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W. B. CHURCHER

ELECTRICAL IGNITION SYSTEM

Filed June 26, 1926

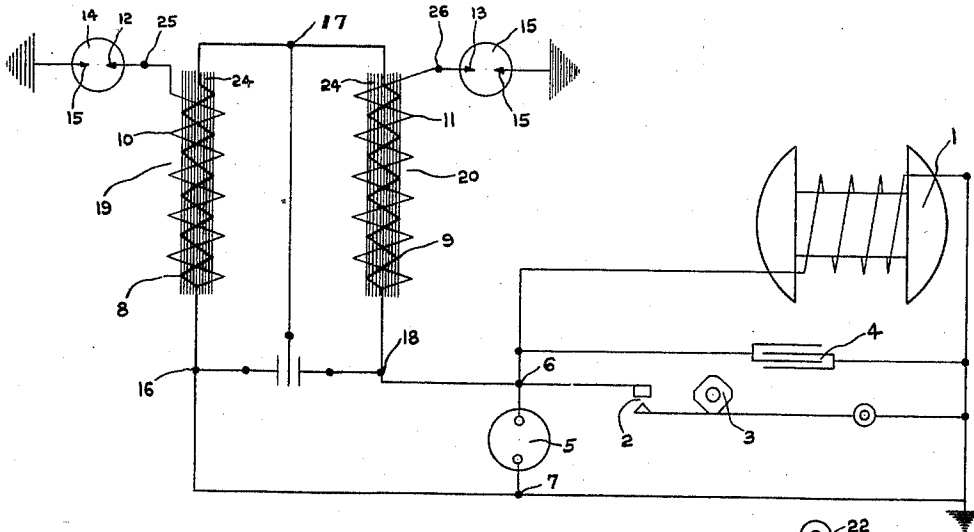


Fig. 1

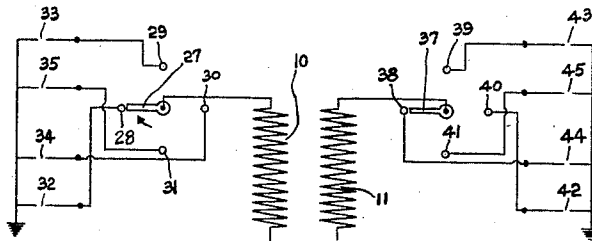


Fig. 2

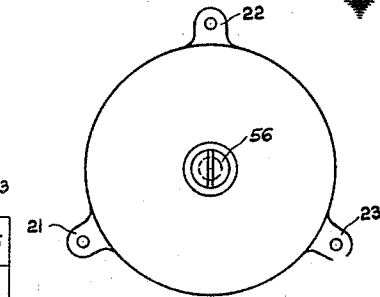


Fig. 3

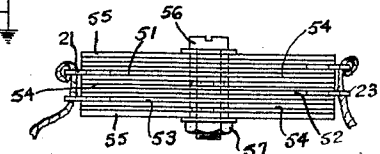


Fig. 4

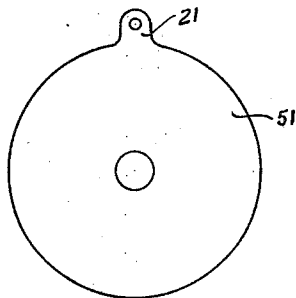


Fig. 5

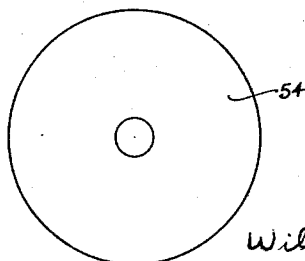


Fig. 6

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UNITED STATES PATENT OFFICE.

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ELECTRICAL IGNITION SYSTEM.

Application filed June 26, 1926. Serial No. 118,635.

My invention relates to ignition systems and relates particularly to ignition systems for internal combustion engines, such as automotive engines. It has been found very desirable in internal combustion engines, in order to accomplish efficient ignition of the hydro-carbon charge in internal combustion engine cylinders, to place in each of such cylinders a plurality of spark plugs, the firing points of which are spaced from each other. Many attempts have been made to evolve a satisfactory ignition system to ignite the charge in such a cylinder at a plurality of firing points disposed therein, but so far as I am aware, such attempts have not resulted in as high a degree of efficiency in ignition as might be expected.

I find that the failures to secure theoretically possible maximum efficiency of ignition under such conditions may be accounted for by deficiencies in the system of supply of ignition current to the points of the plurality of spark plugs employed with each such cylinder.

In my present invention, therefore, I seek to evolve a system of current supply for a plurality of preferably spaced firing points disposed within the same engine cylinder, wherein the disabilities encountered in the making of prior attempts to solve the problem are entirely removed, such disabilities comprising variants in timing of the ignition at the different spark gap firing points, an undesirable decrease in intensity or heating effect, accomplished at the firing points and the like.

Another object of my invention is to provide a firing system for an automotive engine cylinder, comprising means operable to accomplish an efficient ignition effect at a plurality of spark plug gaps, simultaneously.

Another object of my invention is to provide a system of the above type, which although efficient in operation will yet be relatively inexpensive to construct and install.

Other objects of my invention and the invention itself will become apparent by reference to the following description of an embodiment of my invention, and which embodiment is illustrated in the accompanying drawings forming a part of this specification.

Referring to the drawings:

Fig. 1 shows, diagrammatically, a system embodying the principles of my invention;

Fig. 2 shows a plan view of a condenser

which may be employed in the said embodiment;

Fig. 3 shows, in abnormally spaced relation, elements of the said condenser;

Figs. 4 and 5 show plan views of a copper disk and mica disk, respectively, employed in the condenser of the foregoing embodiment; and

Fig. 6 shows another embodiment, diagrammatically, of a system embodying the principles of my invention.

Referring now to the different figures of drawing and particularly to Fig. 1, at 1, I illustrate, diagrammatically, a source of electrical current herein diagrammatically illustrated as being a magneto generator, and at 2, I show a pair of "timer contact points", which are continuously operated during the operation of the engine by a breaker cam element 3 driven from a moving engine part, a condenser 4 being shunted around the breaker points 2 in the usual manner.

A switch 5, capable of short circuiting the terminal conductors 6 and 7 of the magneto, is provided for the purpose of disabling the ignition system whenever it is desired to discontinue the operation of the engine, in the usual way. At 8 and 9, I show a pair of spark coil primary windings serially connected together across the terminal conductors 6 and 7 of the magneto generator. Separate secondary windings 10 and 11 are provided for the primary windings 8 and 9, respectively, and each have a terminal grounded to one of the circuit conductors 6 or 7 and the other terminal leading to a firing point, such as 12 for the secondary winding 10, and 13 for the secondary winding 11, of different spark plugs 14 and 15, which are disposed in spaced relation in the same engine cylinder, not shown in the drawing. Each of the spark plugs has a firing point 15 which is connected to the ground, so-called; that is, the frame of the engine.

Between the points 16, 17 and 18, representing the terminals of the primary windings 8 and 9 of the two separate spark coils 19 and 20, I interpose terminals 21, 22 and 23, Fig. 2, of preferably a three electrode condenser, whereby the effect of a condenser shunted across each individual spark coil primary winding will be had. A separate iron wire or laminated iron core 24 will be provided for each of the spark coils 19 and 20. The circuit connections and disposition

of the spark coils 19 and 20 will be such that substantially no inductive effect will be had between the spark coils, so that each will operate independently of the other and without communicating inductively, or otherwise, an ignition producing electrical impulse to the other to add or subtract from the strength of such an impulse otherwise accomplished in the other. For this reason, the spark coils will be properly spaced one from the other; they may be placed at right angles each to the other; and they may be magnetically shielded each from the other to insure that neither will accomplish an electrical effect on the other.

It will be seen that by this construction a common breaker having a single set of points 2 will be regularly short circuiting the magneto winding, across the terminals of which the primary windings of the spark coils 19 and 20 are connected, that each will receive substantially the same exciting current impulse, the primaries being serially connected, but that because of the employment of separate cores for the spark coils, the spacing of the same and the separate secondary windings therefor, no inductive effect will be had between them. The use of the condenser, illustrated more specifically in Figs. 2 and 3, contributes to this effect. Both spark coils will receive full existing current and will effect simultaneous firing at their respective spark plugs.

It will be understood also that although such has not been illustrated, the usual distributor mechanism may be interposed in the circuit conductor leading to each of the spark plugs 14 and 15, respectively, at the points 25 and 26, in order to predetermine in the usual way the particular cylinder to be fired at a given time. It will be understood that such distributors at 25 and 26 interconnect their respective secondary spark coil windings to a spark plug of a particular cylinder of the engine, and then in sequence interconnect such a secondary winding to the spark plugs of other engine cylinders.

In Fig. 6, I show an arrangement of this kind, wherein from the secondary winding 10, the ignition circuit passes to a revolvable arm 27 of a distributor mechanism extending circuit of the secondary winding to terminals 28, 29, 30 and 31, which in turn are electrically connected to spark plugs 32, 33, 34 and 35 in sequence, the direction of rotation of the arm 27 being indicated by the arrow. At the same time, a second distributor having an arm 37 electrically connected to the secondary winding 11 extends the circuit therefrom through terminals 38, 39, 40 and 41, sequentially, which in turn are connected, respectively, to spark plugs 42, 43, 44 and 45, respectively.

The arms 37 and 27 are preferably mounted on the same shaft and rotate together, and the spark plugs 33 and 43 are disposed in the

same cylinder as are also the spark plugs of each pair, 35—45, 34—44 and 32—42. The cylinders in each case may be according to the firing order of the engine cylinders Nos. 1, 2, 3 and 4, respectively, the order of firing in such a case being 4—1—3—2, although any other desirable firing order may be likewise had.

I find that such an arrangement as above described operates efficiently, the firing being had at both of the spark plugs of a pair projected within the same cylinder, simultaneously, and a spark of full strength is obtained under such conditions from each spark plug.

The condenser which I prefer to use in connection with my invention is one comprising a plurality of interleaved disks, each disk having a lateral terminal projection, the disks of which may be three in number or any desired larger number, but preferably in multiple of three, and there being in such a condenser, three condenser electrodes having their terminals disposed radially at spaces of 120 degrees, as illustrated, Fig. 2. Each of said terminals may comprise the laterally projecting extensions of a plurality of disks spaced from each other, however, by interposed disks of the other two electrodes, and by di-electric material, such as in the form of mica disks, interposed between each pair of successive electrode disks.

Fig. 3 shows such a condenser of three disks only, wherein at 51, 52 and 53 are shown three spaced electrode disks, each spaced from the other by disks of mica or other di-electric material shown at 54, there being preferably, at the top and bottom of the superposed disks, disks 55 of insulating material to insulate the outer disks from extraneous objects. A machine screw 56 and a nut 57 adapted to be placed on the end of the machine screw passes through axial openings of the electrode and insulating disks to secure them together, and may be employed likewise to secure the condenser to a support.

Having thus described my invention in a specific embodiment, I am aware that numerous and extensive departures may be made from the embodiment herein illustrated and described but without departing from the spirit of my invention.

I claim:

1. In an electrical ignition system, the combination with a magneto generator, a pair of discharge circuit conductors therefor, timer breaker contact points bridged across said pair of conductors, a pair of spark coils non-inductively related each to the other and having their primary windings serially connected across said timer terminals, and a separate high tension winding for each spark coil, each adapted to supply high tension electrical ignition impulses to a separate ignition circuit simultaneously with, but independently of the other high tension coil.

2. In an electrical ignition system, the combination with a magneto generator, a pair of discharge circuit conductors therefor, timer breaker contact points bridged across said pair of conductors, a pair of spark coils non-inductively related each to the other and having their primary windings serially connected across said timer terminals, and a separate high tension winding for each spark coil, each adapted to supply high tension electrical ignition impulses to a separate ignition circuit simultaneously with, but independently of the other high tension coil, and a tri-electrode condenser having a pair of outer electrodes and an intermediate electrode, said intermediate electrode adapted to substantially completely electrically shield each of the outer electrodes from the other, and circuit conductors leading from said electrodes to different terminals of said primary windings, the intermediate electrode being connected to the junction of said primary windings.

3. In an electrical ignition system, the combination with a magneto generator, a pair of discharge circuit conductors therefor, timer breaker contact points bridged across said pair of conductors, a pair of spark coils

non-inductively related each to the other and having their primary windings serially connected across said timer terminals, a separate high tension winding for each spark coil, each adapted to supply high tension electrical ignition impulses to a separate ignition circuit simultaneously with, but independently of the other high tension coil, and a tri-electrode condenser having a pair of outer electrodes and an intermediate electrode, said intermediate electrode adapted to substantially completely electrically shield each of the outer electrodes from the other, and circuit conductors leading from said electrodes to different terminals of said primary windings, the intermediate electrode being connected to the junction of said primary windings.

In testimony whereof I hereunto affix my signature this 9th day of June, 1926.

WILLIAM B. CHURCHER.