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IMPULSE IGNITION DEVICE

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FIG. 1.

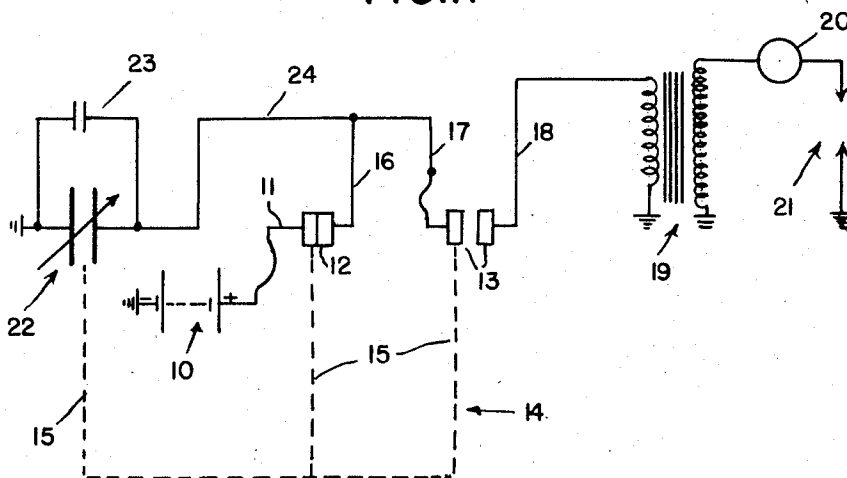
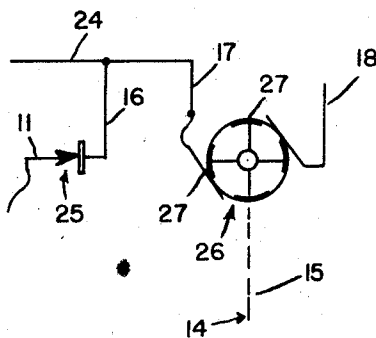


FIG. 2.



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IMPULSE IGNITION DEVICE

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13 Claims. (Cl. 307—10)

The present invention relates to improvements in the electrical ignition system of internal combustion engines of the reciprocating type.

Present ignition systems of this type employ an engine driven breaker unit controlling the rapid periodic electrical engagement of breaker contacts or points, and an increasingly serious problem, as the progress of engine design imposes factors of increased operating speeds and pressures, is the rapid deterioration of such points, due to electrical arcing under the rapidly occurring current interruptions in the highly inductive primary circuit of the system, supplied by the engine driven generator. As engine speeds and compression pressures increase added load is imposed on the primary circuit in its exacting functioning to provide more sparks at higher voltage in a given time.

Consequently, the life of the breaker points is decreased, and still the delivery of sufficiently high voltage to the distributor and spark plugs at high speeds is not satisfactorily attained. This is principally due to the highly inductive nature of the primary circuit.

It is therefore a general object of the invention to supply an improved electrical ignition system which makes possible the use of a less inductive transformer coil by supplying the coil with a higher initial voltage, thereby attaining a higher rate of spark production for a given applied voltage.

Another object is to provide a system of this sort embodying an improved capacitive circuit for the intended purpose.

Yet another object is to provide a system as described, in which said capacitive circuit includes variable and fixed capacitors coupled in parallel, with the charging and discharging of these capacitors controlled in synchronism with the intermittent making and breaking of a circuit connection to the coil and distributor, as by successively engaging and coordinately timed breaker points.

Another object is to provide a system as described, in which the control may be through the agency of intermittently operating sets of breaker points or, alternatively, in a breaker-less manner by using a suitable brush and commutator arrangement coupled with a suitable rectifier circuit.

In general, it is an object of the invention to provide an ignition system which removes inductive load from the breaker points and thus eliminates back-arcing at the contact points, insuring that the system operates at peak efficiency for an increased length of time, with a consequent reduction of the frequency of needed replacement of breaker points. This is accomplished, as indicated above, by the provision of a capacitive circuit in the system, including a variable capacitor driven in synchronized relation to the drive of the breaker points, the variable capacitor being connected in parallel with a fixed capacitor and being instantaneously charged by the battery or other voltage source of the system when certain points are closed, while the fixed capacitor in-

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stantaneously discharges to the coil or transformer of the system when another set of points closes.

The foregoing as well as other objects become more apparent as this description proceeds, especially when considered in connection with the accompanying drawings illustrating a preferred embodiment of the invention, wherein:

Figure 1 is a schematic wiring diagram of the improved circuit as associated with conventionally illustrated breaker, coil, distributor, and spark plug units, with means for the mechanically synchronized operation of certain driven components indicated in dotted line; and

Figure 2 is a fragmentary view very schematically illustrating the nature of an alternative breaker-less circuit employing rectifier and commutator units.

Referring to Fig. 1 of the drawings, the reference numeral 10 generally designates a conventional voltage source of an automotive ignition system, which will be represented by a suitable grounded battery or generator; and the positive side of this source is connected by wiring including a lead 11 to one of two sets of breaker points 12, 13. These are operated by the usual engine driven shaft provisions in a complete cycle the set 12 engaged while the set 13 is open, as depicted in Fig. 1, next with both sets open, and then with the set 13 engaged while the set 12 is open.

Mechanical synchronization of the driven components of the system is obtained through a coupling or ganging structure schematically indicated in dotted line in Fig. 1 and generally designated 14, usually comprising a single shaft conventionally designated 15. Such means also drives the variable capacitor means of the circuit of the invention, to be described.

Points 12, 13 are electrically connected in series by wiring including leads 16, 17, and the set of points 13 is connected by a further lead 18 to the grounded primary winding of a conventional automotive ignition transformer or coil, generally designated 19. The secondary winding of this coil is connected to a conventional distributor 20, which in turn is connected to a conventionally shown set of spark plugs 21.

The reference numeral 22 in Fig. 1 designates a variable capacitor, which capacitor is connected in parallel with a small fixed capacitor 23, and these elements constitute a grounded capacitive circuit according to the invention, which is connected by a lead 24 with a common terminal to which the breaker point leads 16, 17 are wired. The synchronized mechanical coupling 14 drives the variable capacitor 22 in the manner referred to above, its period of charging to a maximum being the period in which the contact is closed at 12.

In the operation of the foregoing system, the battery or other voltage source 10 applies a maximum charge to the fixed capacitor 23 and to the variable capacitor 22 while the points 12 are momentarily closed and the points 13 are open. During this charging the capacitor 22 attains maximum capacitance, and as the points 12 and 13 next both open the variable capacitor 22 is rotated so that it transfers a substantial portion of its charge onto the small fixed capacitor 23, thus substantially increasing the voltage. With both sets of contacts 12, 13 open, reverse flow through the battery is prevented.

In this condition the points 13 close, the fixed capacitor 23 discharging through the points 13 to the primary winding of transformer 19. A very high frequency and high voltage current is induced in the secondary thereof which, as controlled conventionally by the distributor 20, is applied to and jumps the gap of a selected spark plug at the unit 21. Back-arcing through the contact points is eliminated and there is no pitting of the points inasmuch as the entire charge traverses them before they

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open. As indicated, the build-up of the charge on the capacitors is instantaneous.

Fig. 2 of the drawings schematically shows an alternative arrangement of components of the system, to be connected with other components of the system in the fashion illustrated in Fig. 1, by which breaker-less ignition is possible. In this arrangement the timed points 12 of Fig. 1 are replaced by a suitable, unidirectional flow rectifier unit 25, conventionally depicted in Fig. 2 in the simplest possible form, and the points 13 of Fig. 1 are replaced by a brush and commutator unit 26, also conventionally shown. The segments 27 of the commutator are, of course, electrically connected so as to be at the same potential. The commutator of the unit 26 is driven by coupling 14 in timed relation to the variable capacitor 22 to pass current to coil 19.

The drawing and the foregoing specification constitute a description of the improved impulse ignition device in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. In an electrical ignition system including sets of breaker contacts driven in synchronism and electrically connected between a voltage source and a voltage multiplying device, the improvement comprising a voltage storing circuit electrically connected through one of said sets of breaker contacts with said voltage source so as to be charged by said source through said set when the latter is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to charge said device through said last named set when the latter is closed.

2. In an electrical ignition system including sets of breaker contacts driven in synchronism and electrically connected between a voltage source and a voltage multiplying device, the improvement comprising a capacitive circuit including capacitors connected in parallel, said capacitive circuit being electrically connected through one of said sets of breaker contacts with said voltage source to cause said capacitors to be charged by said source through said set when the latter is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to cause the other capacitor to charge said device through said last named set when the latter is closed.

3. In an electrical ignition system including sets of breaker contacts driven in synchronism and electrically connected between a voltage source and a voltage multiplying device, the improvement comprising a capacitive circuit including a driven variable capacitor and a fixed capacitor connected in parallel with said variable capacitor, said capacitive circuit being electrically connected through one of said sets of breaker contacts with said voltage source to cause said variable capacitor to be charged by said source when said set is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to charge the latter when said other set is closed.

4. In an electrical ignition system including sets of breaker contacts driven in synchronism and electrically connected between a voltage source and a voltage multiplying device, the improvement comprising a capacitive circuit including a variable capacitor driven in synchronism with said sets of breaker contacts and a fixed capacitor connected in parallel with said variable capacitor, said capacitive circuit being electrically connected through one of said sets of breaker contacts with said voltage source to cause said variable capacitor to be charged by said source when said set is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to charge the latter when said other set is closed.

5. In an electrical ignition system including a voltage source and a voltage multiplying device, the improvement

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comprising first and second sets of breaker contacts electrically connected between said source and device, and a capacitive circuit electrically connected through one of said sets of breaker contacts with said voltage source to be charged by said source when said set is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to charge the latter when said other set is closed.

6. In an electrical ignition system including a voltage source and a voltage multiplying device, the improvement comprising first and second sets of breaker contacts electrically connected between said source and device, and a capacitive circuit including a driven variable capacitor and a fixed capacitor connected in parallel with said variable capacitor, said capacitive circuit being electrically connected through one of said sets of breaker contacts with said voltage source to charge said variable capacitor when said set is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to cause said fixed capacitor to charge said device when said other set is closed.

7. In an electrical ignition system including a voltage source and a voltage multiplying device, the improvement comprising first and second sets of breaker contacts electrically connected between said source and device, and a capacitive circuit including a driven variable capacitor and a fixed capacitor connected in parallel with said variable capacitor, said capacitive circuit being electrically connected through one of said sets of breaker contacts with said voltage source to charge said variable capacitor when said set is closed, said circuit being electrically connected through another set of said sets of breaker contacts with said voltage multiplying device to cause said fixed capacitor to charge said device when said other set is closed, and means driving said variable capacitor in synchronized relation to said respective sets of breaker contacts to impose a charge from said voltage source on said capacitor when said first set is closed and said second set is open and to discharge said variable capacitor when said first set is open and said second set is closed, whereby said fixed capacitor is charged from said variable capacitor and discharges periodically through said second set to said voltage multiplying device.

8. In an electrical ignition system including a voltage source and a voltage multiplying device, the improvement comprising a capacitive circuit including variable and fixed capacitors connected in parallel and mechanically driven current control means electrically connected between said source and device as well as to said circuit to periodically charge said circuit from said voltage source and discharge said circuit to said voltage multiplying device.

9. In an electrical ignition system including a voltage source and a voltage multiplying device, the improvement comprising a capacitive circuit including variable and fixed capacitors connected in parallel, mechanically driven current control means electrically connected between said source and device as well as to said circuit to periodically charge said variable capacitor of said circuit from said voltage source and discharge said fixed capacitor of said circuit to said voltage multiplying device, and means driving said variable capacitor in predetermined synchronism with said current control means.

10. In an electrical ignition system including a voltage source and a voltage multiplying device, the improvement comprising a capacitive circuit including variable and fixed capacitors connected in parallel, mechanically driven current control means electrically connected between said source and device as well as to said circuit to periodically charge said variable capacitor of said circuit from said voltage source and discharge said fixed capacitor of said circuit to said voltage multiplying device, said current control means including a driven current interrupting unit, and means driving said variable capacitor in

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predetermined synchronism with said current interrupting unit.

11. The further improvement in the system of claim 10, in which said current interrupting unit acts alternately and unidirectionally to forward current for the charging of said capacitative circuit and said voltage multiplying device, and comprises alternately engaging sets of contacts driven in predetermined synchronism with said variable capacitor.

12. The further improvement in the system of claim 10, in which said current interrupting unit acts alternately and unidirectionally to forward current for the charging of said capacitative circuit and said voltage multiplying device, and comprises a commutator and brush unit driven in predetermined synchronism with said variable capacitor.

13. An automotive electrical ignition system comprising a spark plug unit, a coil unit connected at one side in voltage supplying relation to said plug unit, first and second sets of alternately acting make and break contacts electrically connected to the other side of said coil

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unit and operating in alternation, a voltage source connected to said first set, and a capacitative circuit having its discharge side operatively connected at a common terminal to said first and second sets, said capacitative circuit including variable and fixed capacitors connected in parallel with one another and to said common terminal, and means driving said variable capacitor and said first and second sets in predetermined synchronism to charge said variable capacitor through said first set when the same is closed and said second set is open, and to discharge said fixed capacitor through said second set when the same is closed and said first set is open, whereby to forward an augmented primary voltage from said fixed capacitor through said second set to said coil unit.

References Cited in the file of this patent

UNITED STATES PATENTS

2,467,744	Harris	Apr. 19, 1949
2,529,195	Stone	Nov. 7, 1950