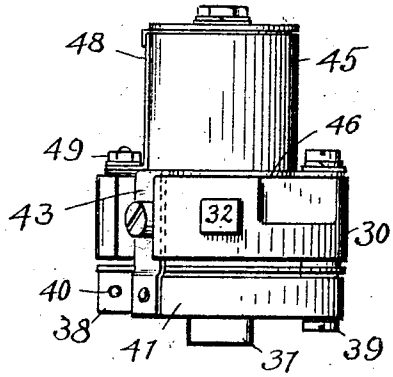


Fig. 7.

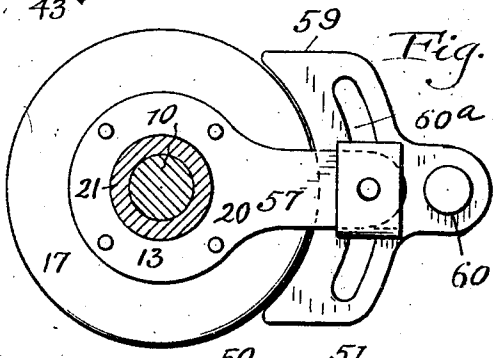


Fig. 9.

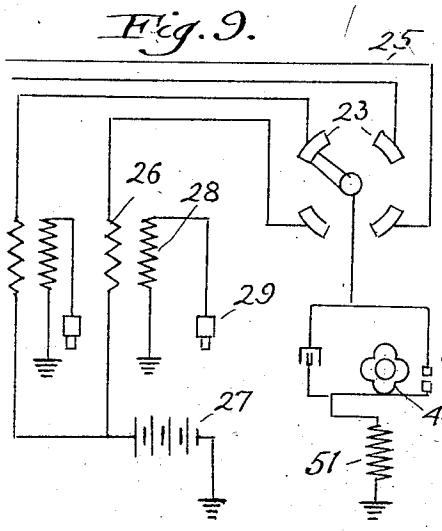
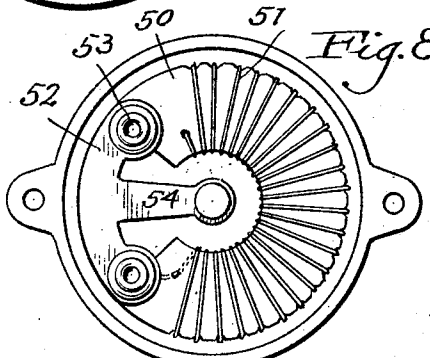


Fig. 8.



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Patented Sept. 4, 1928. 1,683,376

UNITED STATES PATENT OFFICE.

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IGNITION APPARATUS.

Application filed January 7, 1924. Serial No. 684,723.

This invention relates to ignition apparatus, and has for its object to provide certain improvements which increase the efficiency and durability as well as to obtain simplicity in mechanical and electrical features, particularly for certain systems for which apparatus satisfactory in all respects have not heretofore been provided.

Further the invention aims to provide a means for facilitating the timing of ignition, and also means whereby lubricant may be supplied to the rotor driving shaft, not only to permit ease of operation thereof, but to minimize wear which heretofore has adversely affected the timing.

Our invention has particular utility for battery ignition, and in certain aspects the invention has particular reference to an ignition apparatus for Ford ignition systems wherein there are separate coils for the different cylinders, and a rotor or timer for distributing or handling low tension currents, though numerous features of the invention are not confined to such systems.

In the latter aspects, the invention may be regarded as an improvement over the subject matter of an application filed in the name of Albert G. Karkau, Serial No. 608,883.

The invention may be here briefly summarized as consisting in certain novel details of construction, and combinations and arrangements of parts will be described in the specification and pointed out in the appended claims.

In the accompanying sheets of drawings, Fig. 1 is an elevation of apparatus formed in accordance with my invention; Fig. 2 is a sectional view of the same; Fig. 3 is a view looking at the top of Figs. 1 and 2 with the cap of the rotor or timer case removed; Fig. 4 is a bottom view of the rotor head; Fig. 5 is an elevation of the rotor head removed from the case, showing particularly the condenser which rotates with the brush and circuit breaker; Fig. 6 is a view of a metal stamping carried by the rotor for forming the condenser connections as well as the grounding connection; Fig. 7 is a sectional view looking upward substantially along the line 7—7 of Fig. 2; Fig. 8 is a view looking at the inside of the rotor cap showing particularly the resistance member supported therein; and Fig. 9 is a diagram of the electrical connections which may be utilized when the invention is applied to a Ford ignition system.

In this instance the apparatus includes a shaft 10 adapted to be supported in upright position by the upper and lower bearings 11 and 12, the latter being in a bracket or casting 13 designed to be secured to the engine, said shaft adapted to be driven by a shaft 14 which when the device is applied to a Ford car is the cam shaft. In this instance the shaft 14 rotates the shaft 10 through spiral gears 15 and 16 enclosed in a cup-shaped housing 13^a forming a part of the bracket and adapted to be clamped in tight engagement with the engine frame.

At the top of the bracket 13 is a rotor case or housing composed of a cup-shaped lower portion 17 to the top of which is secured an insulating ring 18 to which is secured a removable cap 19, somewhat elongated or higher than is usually found in devices of this kind.

The base or cup 17 has secured to the bottom thereof, a plate or disk 20 with a downward tubular extension 21 forming the bearing 11 for the shaft 10, this tubular extension being rotatively fitted in the upper part of the bracket 13. The plate 20 also has an upward tubular extension 22 located in the lower part of the rotor case or housing, this being for a purpose to be referred to presently.

The insulating ring 18 carries at its inner periphery a series of stationary contacts 23 to which are attached terminal or binding posts 24, in this instance four in number, to which electrical conductors of the system are adapted to be attached.

In applying this apparatus to a Ford ignition system, the terminals 24 will be connected to conductors 25 connected to the primaries 26 of the ordinary Ford coils, common terminals of which primaries will be connected to a source of current, here indicated as the battery 27 (see Fig. 9). The secondaries 28 of the coils will be connected to the spark plugs 29 and to ground in the usual manner.

Attached to the top of shaft 10, and located in the case, is a rotor or rotating unit involving important features of our invention in respect to the parts that it carries and the manner in which they are arranged and

connected. This rotor includes a head 30, formed of insulating material, which in accordance with the present invention carries not only a brush adapted to successively engage the contacts or segments 23, but a circuit breaker and a condenser designed to bridge the breaker points. The rotating unit which is shown in Fig. 5, has a slip connection with the top of the shaft, the same permitting its easy attachment and removal from the shaft, and being formed by a sleeve-like extension 31, non-rotatively fitted on the end of the shaft. The brush which is carried by the head is shown at 32, this brush preferably having a sliding fit in a socket 33 of the head (see Fig. 2) and pressed yieldingly outward by a spring indicated at 34 in the same figure.

The circuit breaker is located on and attached to the lower side of the head, and it includes a stationary contact member 35 which is connected to the brush 32 by a flexible conductor or pig-tail, the end of which is indicated at 36, this member carrying a contact point 37. The movable contact member is shown at 38, this member being pivoted by a screw 39 to the head and carrying at its free end a contact point 40. The opening movement of member 38 is resisted by a spring 41, in this instance a flat strip of metal attached at 42 to the end of member 38, and its opposite end attached to a flat strip in the form of a conductor 43 extending up along the side of the insulating body or head for a purpose to be explained.

As both elements of the breaker are carried by the rotating head, it is essential that the cam which operates the breaker be stationary, and accordingly there is arranged on the tubular extension 22 of the plate 20, a stationary cam 44 which lies inside the movable contact members, as indicated in Fig. 2, this cam having lobes which at each revolution will shift the movable breaker member a number of times, depending upon the number of cylinders of the engine, in this instance, four times.

The details of the rotor, including the breaker members and the stationary cam are substantially the same as in the Karkau application previously referred to, and therefore need no further description here.

In the Karkau application it is contemplated to use the apparatus therein disclosed in connection with the ignition coils, utilizing the usual vibrators thereof to break the circuits of the primary, and the breaker was provided principally for the purpose of opening the primary circuit before the rotor brush left the segment connected to any particular primary so as to protect the segments from sparking and disintegration. In this instance the breaker performs the function just stated, but with our improved apparatus we contemplate eliminating the vibrators of the coils and relying on the breaker carried by the rotor head 30 to break or interrupt the primary circuits. This makes the use of a condenser advisable around the contact points, and this also is arranged in the rotor case. To avoid outside connections, and, in fact, to minimize and arrange in the simplest possible manner the electrical connections between the condenser and breaker, and at the same time to do away with the necessity of relatively rotating contacting members or collecting members to connect the condenser to the breaker, as would be required if the condenser were on the stationary part and the breaker on the rotary part, or vice versa, we arrange the condenser directly on the rotor and attach it to the top of the rotor as shown at 45. The details of the condenser are immaterial to my invention, the condenser here shown being cylindrical in form, and composed of metal plates or leaves such as commonly employed, and separated by a suitable dielectric material.

The condenser 45 is secured centrally to the top of the rotor, that is to say, its axis coincides with the axis of the rotor and shaft 10. To secure the condenser in place and at the same time to make the electrical connections, there is secured to the top of the rotor head 30, a disk 46 having an upstanding central stud 47, which extends up into a central opening of the condenser, as clearly illustrated in the drawings, the central opening extending from end to end therethrough. The two terminals of the condenser are located one at the bottom and the other at the top, the disk 46, which is a metal disk, constituting one of these terminals. Accordingly this disk is connected to one of the breaker members, and this connection is brought about by strap 43, previously referred to, which forms a part of the disk 46 and is attached to the end of breaker spring 41, as shown in Figs. 4 and 5. The connection is made between the upper terminal of the condenser and the other breaker member by a strap 48 which extends down along the side of the condenser, as shown in Fig. 5, and is connected to a screw 49 which extends through the insulating head 30 to the stationary breaker member 35, this being illustrated in Figs 2, 3, 4 and 5.

To protect the primary coils from burning out if the engine should come to a stop with the brush of the rotor engaging one of the stationary contacts or segments, in the event the driver fails to open the ignition switch, we prefer to provide in the system a resistance which will reduce the passage of current through the coils and prevent this occurrence, i. e. prevent damage to the coils.

In accordance with another feature of our invention, this resistance is arranged in the rotor case. By so locating the resistance, it is protected from dirt, oil and water, and

the liability of corrosion is avoided. It also enables us to provide a more or less of a self-contained unit which can be substituted for existing timers on certain cars, particularly Fords, with the least trouble and expense.

The resistance unit is in this instance supported on the under side of the cap 19, as clearly shown in Figs. 2 and 8, and directly above the condenser. The unit includes an arc-shaped piece of insulating material 50 carrying a resistance wire 51. Secured to the ends of, and bridging the space between the ends of the insulating piece 50, is a metal strip 52. Rivets or equivalent securing devices 53 fasten together the parts 50 and 52, and also secure the resistance unit to the inner side of the top or cap 19 of the case.

In accordance with our invention, the necessary electrical connections are made between one member of the circuit breaker and the resistance wire in an extremely simple manner. This is accomplished by connecting one end of the resistance wire 51 to the metal piece or strip 52 and by providing on this piece 52 a tongue 54 (the same consisting of a spring tongue) which extends inwardly to the center of the case and bears against the head of a centrally disposed screw 55, the lower end of which is screwed into a threaded socket in the post 47, extending up into the condenser, centrally thereof, as previously explained. The other end of the resistance wire is suitably attached to the case, and therefore to ground, thus completing the electrical circuit as illustrated in Fig. 9. To improve the ground connection with the bracket 13 so that it will not be affected by lubricant between the adjustable lower part of the case and the bearing of the bracket 13 receiving it, the upper part of the bracket has secured to it a leaf spring 56 which engages the lower part or cup 17 of the case as illustrated in Fig. 2.

Thus it will be seen that connection is made from the primary 26 to the segments 23, and from one of these segments to the brush 32, and from this brush to the stationary element of the breaker, to the movable element of the breaker, to the stud 47 inside the condenser, and by way of screw 55, tongue 54, and resistance wire 51 to ground. At the same time the condenser is connected across the contact points by reason of the fact that one terminal of the condenser is connected to the disk 46 and to the movable member of the breaker, while its other terminal is connected by a strap 48 to the stationary element of the breaker as already explained. The features of simplicity and durability of the electrical connections will be apparent from the drawings, as will also the feature of compactness. It might be mentioned at this point, that other important advantages are derived from this arrangement of the parts. A decided cooling effect is obtained by reason of the fact that the breaker is on the rotating unit and the heat from the resistance wire is rapidly dissipated by reason of its very close proximity to the top of the metal rotor case. Furthermore the proximity of the resistance wire to the condenser is advantageous since the condenser is warmed by the resistance wire and its capacity is therefore increased. In other words, as the load increases the capacity increases to take care of the increased sparking that would tend to result.

Another improvement which we have provided in this apparatus relates to the means for facilitating correct timing. In this connection it will be seen that the disk 20 at the bottom of the rotor case is provided with an outstanding arm 57 which is generally attached direct to the rod leading to the spark advance and retard lever on the steering post. In accordance with our invention, in the embodiment here illustrated, the spark advance rod is not designed to be directly attached to the arm 57, as heretofore, but attached to this arm by a screw 58 is a segment 59 on the under side of which is a block 60 to which the spark advance rod is designed to be attached. This segment 59 has an elongated slot 60^a (see Figs. 3 and 7) through which the screw 58 passes, this construction enabling any desired adjustment to be made between the arm 57 and segment 59. The inner edge of the segment has an arc-shaped curvature with a radius corresponding to the radius of the cup 17, and it bears against the periphery of the cup, thus permitting a firm connection to be made with the arm regardless of the position to which the segment 59 may be adjusted. With this construction, correct timing can be obtained, and the timing can be very accurately adjusted by reason of the fact that the adjustment can be made while the engine is running.

Another feature of our invention resides in the provision for proper and ample lubrication of the bearings of shaft 10, and also the timing gears in cup 13^a.

With elevated timers for Ford cars having timer brackets of the type herein illustrated, the central or middle part of the bracket between the upper and lower bearings of shaft 10 is generally cut away for the sake of clearance and in some instances the shaft has been left exposed.

In the Karkau application the shaft was protected against the entrance of dirt, oil and the like by the provision of a tube surrounding the shaft at the cut-away part of the bracket. Our present construction is an improvement over that illustrated in the Karkau application, as it allows grease to be supplied from a grease cup provided in the upper part of the bracket and to be forced

down along the shaft without extrusion of the grease at the ends of the protecting tube. In this instance an extensible or expansible tube 61 is provided around the shaft 10 at the cut-away part 13^b of the bracket 13. This is brought about by providing in the tube, and in this instance at the top, a threaded extension 62 in the form of a nut which can be turned by a wrench to cause the lower end of the tube and the top of the nut to very tightly engage the bracket. Additionally the lower end of the tube and the upper end of the nut are tapered and these engage tapered seats on the bracket as shown at 64 and 65. Obviously by turning the nut or tube extension 62 the lower tapered end of tube 61 can be forced tight against the lower tapered surface of lower bearing 12 and the tapered upper end of nut 62 is at the same time forced tight against the upper tapered seat of the bracket, so as to prevent loss of grease at these joints.

Grease is supplied to lubricate the bearings for shaft 10 from a grease cup 66 which is screwed into the upper part of the bracket surrounding bearing 11. Opposite this grease cup the bearing 11 has an external annular groove 11^a. A set screw 11^b extends through the bracket, and its inner edge engages in this external groove 11^a to hold the timer case and its lower extension constituting the bearing 11 from endwise movement on the shaft.

An opening extends from the base of groove 11^a to the inner surface of bearing 11 so that grease may be supplied to lubricate the upper bearing shaft.

Additionally the lower end of bearing 11 is provided with internal and external vertical grooves 11^c which extend downward from the annular groove 11^a to the lower end of bearing 11 so that grease may pass freely downward into the space between tube 61 and the shaft so as to lubricate the lower bearing 12. Additionally there is provided for the full length of bearing 12, a vertical groove 12^a, through which an ample quantity of grease may be forced down from the space between the shaft and tube not only to secure good lubrication of bearing 12, but to feed the grease into the gear housing or cup 13^a so as to provide ample grease for lubricating the gears therein.

The several novel features above described are of a very practical nature as they improve the device both from electrical and mechanical standpoints as they provide greater efficiency, greater durability, and decrease the likelihood of derangement and trouble.

We do not desire to be confined to the exact details shown, but aim in our claims to cover all modifications which do not involve a departure from the spirit and scope of our invention.

Having described our invention, we claim:

1. In an ignition apparatus for a system having primary and secondary circuits, a rotor carrying a brush and a case enclosing the rotor and having spaced contacts adapted to be engaged by the brush, said brush and contacts being adapted to be included in the primary circuit, said case additionally enclosing a circuit breaker for interrupting the circuits established by the engagement of the brush with the contacts, and a condenser for bridging the contact points of the circuit breaker, said condenser being carried by the rotor.

2. In an ignition apparatus for a system having primary and secondary circuits, a rotor carrying a brush, a case having spaced contacts adapted to be engaged by the brush and said case enclosing also a circuit breaker for interrupting the circuits established by the engagement of the brush with the contacts, said brush and contacts being adapted to be included in the primary circuit and additionally a condenser for bridging the contacts of the circuit breaker, the circuit breaker being composed of relatively movable members carried by the rotor.

3. In an ignition apparatus for a system having primary and secondary circuits, a rotor, a case enclosing the same and provided with a set of contacts to which conductors are adapted to be connected, the rotor comprising a body having a brush for engaging said contacts and carrying a circuit breaker and also a condenser for bridging the contacts or points of the circuit breaker, said brush and contacts being adapted to be included in the primary circuit.

4. In an ignition apparatus for a system having primary and secondary circuits, a rotor, a case enclosing the rotor and having contacts or segments to which conductors are adapted to be connected, said rotor comprising a member carrying a brush adapted to engage said contacts and provided on the one side with circuit breaker members and on the other side with a condenser adapted to bridge the same, said brush and contacts being adapted to be included in the primary circuit.

5. In an ignition apparatus for a system having primary and secondary circuits, a rotor, a case enclosing the same and carrying contacts or segments to which conductors are adapted to be connected, said rotor comprising a body having a brush adapted to engage said contacts and provided on the lower side with the relatively movable elements of a circuit breaker and on its upper side with a condenser having its terminals connected to said elements of the circuit breaker, said brush and contacts being adapted to be included in the primary circuit.

6. In an ignition apparatus for a system having primary and secondary circuits, a

rotor carrying a brush and a case having spaced contacts adapted to be successively engaged by the brush and a resistance located in and supported by the case and adapted to be connected in the circuits established by the engagement of the brush with the contacts, said brush and contacts being adapted to be included in the primary circuit.

7. In an ignition apparatus for a system having primary and secondary circuits, a rotor carrying a brush and a case having spaced contacts adapted to be successively engaged by the brush, said brush and contacts being adapted to be included in the primary circuit, and a resistance located in the case and adapted to be connected in the circuits established by the engagement of the brush with the contacts, said resistance having one end grounded on the case and its other end electrically connected with the brush.

8. In an ignition apparatus for a system having primary and secondary circuits, a rotor head, a case enclosing the same and provided with spaced contacts adapted to be successively engaged by the brush, said brush and contacts being adapted to be included in the primary circuit, said case enclosing also a circuit breaker having an element connected to the brush, a condenser having its terminals connected to the elements of the circuit breaker and a resistance conductor also connected to the brush.

9. In an ignition apparatus for a system having primary and secondary circuits, a rotor head carrying a brush, a circuit breaker and a condenser, and a case carrying contacts adapted to be engaged by the brush and enclosing said parts and also a resistance conductor connected to the circuit breaker, said brush and contacts being adapted to be included in the primary circuit.

10. In an ignition apparatus, a rotor head carrying a brush, relatively movable circuit breaker members on the under side of the head and a condenser on the upper side of the head, the brush being connected to one element of the circuit breaker and the condenser having terminals connected to both elements of the circuit breaker, and a resistance conductor supported within the case on the upper part thereof above the condenser, said conductor being connected to one element of the breaker and to ground.

11. In an ignition apparatus, a rotor head carrying a brush, relatively movable circuit breaker members on the under side of the head and a condenser on the upper side of the head, the brush being connected to one element of the circuit breaker and the condenser having terminals connected to both elements of the circuit breaker, and a resistance conductor supported in the case adjacent the condenser and having a connection with one element of the circuit breaker through the middle of the condenser.

12. In an ignition apparatus, a timer comprising a rotating head carrying a brush, a circuit breaker and a condenser, the brush being connected to one element of the circuit breaker and the condenser having terminals connected to both elements of the circuit breaker, a grounding element extending through the condenser and connected to one element of the circuit breaker, a case enclosing said parts and including a body portion having contacts adapted to be engaged by the brush, and a removable cap having on the under side thereof a resistance unit comprising a conductor having one end grounded on the cap and its other end in the form of a spring tongue engaging the end of said grounding conductor extending through the condenser.

13. An ignition apparatus comprising a rotating member having a brush, contacts adapted to be successively engaged by the brush, a circuit breaker, and a resistance conductor connected to the brush so as to be in the circuits established by the engagement of the brush with the contacts, the condenser and resistance conductor being so located that the former is warmed or heated by the latter so as to increase its capacity as the current transmitted increases.

14. An ignition apparatus comprising a rotating brush, a plurality of contacts adapted to be successively engaged by the brush, a circuit breaker for opening and closing the circuits established by the brush, a condenser connected across the contacts of the circuit breaker, and a resistance connected so as to be in the circuits established by the engagement of the brush with the contacts, the condenser and resistance being located in the same enclosure so that the latter may warm or heat the former and thereby vary its capacity.

15. In an ignition apparatus, a rotor carrying a brush, a case enclosing the rotor and having segments adapted to be successively engaged by the brush, the case having a projecting part to which a spark advance rod is adapted to be connected, and means whereby the connection between said rod and the projecting part may be adjusted.

16. In an ignition apparatus, a rotor carrying a brush, a case enclosing the same and carrying contacts or segments adapted to be successively engaged by the brush, a spark advance and retard arm carried by the case, and a member adjustably attached to said arm and adapted to be connected to a spark advance and retard rod.

17. In an ignition apparatus, a rotor having a brush, a case enclosing the same and provided with contacts or segments adapted to be successively engaged by the brush, a

spark advance and retard arm extending from the case, and a circumferentially adjustable member attached to said arm and adapted to be connected to a spark advance and retard rod.

18. In an ignition apparatus, a rotor, a shaft for rotating the same, a bracket through which the shaft extends, the bracket having upper and lower bearing portions and an intermediate cut-out portion, and an extensible tube surrounding the shaft between said upper and lower bearing portions.

19. In an ignition apparatus, a rotor, a shaft for rotating the same, a bracket through which the shaft extends, the bracket having upper and lower bearing portions and an intermediate cut-out portion, an extensible tube surrounding the shaft between said upper and lower bearing portions, and means whereby the extrusion of grease at the ends of the tube is prevented by the engagement of the ends of the tube with the upper and lower bearing portions of the bracket.

20. In an elevated timer for internal combustion engines, a bracket adapted to be secured to the engine and having upper and lower separated bearing portions, a timer shaft extending through said bracket, the bracket having a lower portion for enclosing the gearing for driving the shaft, means for supplying grease to lubricate the shaft bearings and the gears comprising a grease supplying member carried by the upper part of the bracket and grease conveying ducts or passageways leading therefrom to said lower part of the bracket.

In testimony whereof, we hereunto affix our signatures.

JOSEPH A. WILLIAMS.
ALBERT G. KARKAU.