

March 4, 1952

W. B. SMITS
ELECTRICAL IGNITION SYSTEM

2,587,780

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2 SHEETS—SHEET 1

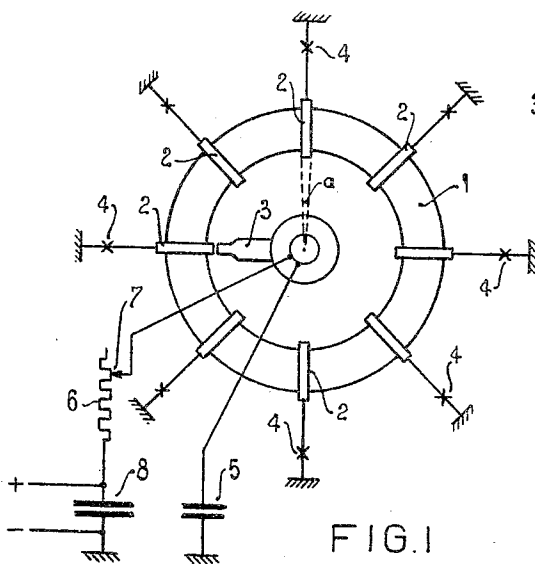


FIG. 1

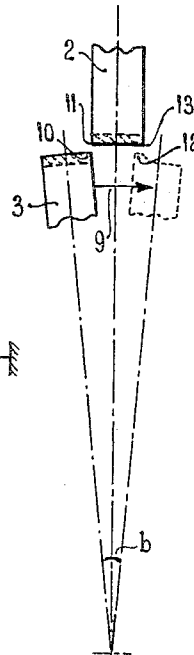


FIG. 3

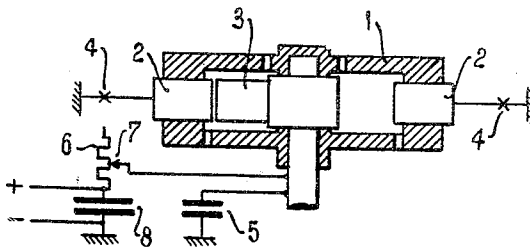


FIG. 2

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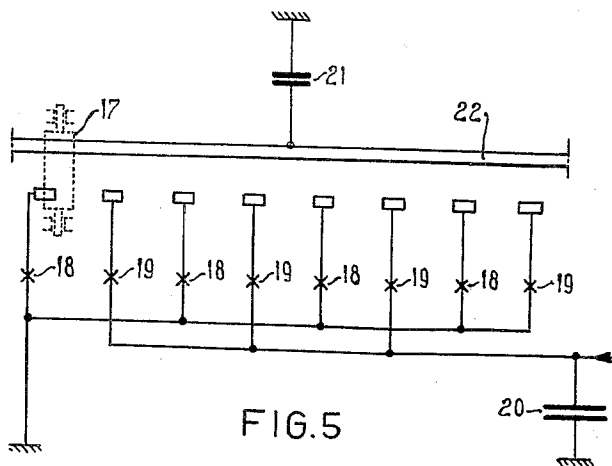
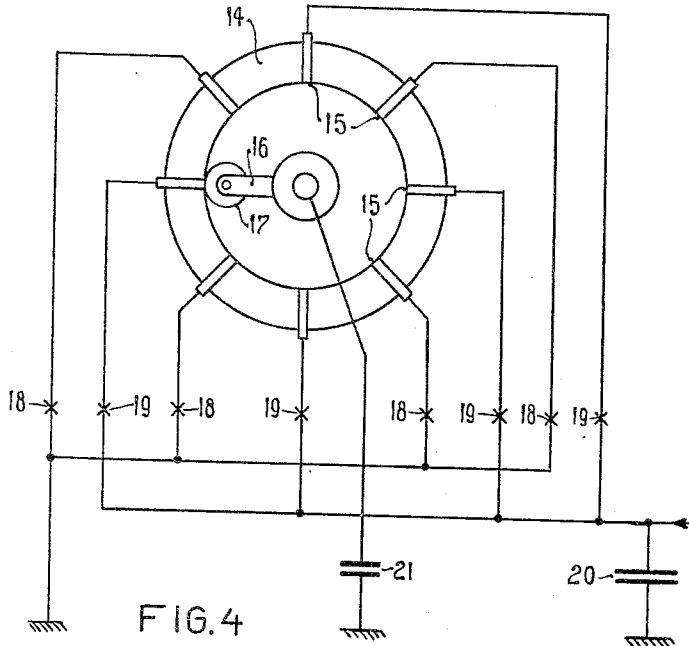
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2 SHEETS—SHEET 2



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ELECTRICAL IGNITION SYSTEM

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4 Claims. (Cl. 313—149)

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The invention relates to an electrical ignition system comprising a device for the generation of current impulses, two or more spark gaps for the igniting sparks, particularly spark plugs, and a distributor connecting said spark gaps by turns to the device generating the current impulses. Such an igniting system is particularly adapted for use in combination with internal combustion motors or the like. For the exact determination of the moment, in which the igniting spark occurs across the spark gap the known ignition systems of this kind and designed for relatively high voltages were provided with an interruptor, e. g. an interruptor constituted by contact-hammers, which are removed from fixed contacts by sudden blows imparted to them by one or more cams provided on a rotary shaft at the moment, in which the distributor connects a spark plug to the device for the generation of the impulses. The interruptor used for the timing is a source of defects and requires a careful upkeep.

The invention has for its object to provide an ignition system, in which the ordinary interruptor may be omitted. It provides such a construction of the igniting system, that the moment, in which an igniting spark is produced, is exclusively determined by the distributor. The invention is especially of importance for ignition systems, in which the device generating the current impulses comprises a condenser and an apparatus for periodically loading said condenser and in which the spark gaps for the igniting sparks are creeping spark-plugs, that means for ignition systems which in comparison with the ordinary ignition systems work at low voltages. In that case the distributor connects the spark-plugs by turns directly to said condenser in order to produce the igniting sparks. This connection may be effected by metallic contact or by the insertion of an air-gap in the distributor. Both the discharging-current and the loading-current of the condenser may be used for the production of the igniting spark.

It has been found, that at the lowest voltages, at which an ignition system of this kind is still able to work, e. g. at voltages below about 1000 volts, the rotor arm of the distributor used for the timing has to touch metallically the fixed contacts mounted in a circle around said rotor arm in order to obtain a reliable operation, that means to obtain an exact determination of the moment, in which the igniting spark is produced. In that case the rotor arm may be provided at its end with a brush, a sliding-contact face, but is preferably provided with a roller which is rolled

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across the fixed contacts. In order to reduce the contact resistances between rotating parts of the distributor as much as possible it is advantageous to construct the distributor in such a manner, that the roller of the rotor arm constitutes a bridge between two circular series of fixed contacts.

At higher operating voltages the distributor may be so constructed, that the rotor arm passes the fixed contacts at some distance. Evidently the avoidance of metallic contact between the rotor arm and the fixed contacts is of great importance for the simplicity of the construction and the life-time of the distributor.

In a distributor used for timing, in which the rotor arm does not touch the fixed contacts, the moment, in which the igniting spark is produced, will be determined by the moment of rupture of or passing of the current through the air-gap between the rotor arm and a fixed contact of the distributor. This rupture does not merely depend on the distance, at which the rotor arm and the fixed contact in question have approached each other, but also on the moisture, the purity and the ionisation condition of the air within the distributor. Moreover, the dielectric distance between the rotor arm and a fixed contact does not exclusively depend on the angle between the rotor arm and said fixed contact but also of the wear of the active faces of the contact arm and the fixed contacts.

When the usual high voltages are used, which ordinarily are coupled with relatively small current intensities, the variation due to the very inconstant condition of the air in the distributor predominates and a separate interruptor for the exact determination of the moment of the ignition cannot be missed. When, however, lower voltages are used, which are coupled with relatively great current intensities, the quality of the air has a negligible influence on the moment of rupture in the distributor, but the wear of the active surfaces delaying the moment of the ignition is much greater. In this case the boundary line between high and low voltages lies at about 5000 volts.

A distributor which not only operates as a distributor, but also determines the moment of the ignition and in which the rotor arm does not touch the fixed contacts and the influence of the wear of the active surfaces on the determination of the moment, in which the ignition spark is produced, may be neglected, may be so constructed, in accordance with a further development of the invention, that the active surfaces

of the contact arm and the fixed contacts facing each other extend, with respect to the axis of revolution of the contact arm through an arc of less than 10° .

The active surfaces of the fixed contacts will be burnt away gradually in the direction of revolution of the contact arm by the sparks, whereas the active surface of the rotor arm will be burnt away gradually in the opposite direction. This means, that the rupture in the distributor, consequently, the ignition will be gradually delayed. However, if the active contact surfaces extend through a smaller arc than 10° , the variation of the moment of the ignition appears not to have any noticeable influence on the regular operation of the motor. In order to obtain a certain contact area and a practical lifetime of the distributor when using such narrow contact surfaces, it is advantageous that the contact surfaces of the rotor arm and the fixed contacts facing each other have an axial length, which is greater than the length of the arc through which said active surfaces extend in cross direction.

If the fixed contacts of the distributor having a rotor arm passing by at some distance from the fixed contacts be made radially adjustable, said contacts may be readjusted with regard to the rotor arm after the distributor having operated a certain time. After equal wear of all fixed contacts the free distance between the rotor arm and said fixed contacts may be readjusted by making the contact arm longer.

For the elucidation of the invention reference is made to the accompanying drawing, which, by way of example, illustrates some ignition systems according to the invention very diagrammatically.

Fig. 1 shows a plan view of a distributor which is inserted in an ignition system having a condenser discharging directly through the spark plugs.

Fig. 2 is the ignition system according to Fig. 1 showing an axial sectional view of the distributor.

Fig. 3 is a part of the distributor according to Figs. 1 and 2 on an enlarged scale.

Fig. 4 is a plan view of another distributor, which is inserted in an ignition system having a condenser which is directly discharged and charged through the spark plugs.

Fig. 5 shows a developed view of the distributor used in the ignition system according to Fig. 4.

In the drawing 1 designates the casing of a distributor having fixed contacts 2 and a rotatable contact arm 3. Each fixed contact 2 is connected to a spark plug 4. Each spark plug is in its turn connected to "earth." The rotatable contact arm 3 is connected to one plate of an ignition condenser 5, the other plate of which is connected to "earth," as well as to the sliding contact 7 of an adjustable resistance 6. This resistance is connected to one plate of a supply condenser 8, the other plate of which is connected to "earth." The supply condenser 8 is loaded by a direct current source (not shown). The ignition condenser 5 is loaded continually by the supply condenser 8 through resistance 6 and is periodically discharged directly through a spark plug, when the rotor arm 3 has sufficiently approached a fixed contact 2 of the distributor. The rotor arm 3 remains spaced apart from the fixed contacts 2 when passing by. The arc, through which the active surfaces of the rotor arm and the fixed contacts facing each other extend, is less than 10° . In Fig. 1 said arc (angle α) has been made about 6° . The dimensions of the distributor may be such, that the fixed contacts have a thickness

in tangential direction of less than 2 mm. (0.08 inch). In order to give the active surfaces a sufficiently large area the axial dimension of the contact members of the distributor has to be relatively great (see Fig. 2).

Fig. 3 shows, what happens, as the active surfaces of the contact members of the distributor are burnt away gradually by the sparks jumping over from the rotor arm 3 to a fixed contact 2. When the rotor arm rotates in the direction of the arrow 9 the spark in the distributor will first jump over from the right hand edge 10 of the contact arm 3 to the left hand edge 11 of the fixed contact 2 in question. The moment, in which the igniting spark is produced, which spark comes in existence simultaneously with the spark in the distributor, is then determined by the left hand position of the rotor arm. The edges 10 and 11, however, will be gradually burnt away through their entire length by the sparks and consequently, the active surfaces of the contact members will be gradually corroded, till only a narrow ridge at the right hand edge 13 of the fixed contact and a narrow ridge at the left hand edge 12 of the rotor arm remain. In that case the igniting sparks will be produced, when the rotor arm is in the right hand position, shown in dotted lines. Thus, the ignition is gradually delayed by the wear of the active surfaces. This variation of the moment of the ignition is determined by the angle β , which is about twice the angle α (Fig. 1). It will be apparent, that the smaller the angle α is made, the smaller the mentioned variation itself and the less the effect of said variation on the operation of the internal combustion motor provided with the ignition apparatus in question will be.

When the active surfaces are entirely worn away the most favourable distance between the rotor arm and the fixed contact may be readjusted by moving the fixed contacts radially inwards. It is also possible to leave the fixed contacts in their places and to make the rotor arm longer. How this could be done will be clear to the expert and requires no further elucidation.

Since the rotor arm has a relatively great axial dimension it can easily be constructed as the blade of a blower and operate as a blower in order to produce an air current for cooling the contacts and for washing away the ionized air from the casing of the distributor.

In the ignition system according to Figs. 4 and 5 the distributor is provided with a casing 14 having fixed contacts 15. A rotatable contact arm 16 provided on its free end with a rotatable contact roller 17 cooperates with said fixed contacts. This roller rolls across the fixed contacts 15. The fixed contacts 15 are connected to "earth" through spark-plugs 18 and to a supply condenser 20 through spark-plugs 19. The contact arm 16, 17 is connected to an ignition condenser 21. Fig. 5 shows that the contact roller 17 constitutes a bridge between two circular series of fixed contacts, one of said circular series being carried out as a continuous ring 22. The ignition condenser 21 is connected to said ring.

Evidently, the described ignition systems may be so constructed, that the igniting spark is produced either by the discharging-current (Figs. 1 and 2) or by the loading-current, or alternately by the discharging-current and the loading-current (Figs. 4, 5). Also other current sources than the supply condenser referred to hereinbefore may be used for loading the ignition condenser.

What I claim is:

1. A distributor for low tension electrical ignition systems in which condenser operated surface discharge spark plugs are directly connected to the condenser in succession by the distributor, said distributor consisting of a number of fixed contacts and a rotor arm cooperating therewith, characterized in that the active surface of each fixed contact of the distributor and the active surface of the rotor arm thereof circumferentially extend through arcs, the sum of which is less than 10° so as to give less than 3% variation of the spark frequency of each spark plug.

2. A distributor as claimed in claim 1, in which the axial length of the active surface of each of the fixed contacts and that of the active surface of the rotor arm are substantially greater than the circumferential dimensions of said active surfaces.

3. A distributor as claimed in claim 1, in which the rotor arm is radially adjustable.

4. A distributor for low tension electrical ignition systems in which condenser operated surface discharge spark plugs are directly connected to the condenser in succession by the distributor; said distributor comprising a circularly arranged series of fixed contacts each formed with an active surface at the side thereof facing radially

inward, and a rotor arm mounted at one end for rotation within said circularly arranged series of fixed contacts to cooperate with the latter and having a radially outward facing active surface at the free end thereof, said active surfaces of each of said fixed contacts and of said rotor arm being formed with substantially the same circumferential dimensions extending through arcs the sum of which is less than 10° so that the possible variation in the timing of the connection of each spark plug to the condenser is limited to less than 3% of the time required for a complete revolution of said rotor arm.

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