

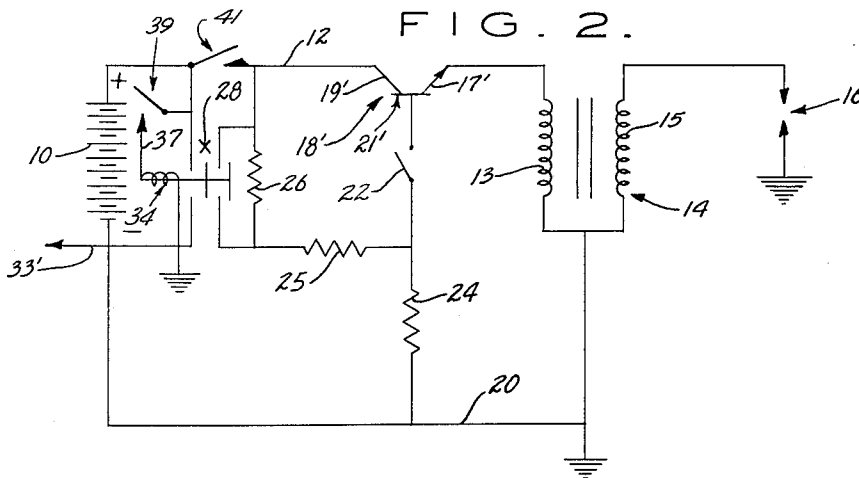
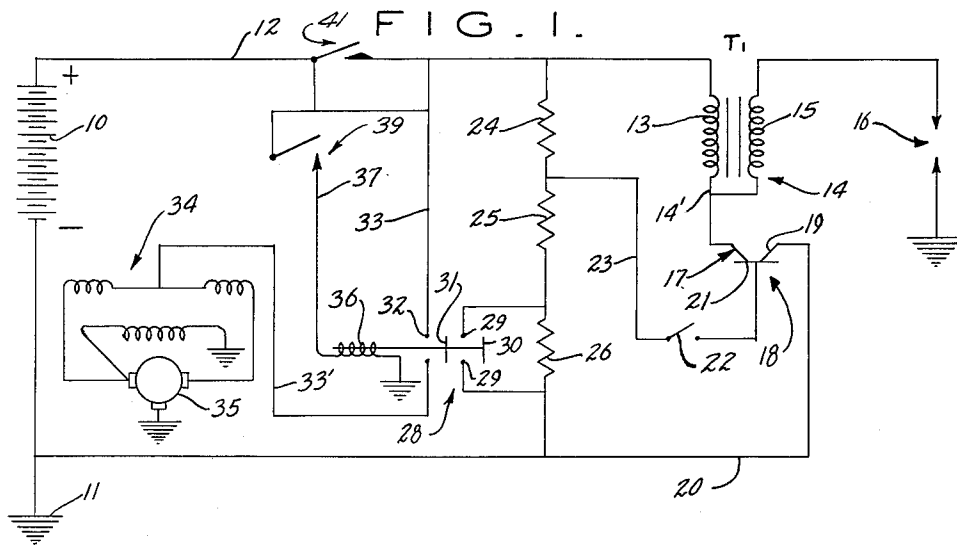
Feb. 13, 1962

F. S. KERR

3,020,904

TRANSISTOR IGNITION SYSTEM

Filed Oct. 20, 1958



INVENTOR.  
**FRED S. KERR**  
 BY *Whitcomb, Halbert & Belknap*  
 ATTORNEYS

1

3,020,904

## TRANSISTOR IGNITION SYSTEM

Fred S. Kerr, Royal Oak, Mich., assignor to Holley Carburetor Company, Van Dyke, Mich., a corporation of Michigan

Filed Oct. 20, 1958, Ser. No. 768,414

2 Claims. (Cl. 123—179)

The present invention relates to an improved transistor ignition system, and more particularly to improvements in the starting circuit to the coil of the system, whereby adequate voltage is applied to the ignition coil in starting or cranking.

It is customary and well known in present day ignition systems to connect a resistor in series with the ignition coil of an ignition circuit, and to provide means for shorting out this coil during the initial cranking period, so that full and adequate battery voltage is imposed across the coil; otherwise the drain in cranking on the battery voltage reduces it to a value insufficient to properly charge the coil for sparking.

It is an object of the present invention to provide an ignition system in which voltage is supplied to the primary winding of the usual ignition coil through a circuit including a conventional electrical transistor, with improvements in operation due to the instantaneous shut-off characteristic of such transistor, and in which the coil voltage is elevated in value above normal operating value at the time of closing of the ignition circuit, as by shorting out a resistor controlling the ignition coil voltage value.

Another object is to provide a transistor ignition system or circuit as described, which is capable, with minor variations in the wiring arrangements, to operate with transistors of either the P-N-P or N-P-N type.

The foregoing as well as other objects will become more apparent as this description proceeds, especially when considered in connection with the accompanying drawing illustrating the invention, wherein:

FIG. 1 is a schematic wiring diagram of an embodiment of the improved system in a circuit employing a P-N-P type resistor; and

FIG. 2 is a similar schematic diagram showing essential components of the system in the circuit arrangement employing a N-P-N transistor.

As illustrated in the embodiment of FIG. 1, the improved transistor ignition system is energized by the usual battery 10 grounded at 11 and having its positive terminal connected by a lead 12 to the primary winding 13 of a conventional ignition coil or transformer 14. The terminals of these coils have a common connection, and the secondary coil, designated 15, is conventionally connected to the usual grounded sparking system, generally designated by the reference numeral 16. The common terminal, at 14', of the windings of coil 14 is connected to the emitter electrode or terminal 17 of a conventional P-N-P electrical transistor 18, and its collector electrode 19 is connected by a lead 20 to ground. The control base 21 of the transistor is connected through a conventionally shown ignition circuit breaker or switch 22 and a lead 23 to the common intermediate terminal of a pair of resistors 24 and 25. These resistors are connected in series with a third resistor 26 across the battery positive lead 12 and the ground lead or connection 20.

A double pole switch, generally designated 28, is connected in shunt relation to the resistor 26. Switch 28 has contacts 29 which are connected by a contactor 30 for this purpose when the switch is closed; and a second contactor 31 of switch 28 similarly connects contacts 32 of a pair of leads 33, 33' when the switch is closed. The leads 33, 33' are respectively connected to the battery positive connection 12 and to the entirely conventional starting circuit 34 of a starting motor 35. Closing of

2

the switch 28 is effected upon energization of the coil of a grounded solenoid 36, whose supply lead 37 is wired through the usual ignition starter switch of the system. Thus, the reference numeral 39 designates a conventional starting switch connecting the lead 37 through appropriate wiring including lead 12 to the positive terminal of battery 10; and the reference numeral 41 designates the key-controlled ignition switch, through which lead 12 is connected to the resistor 24 and the primary winding 13 of transformer 14. Although conventionally shown, the switches 39 are commercially available in a combined key-start ignition and starter switch unit. In accordance with the invention, the starting switch 39 may or may not be operated in conjunction with ignition switch 41. If it is, it will be so operated by means of a spring override, whereby ignition switch 41 may be closed without closing starting switch 39, in a manner well known to the art. In the normal operation of the improved system, i.e., during normal energization of coil 14 and operation of the sparking unit 16 under the control of the circuit breaker 22, current flows from battery 10 through switch 41 and lead 12 to and through the primary winding 13 of coil or transformer 14, and to the emitter 17 of transistor 18. The current that flows through the primary winding 13 of coil 14 subsequently flows through the emitter 17, from where part of the current flows through the base 21 and the remainder through the collector 19 to the battery ground terminal. The base current is limited by the resistors 24, 25 and 26. In starting, upon energization of the solenoid lead 37 and coil 36 through starting switch 39, the switch contactor 30 connects contacts 29 to short circuit the resistor 26, permitting more current to flow in the transistor base circuit, and thereby under this control increasing the total or emitter current. Since the emitter current must pass through the primary winding 13 of coil 14, the increase of current flow tends to offset the effect of lowered battery voltage normally experienced during cranking.

FIG. 2 illustrates an application of the same principle of operation to a circuit wired for use with an N-P-N type transistor, designated 18', having an emitter terminal 17', a base 21' and a collector 19'. In other respects, the components of this modified circuit are similar to that of FIG. 1, hence are designated by corresponding reference numerals, and further description is dispensed with.

The invention combines the advantages of transistor controlled transmission of coil primary current with a feature of augmentation of the coil voltage in starting or cranking. The arrangements are structurally simple and inexpensive and well adapted for utilization in all types of automotive ignition arrangements.

The drawings and the foregoing specification constitute a description of the improved transistor ignition system 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. An ignition system for an internal combustion engine having a starting motor for cranking the same, comprising a main electrical circuit including, in series-connected relation, a source of current, operably connected emitter, base and collector elements of a transistor, and an ignition coil primary winding; a distinct secondary electrical circuit including said current source and electrical resistance means connected in series thereto to provide a path for current in addition to said main circuit; a circuit breaker connecting said transistor base element to said resistance means and opening and closing in timed relation to operation of the engine; and control means having an operative connection to said starting motor by which said control means is rendered operative during energization of the motor and periods of engine cranking

for removing a portion of said resistance means from said secondary circuit.

2. An ignition system for an internal combustion engine having a starting motor for cranking the same, comprising a main electrical circuit including, in series-connected relation, a source of current, operably connected emitter, base and collector elements of a transistor, and an ignition coil primary winding; a distinct secondary electrical circuit including, as serially connected, said current source, said transistor emitter and base elements to the exclusion of said collector element, and electrical resistance means to provide a path for current in addition to said main circuit; a circuit breaker connecting said transistor base element to said resistance means and opening and closing in timed relation to operation of the engine; and control means having an operative connection to said starting motor by which said control means is rendered operative during energization of the motor and periods of engine

cranking for removing a portion of said resistance means from said secondary circuit.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |            |                |
|-----------|------------|----------------|
| 2,090,365 | Harris     | Aug. 17, 1937  |
| 2,550,026 | Short      | Apr. 24, 1951  |
| 2,684,666 | Deacon     | July 27, 1954  |
| 2,723,654 | Hartzell   | Nov. 15, 1955  |
| 2,769,021 | Crosby     | Oct. 30, 1956  |
| 2,807,729 | Redick     | Sept. 24, 1957 |
| 2,846,992 | Short      | Aug. 12, 1958  |
| 2,878,298 | Giacoletto | Mar. 17, 1959  |
| 2,888,914 | Sherman    | June 2, 1959   |

##### FOREIGN PATENTS

|           |        |                |
|-----------|--------|----------------|
| 1,137,949 | France | Jan. 21, 1957  |
| 1,170,981 | France | Sept. 29, 1958 |