Jan. 23, 1962 N. T. NEAPOLITAKIS 3,018,413

TRANSISTORIZED IGNITION SYSTEM

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FIG. 1

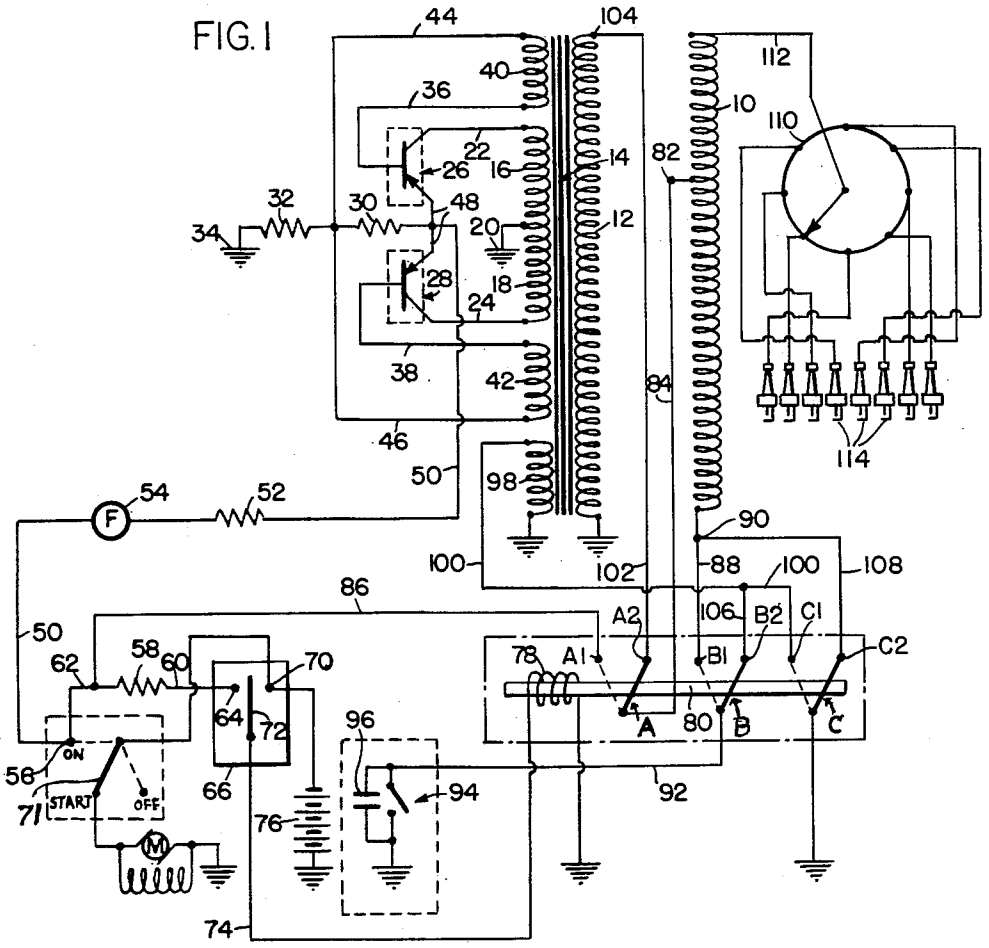
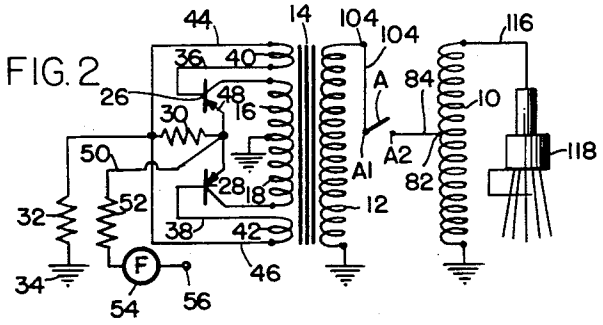


FIG. 2



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TRANSISTORIZED IGNITION SYSTEM

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This invention relates in general to an ignition system for internal combustion engines for automobiles and the like, and for jet engines for aeroplanes.

Among the objects of the invention are, to utilize a push-pull oscillator for generating alternating current power; to prevent premature firing by controlling the voltage generated by the breaker set; reducing the current through and extending the life of the breaker set; to provide a transformer for controlling the voltage generated by the transistors and the feed back windings so that the high voltage at the output remains nearly constant at high speeds.

A further object of the invention is to provide a highly efficient ignition system capable of delivering extremely high voltages without any basic modification of the ignition installation, reducing the current through the breaker points to negligible values extending the life of the breakers by means of small inexpensive transistors, resistors and transformers.

Other objects of the invention will appear in the specifications and will be apparent from the accompanying drawings in which:

FIG. 1 is a wiring diagram of a transistorized ignition system for automobile engine operation; and

FIG. 2 is a wiring diagram for a transistorizing ignition system for jet engines.

When the breaker points in a transistorized ignition system are open, the switching winding is ineffective and flux from primary winding links with feed back windings so that the oscillator becomes excited. The alternating flux so generated, interlinks with the secondary of the transformer which develops sufficient voltage to excite a standard ignition coil to a high voltage such as 21,000 volts and over. When the points are closed (with the switch and winding shorted), the switch and winding prevent the flux generated in primary windings from linking with the feed back windings and thus prevent the oscillator from operating.

Due to inherent intricacies in the operating principles of a transistorized push-pull oscillator system for generating alternating power, it may be preferable to start an ordinary automobile engine system with a standard coil alone and then to switch to the transistor push-pull system as herein provided.

Referring now more particularly to FIG. 1 of the drawings, a push-pull transistor system is described in connection with an ordinary standard automobile ignition coil **10** which is grounded at one end and connected to a spark plug distributing system at the other. To this ignition coil is connected a secondary winding **12** of a transformer **14** which has primary windings **16** and **18** connected to a common ground **20** between them and with the outer ends connected by conductors **22** and **24** to the collectors of transistors **26** and **28** respectively. The emitters of these transistors are connected together and through resistances **30** and **32** to a ground **34**. The bases of the two transistors are connected by conductors **36** and **38** to opposite feed back windings **40** and **42**, the other ends of which are connected by conductors **44** and **46** respectively to a point between the two resistances **30** and **32**, thus forming a push-pull connection.

The push-pull system is activated from conductors **48** which connect the emitters of the transistors, and a conductor **50** is connected thereto and through a resistance **52**

and a fuse **54** in series to a terminal **56** of a regular ignition switch represented as an On terminal. A conductor **62** connects the On terminal to a resistor **58** and through a conductor **60** to a terminal **64** of a toggle switch **66**. The toggle switch has an arm **72** movable from an intermediate position to engage terminal **64** or a spaced terminal **70** which is connected through a conductor to a battery **76** and to ground.

The arm **72** of the toggle switch **66** is connected to the energizing coil **78** of the relay switch by a conductor **74**. The contact **70** of the toggle switch is connected to a switch arm **71** of the ignition switch (or to the foot starter switch). Thus the toggle switch provides means for energizing the relay either momentarily through the starting provisions of the car by having the toggle switch arm **72** in engagement with the contact **70**, or by energizing the relay continuously by having the switch arm **72** in engagement with the contact **64**.

Since the position of the relay contacts determine whether the car is run on a transistorized or a standard ignition system, the toggle switch **66** provides means to run the car on standard ignition if it becomes necessary.

The relay switch having the winding **78** is represented as having an extending core **80** for engaging movable contact arms of switches A, B and C. When the relay winding **78** is energized, the contact arms of the switches are moved into engagement with corresponding contacts **A1**, **B1** and **C1** and when the winding is de-energized, the switch arms make engagements with the back contacts **A2**, **B2** and **C2** respectively. The movable arm of switch A is connected to a battery terminal **82** of the standard ignition coil **10**, by a conductor **84**; contact **A1** is connected by conductor **86** to the normally low voltage side of the standard battery resistor **58**. The movable arm of switch B is connected by a conductor **92** to the ignition breaker set **94**; contact **B1** is connected by a conductor **83** to the distributor terminal **90** of the standard ignition coil **10**; contact **B2** is connected by a conductor **106** and a conductor **100** also connected to contact **C1** with one end of the switching winding **98**. The movable arm of switch C is connected to ground; the contact **C1** is connected by a conductor **100** to one end of the switching winding **98**, the other end of which is grounded; and the contact **C2** is connected by a conductor **108** with the distributor terminal **90** of the ignition coil.

From the above diagram, it will be seen that while the car (or its engine) is being started, the relay **78** is connected in the number **1** switch position which connects the ignition system in the standard starting manner. When the engine starts, the starter motor is disconnected from the battery, the relay winding is de-energized, and the contact arms of the switches A, B and C return to the number **2** position. The contact **A2** of the switch A connects the battery terminal **82** of the standard ignition coil by conductors **84** and **102** with a terminal **104** at one end of the secondary winding of the transformer, the other end of which is ground; the contact arm of the switch B which is connected to the ignition breaker by the conductor **92**, is connected through the switch contact **B2** and conductors **106** and **100** with a switching winding **98**, and the contact arm of the switch C which is grounded, connects the distributor **110** of the standard ignition coil **10** through the conductor **108** and the switch to ground.

At this time, a high voltage (spark) is developed by the transistorized oscillator system, using the above described positive feed-back circuit.

With this construction, the push-pull oscillator is used for generating alternating current power. The separate switching winding **98** does not allow a D.C. component through the breaker points thus eliminating material transfer or pitting of the points. Premature firing can be controlled by the voltage generated, by the dwell of the

distributor and by the contour of the distributor rotor contact. Ah high speeds, the high voltage from the coil remains nearly constant. The current through the ignition breaker set is reduced and thus the life of the breaker points is appreciably extended up to about 300,000 mile life.

A distributor **110** is connected to the end of the standard ignition coil by conductor **112** and is conventionally shown with a plurality of spark plugs **114**.

By simply removing the breaker points, a continuous arc may be developed which is ideal for jet engine ignition without mechanical contacts. The essential parts for operating a basically push-pull oscillator is diagrammatically represented in FIG. 2 in which an A.C. arc is generated continuously while the breaker points are open. In this figure, the similarly indicated parts correspond to those already described in connection with the transistorized system shown in FIG. 1, and switching of the push-pull oscillator is accomplished by a separate on-off switch to the battery as shown.

With this type of push-pull oscillator, a continuous high voltage current is built up in the ignition coil which is connected at its operating end by a conductor **116** with a conventionally shown continuous arc in a spark plug or a glow tube **118** for use with jet engines.

In both of the systems as described, it may be preferable to initiate operations through a battery and an On-Off switch, but after starting, to rely upon the transistorized push-pull operation. This ignition for jet engines has the advantage that the high frequency A.C. gives much better control over possible flameouts.

While a preferred transistorized push-pull ignition system for ordinary automobile engine operation and for jet engine operation has been described in some detail, it should be regarded as an illustration or example rather than as a limitation or restriction of the invention, since various changes in the construction, combination, and arrangement of the parts may be made without departing from the spirit and scope of the invention.

I claim:

1. In an ignition breaker circuit system for combustion engines, a battery source of electric current, an ignition coil for the engine, a transformer, a circuit and switch means therein for connecting the source of current through the transformer to the coil, a transistorized push-pull oscillator connected to the source of current and to the transformer primary for exciting the coil to high voltage, the switch means comprising a relay having an energizing winding and a plurality of two-way switches with circuit connectors and operated thereby in one position to connect the ignition coil to the battery, the coil to the ignition breakers, and a portion of the transformer winding to its ground in starting the engine.

2. In an ignition breaker circuit for combustion engines, a battery source of electric current, an ignition coil for the engine, a transformer, a circuit and switch means therein for connecting the source of current through the transformer to the coil, a transistorized push-pull oscillator connected to the source of current to the transformer primary for exciting the coil to high voltage, the switch means comprising a relay having an energizing winding and a plurality of two-way switches with circuit connectors and operated thereby in a second position when the relay is de-energized to connect the ignition coil across the oscillator, the breaker ignition through a portion of the transformer primary winding, and coupling the ignition coil with the transistorized oscillator to develop a high voltage discharge in the ignition breaker.

3. In an ignition breaker for combustion engines, a battery source of electric current, an ignition coil for the engine, a transformer, a circuit and switch means therein for conducting the source of current through the transformer to the coil, an oscillator comprising a pair of oppositely connected transistors in double feed-back circuits with primary transformer windings and feed-back portions thereof, the primary of the transformer having a switching winding portion, switch means and conductors to connect this last winding to ground in starting the engine, and other switch means and conductors to connect this last winding portion through the ignition breaker when the engine is in operation.

4. In an ignition breaker system for combustion engines, a battery source of electric current, an ignition coil for the engine, a transformer, an ignition breaker, a distributor and engine spark plugs in connection therewith, an electric circuit and a switch therein for connecting the transformer in the circuit to the coil and thence through the breaker and distributor to the spark plugs, a transistorized push-pull oscillator connected to the source of current and to the transformer primary for exciting the coil to high voltage and means comprising a separate winding for the transformer, an ignition breaker seat connected to the terminal of the separate winding, and switch means operated in starting the engine through the transformer and the ignition coil for standard operation and operative to change the circuit to the ignition means through the transistorized push-pull oscillator after the engine is started.

5. In an ignition breaker system for combustion engines in accordance with claim 4, in which the separate winding is left open or shorted by means of the ignition breaker whereby when the points are closed, the switch means and the winding prevent the flux generated in the primary transformer windings from linking with the feed back windings of the oscillator preventing the latter from being excited or operated.

6. In an ignition breaker for combustion engines, a battery source of electric current, an ignition coil for the engine, a transformer, a circuit and switch means therein for conducting the source of current through the transformer to the coil, an oscillator comprising a pair of oppositely connected transistors in double feed-back circuits with primary transformer windings and feed-back portions thereof, a switching winding in the primary of the transformer and ignition breaker mechanism in connection with the switching winding, and switching means for connecting the ignition breaker mechanism directly to one end of the ignition coil and starting the engine and to the switching winding coil after the engine has been started.

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