May 26, 1959 G. A. BUON 2,888,574

IGNITION CIRCUIT DEVICE

Filed Dec. 31, 1956

FIG. 1

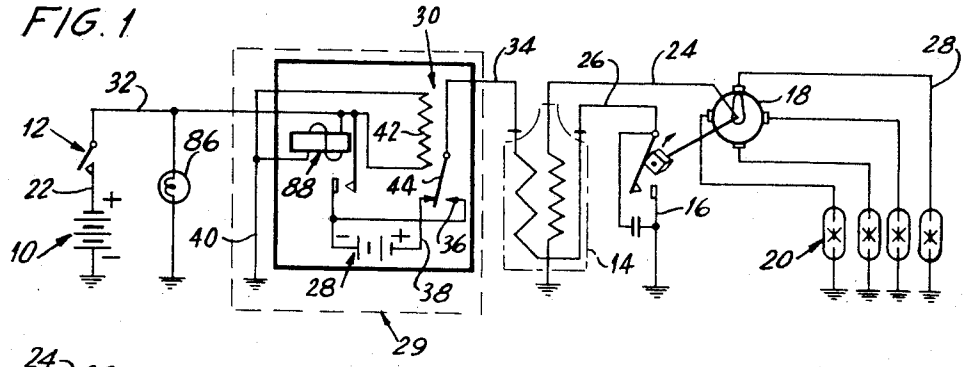


FIG. 2

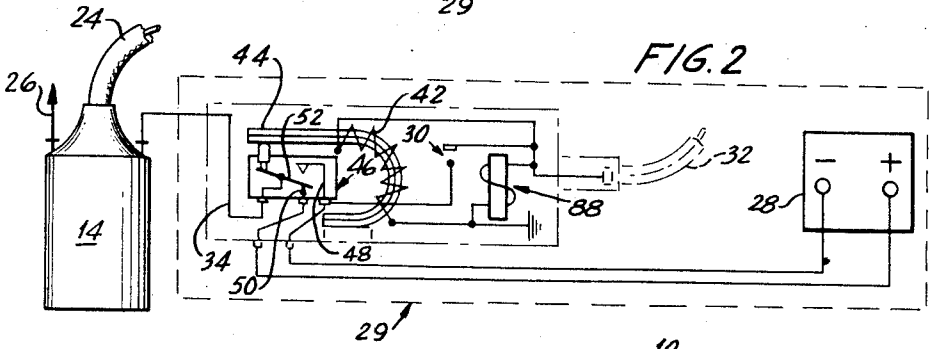


FIG. 3

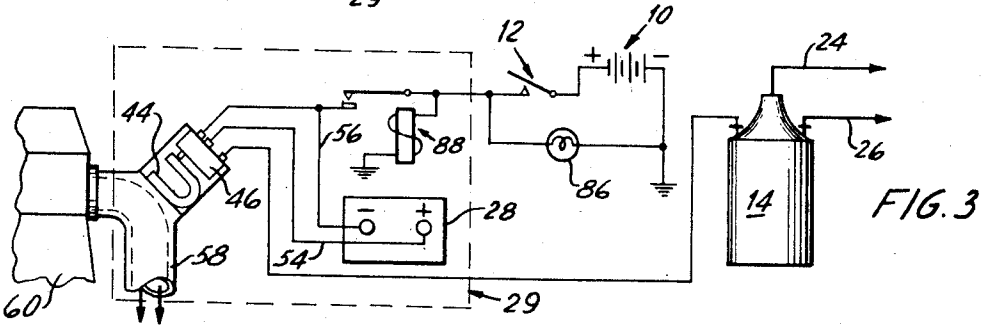
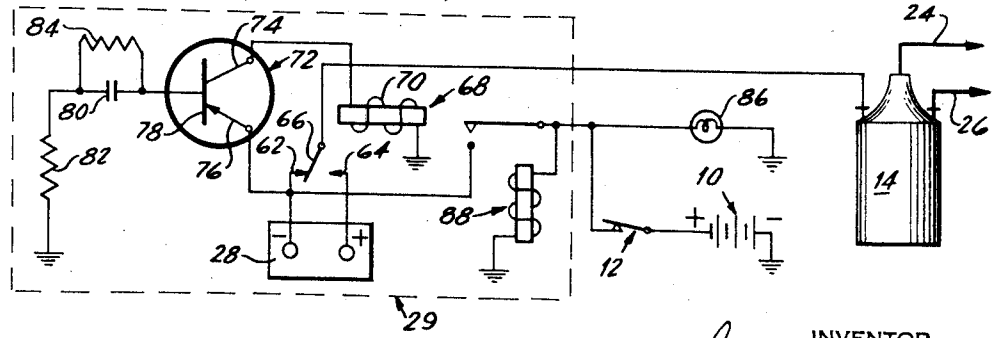


FIG. 4



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IGNITION CIRCUIT DEVICE

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11 Claims. (Cl. 307—10)

This invention relates to ignition circuit devices, and more particularly to booster devices for improving ignition circuit service during the initial periods of operation thereof.

The invention contemplates providing vehicles which employ ignition circuits with optimum ignition conditions each time the engine of the vehicle is started and takes particular consideration of the adverse conditions to which vehicles and their elements can be exposed.

During the starting period of an engine, the drain upon its electrical starting system is severest. For example, in an automobile, when the ignition switch is employed to close the electrical circuit, the starting motor and the ignition system constitute simultaneous loads on the battery. Moreover, under adverse conditions such as low ambient temperatures, the electric starting motor has a heavy mechanical load imposed upon it so that the starting motor in turn increases its drain upon the battery which itself is at its lowest electrical capacity due to the low temperature.

An object of the invention is to avoid severe drains on the starter power supply by the provision of a temporary supplementary supply to the ignition circuit which is effective only during the starting period of the engine with which it is associated.

Otherwise expressed, it is an object of the invention to provide an improved ignition device for facilitating engine starting especially under adverse conditions.

A further object of the invention is to provide a unit which can be installed in known ignition circuits to cooperate therewith to achieve the various improvements which inure to the benefit of ignition circuits incorporating features of the invention.

To provide its various benefits, the invention in its various embodiments involves the use of a supplementary power supply which is effective in the ignition circuit, in combination with the usual power supply of the starting device of an engine, during the starting period of the engine. In combination with the supplementary supply, there is further provided a switching means which is operative to render the supplementary supply ineffective after a period of time has elapsed following the starting operation initiation.

Advantageously, the intermittent use of the supplementary or booster supply enables a very efficient use of this component. Thus, since the booster is not always in use, it is not necessarily of the same strength or reserve as would be required for full time operation. Moreover, the life of this unit is accordingly extended.

A further advantage of the means provided in accordance with the invention is that, since they can be installed in existing devices for cooperation therewith, they can be independently and economically assembled.

Other objects and advantages of the invention will be shown in the following detailed description of a preferred embodiment of the invention, this and other embodiments of the invention being illustrated in the accompanying drawing in which:

Figure 1 is a partially schematic and partially diagrammatic illustration of an ignition circuit embodying features of the invention;

Figure 2 is a pictorial view of an ignition device in which the invention is employed in correspondence with the circuitry shown in Fig. 1;

Figure 3 is a partially pictorial and partially schematic illustration of another embodiment of the invention featuring a variation in the switching means for controlling the operation of the booster supply; and

Figure 4 represents still another embodiment of the invention also featuring a variation in the switching means.

The ignition device and circuit shown in Figs. 1 and 2 includes a battery **10**, an ignition switch **12**, an ignition coil **14**, a breaker **16**, a distributor **18**, and spark plugs **20**. In known ignition devices, the battery **10** is coupled to the ignition switch **12** by a connection **22**, the switch **12** controlling the supply of power to a starting motor (not shown) and via the ignition coil **14** to the breaker **16** and to the distributor **18**. Connections **24** and **26** are provided between the coil **14** and the distributor **18**, and the breaker **16** and coil **14**, respectively. These components are known in various arrangements of which the illustrated arrangement is exemplary only, the invention being equally applicable to the various types of devices in a manner similar to that which will be shown. For present purposes, the relay **86** illustrated in the circuit will be assumed to be a short circuit.

In accordance with the invention, there is further provided a device **29** including a booster voltage supply or battery **28** and a switch means (generally indicated) **30**, these components being coupled intermediate the ignition switch **12** and coil **14** by leads **32** and **34**. Also provided are the leads or connections **36—40**.

The switch means **30** includes the heat generating element or heater **42** which may simply be a resistor, and a heat responsive element **44** which may be a bimetallic strip. There are commercially available units capable of serving as the switch means **30** but the unit may be such as is illustrated in Fig. 2 by the micro-switch **46** including contacts **48** and **50** and blade **52**.

In fact, the structures of Figs. 1 and 2 differ slightly in that in Fig. 1 the bimetallic strip is a conductor whereas in Fig. 2 the bimetallic strip operates the micro-switch within which the blade **52** acts as the conductor. However, in principle, the two devices operate almost identically.

In use, the batteries **10** and **28** are connected in their respective circuits so that they are series adding when the ignition switch **12** is closed. Moreover, the closing of switch **12** couples the heater **42** to the battery **10**.

As a consequence thereof, when the ignition switch **12** is closed, the combined voltages of the batteries **10** and **28** are applied to the ignition coil **14** and to other utilization devices in the circuit. The battery **10** is applied to the heater **42** which generates sufficient heat in a determinable period of time to cause a switching action by means of the bimetallic strip **44**. This switching action is very nearly instantaneous in the micro-switch **46** and also in the element **44** of Fig. 1 in accordance with known spring biasing provisions.

Thus, in accordance with the principles of the invention, an action is provided whereby a booster supply is employed in an ignition circuit during the starting period and for a period of time following the closing of the ignition switch. The auxiliary voltage provided by the booster **28** is preferably fifty percent of the normal voltage supply so as to compensate for the voltage drop in the main power supply or to add thereto during the warmup period. Trial has shown that the utilization elements of ignition circuits can readily absorb this additional power without deleterious effects.

The period during which the booster supply is employed is generally defined by the expected length of the warmup period and the booster mechanism is readily calibrated with the length of this period by the parameters of the heater and the heat responsive element as well as the spacing therebetween. It will be noted, however, that the choice of these parameters establishes an unalterable predetermined period of time for the booster application unless, for example, the heater is provided in variable form. It is conceivable, notwithstanding the above provisions, that another form of time control may be desirable and for this reason the invention contemplates an analogue control which may be, for example, a control of the period in response to a quantity of energy or the like generated or existing in the engine itself.

Accordingly, there is illustrated in Fig. 3 a mechanism in which the period of booster application can be variable and in which the period is controlled by a quantity of energy supplied by the engine. The circuit employed in this embodiment consists of the same elements as in the previously described embodiment and in similar manner the booster battery **28** is connected in series with the main battery **10** or the booster battery is by-passed by means of the leads **54** and **56**, respectively as controlled by operation of the micro-switch **46**.

In this embodiment, however, the bimetallic strip **44** responds to the temperature of the exhaust manifold **58** of the engine **60** which function is achieved through the simple expedient of mounting the switch and the heat responsive element on and adjacent the manifold. As a consequence thereof, the booster battery operates during the initial warmup period of the engine and cuts out when the exhaust manifold reaches a predetermined temperature.

It is obvious that various mounting positions can be used to accommodate the switch and its heat responsive element and that the manifold is illustrated for exemplary purposes only. The illustration should be considered as one of a device wherein the period of time during which the booster supply is employed is variable in accordance with operating conditions. This embodiment more suitably takes into account such things as weather conditions and the like.

Attention is next directed to the fact that the embodiments which have been described have each employed heat responsive elements. It is not to be assumed, however, that the invention is thus limited and, by way of example, the invention is further illustrated in Fig. 4 wherein is shown an electrical time delay circuit which is rendered operative upon the closing of an ignition switch and maintains the booster supply effective for a determinable period of time.

The device of Fig. 4, apart from the elements previously described, includes the contacts **62** and **64** and the blade **66** of a relay **68** whose coil is **70** is coupled to a transistor **72**.

The transistor, as is known, comprises a collector electrode **74**, an emitter electrode **76** and base electrode **78**, the latter being coupled through a capacitor **80** and a resistor **82** to ground. A resistor **84** of high value can be used in parallel with capacitor **80** to enable the complete discharge thereof when the circuit is at rest.

The emitter electrode **76** is connectible by the ignition switch **12** to the battery **10** and, when the switch is closed, the transistor **72** conducts thereby activating the relay **68** so that the blade **66** is transposed from the contact **62** to the contact **64** in order to connect the booster battery **28** in series with the battery **10**.

Once the ignition switch has been closed, the capacitor **80** commences to charge and reaches a condition at which the transistor is biased to cutoff after a determinable period of time dependent upon the values of the capacitor and resistor. With the transistor cut off, the coil **70** no longer operates to retain the blade **66** on the contact **64** and the blade returns to the contact **62** to remove the booster **28** from the circuit.

A further circuit which can be used is illustrated in Fig. 12–25, page 462 of "Transistor Electronics" by Lo, Endres, Zawels, Waldhauer and Cheng; Prentice-Hall, Inc.; 1955. In this circuit, the relay can be connected to the output terminal with the ignition circuit being connected to the voltage source (Vcc).

The devices which have been shown and described have in common the utilization of a booster supply which is employed for a finite period of time following the initiation of the starting of an engine by means of closing the associated ignition switch. The period of time may be predetermined or it may vary in accordance with operating conditions and the like. The device may be heat responsive or it may be controlled by other means or forms of energy.

The functions of the devices of the invention include providing an additional source of voltage to a main source of power for the starting of an engine or the like at the time during which such assistance is especially required. The use of the invention is especially noteworthy under adverse conditions. Advantageously, the booster supply is rendered ineffective and is thus conserved after its objectives have been achieved.

The incorporation of accessories in the ignition circuit is of little consequence since the devices of the invention can readily be modified to accommodate the same. Assuming, therefore, that an accessory represented by the lamp **86** (see Figs. 1–4) is incorporated into the ignition circuit so as to present a discharge path for the booster battery **28**, a relay **88** can be simply added to the circuit so that the discharge circuit for the battery **28** is open excepting during the warmup period as explained above.

There will now be obvious to those skilled in the art many modifications and variations utilizing the principles set forth and realizing many or all of the objects of the invention, but which do not depart essentially from the scope of the invention as defined in the following claims.

What is claimed is:

1. A booster device for an engine ignition circuit provided with a battery, an ignition switch coupled to the battery and a utilization device adapted for being operatively coupled to the battery, said booster device comprising a booster voltage source, circuit means for normally coupling said booster voltage source operatively with said battery to provide said utilization device with an adequate source of power with said ignition switch closed, and switch means in said circuit means, said switch means including means for being actuated at the closing of the ignition switch to commence a delay period and rendering said booster voltage source ineffective following the period.

2. A device as claimed in claim 1 wherein said switch means renders said booster voltage source ineffective a predetermined period of time following the closing of said ignition switch.

3. A device as claimed in claim 2 wherein said switch means is thermal-responsive for rendering said booster voltage source ineffective.

4. A device as claimed in claim 2 wherein said switch means is an electro-mechanical device for providing a switching operation after a determinable time delay.

5. A device as claimed in claim 2 wherein said booster voltage source is a booster battery.

6. A device as claimed in claim 5 wherein said circuit means normally couples said booster battery in series with said ignition circuit battery and said switch means and said switch means operates to switch said booster battery out of the circuit a predetermined period of time after the ignition switch is closed.

7. A device as claimed in claim 6 comprising a source of heat and wherein said switch means comprises a heat

responsive element coupled in said circuit means and responsive to said source of heat for switching said booster battery into and out of the circuit.

8. A device as claimed in claim 7 wherein said switch means comprises a heat generating element which is coupled to said ignition circuit battery by means of said ignition switch, said heat generating element being cooperative with said heat responsive element to cause a switching operation a determinable period of time following the coupling of said heat generating element to said ignition circuit battery by the closing of said ignition switch.

9. A device as claimed in claim 1 wherein said switch means is responsive to an external source of heat.

10. A device as claimed in claim 6 wherein said switch means is an electro-mechanical device including a relay

for switching said booster battery into and out of said circuit and a time delay circuit for controlling the operation of said relay.

11. A device as claimed in claim 10 comprising a transistor coupled to said relay and by said ignition switch to said ignition circuit battery and a resistor-capacitor circuit coupled to said transistor to enable said transistor to pass power from said ignition circuit battery to said relay for only a determinable period of time after said ignition switch is closed.

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