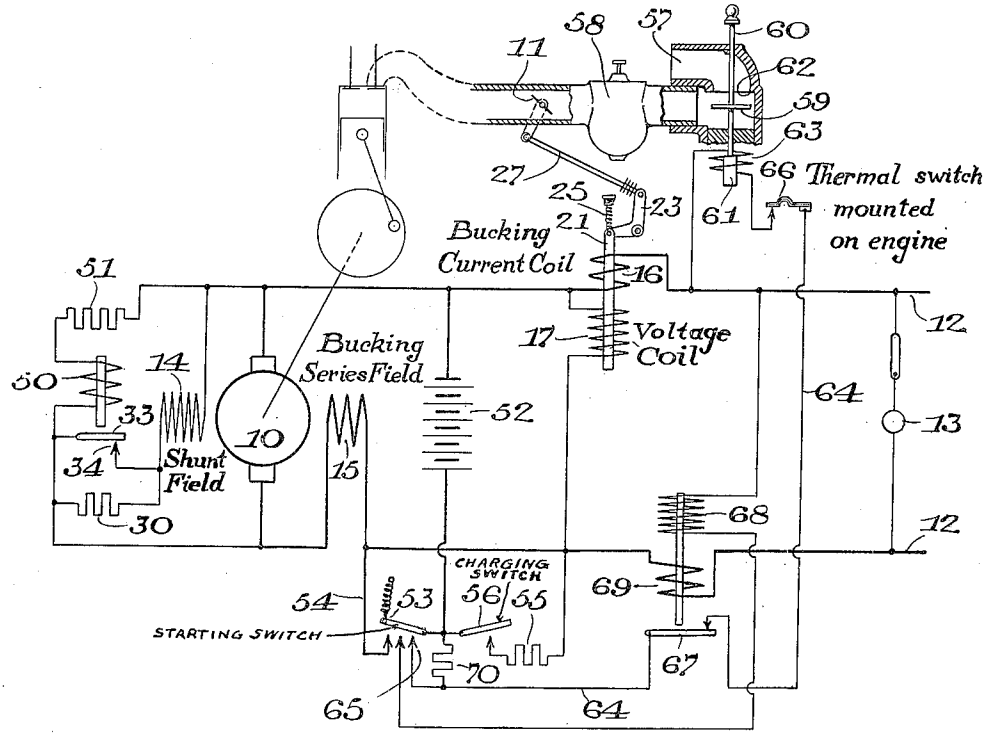
Nov. 2, 1926. 1,605,165

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AUTOMATIC VARIABLE CHOKER

Filed Jan. 11, 1924



WITNESSES

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Patented Nov. 2, 1926. 1,605,165

UNITED STATES PATENT OFFICE.

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AUTOMATIC VARIABLE CHOKER.

Application filed January 11, 1924. Serial No. 685,659.

This invention has for its object to facilitate the starting of an automatic gas-engine-driven generating plant of the demand starter type by providing for automatically choking the carbureter of the engine during the cranking of the engine followed by a period during which the carbureter is partially choked, which period will continue until the engine becomes warm.

It is well recognized practice in the operation of gas engines in automobiles that during cold weather best results are obtained by choking the carbureter during cranking and retaining a partial choking condition until the engine has become sufficiently warm. It is the purpose of this invention to provide automatic means for accomplishing this practice in an automatically controlled generating unit plant and thereby avoid a repeated cranking operation occasioned by the removal of the choking effect entirely as soon as the engine is cranked.

With these objects in view the invention contemplates the use of an electrically controlled choking device capable of producing choking effects of varying degrees, the greatest choking effect to be produced during the cranking operation and preferably controlled by a circuit established by the motor starting switch and a lesser choking effect produced by a circuit controlled by a thermal switch on the engine so as to be discontinued when the engine is sufficiently warm to require no choking effect.

While the invention is especially applicable to internal combustion engine driven farm lighting and power plants, it is not limited thereto but is suitable for use with internal combustion engines generally.

With the above and other objects in view the invention consists in the automatic variable choker for internal combustion engines as herein claimed and all equivalents.

Referring to the accompanying drawing, the figure constitutes a diagram of a generating plant containing the automatic variable choker of this invention.

In the drawing is shown a generating unit approximately conforming with actual practice and fully described in my co-pending application for starting field for generating units, Serial Number 698,110, filed March 10, 1924, and regarding much of which it will be sufficient for the purposes of this case to merely mention the names of parts without further explanation.

In the drawing, 10 indicates a generator driven by an internal combustion engine, the throttle valve 11 of which is controlled by a solenoid having windings connected with the generator windings, as will be described. The generator, as shown, is of the shunt type and supplies the mains 12 containing lamps 13 or other translating devices. The shunt field winding 14 of the generator is opposed by a bucking series field winding 15. The solenoid comprises a series coil 16 opposed by a voltage coil 17 and the solenoid core 21 operates the throttle through a bell crank lever 23 and a link 27 and is under the influence of a spring 25.

A resistance 30 is connected in series with the shunt field winding 14 of the generator but may be short circuited by switch contacts 33 and 34 controlled by a solenoid 50, which is across the terminals of the generator, preferably with a resistance 51 in series therewith.

A battery 52 has one terminal permanently connected with one generator terminal and its other terminal connected by means of a spring-retracted switch 53 with a wire 54 leading to the bucking series field 15. In practice switch 53 constitutes a solenoid-operated starting switch closed only during the starting operation.

A connection is shown for placing the battery across the mains with a resistance 55 in series therewith and controlled by a switch 56 for recharging the battery from the generator, the resistance 55 being necessary in view of the battery voltage in practice being much less than that of the generator. In practice the switch 56 for establishing the battery recharging connection is a solenoid-operated switch which is only closed during the time the generator is in operation.

The operating connections for starting switch 53 and charging switch 56 are not shown, since they form no part of the present invention.

The air passage 57 to the engine carbureter 58 is controlled by a choke valve 59 on a stem 60 carrying a solenoid core 61, which is lifted against its seat 62 with more or less force by a solenoid 63 according to the

strength of current flow through said solenoid. The solenoid 63 has one terminal connected with the line wire with which the battery terminal is directly connected and its other terminal is connected by a wire 64 with a switch contact 65 engaged by the motor starting switch 53 so that when the motor starting switch is closed the solenoid 63 receives practically the full voltage of the battery and closes the choke with considerable force and this condition continues as long as the starting switch is closed, that is during the cranking of the engine. This is notwithstanding the fact that the wire 64 includes a thermal switch 66 mounted on the engine, for such switch is normally closed at the temperature of the engine when it is not running and also notwithstanding the presence in said wire 64 of a normally open switch 67 for the latter is closed whenever the motor starting switch 53 is closed. As shown, the switch 67 is closed by a solenoid coil 68 controlled by the motor starting switch 53 and it is retained in its closed position as long as the generator supplies a load on the mains by a solenoid coil 69 in the main line 12.

The degree of choking produced by the circuit closed through the solenoid 63 by the closing of the starting switch 53 is such as to be suitable for cranking the engine when it is cold and as soon as cranking is effected the starting switch in opened, automatically in practice, and the generator driven by the gas engine supplies the load on the mains. This, as before stated, retains switch 67 closed and current continues to flow through the choker circuit notwithstanding the opening of the starter switch for a resistance 70 is permanently connected between the terminals of the switch 53—65. Because of the resistance 70 introduced in the choker circuit, the flow of current is weaker and the choker 59 is not held with as much force as during the cranking. Consequently, as long as this circuit is maintained, a partial chocking operation is produced, the air intake to the carbureter being only partially impeded by the influence of the choker coil 63. This condition continues until the engine is warm and the heat of the engine opens the thermal switch 66 to interrupt the choker circuit. The choker then falls and the carbureter is restored to its normal condition. The release of switch 67 by solenoid 69 when the system is idle prevents the choker circuit becoming re-established when the engine cools down and the thermal switch 67 closes.

It will be seen that by means of this invention the practice of fully choking the carbureter during cold weather cranking and continuing a partial choke until the engine is warm is automatically accomplished even in the case of automatically controlled electric generating units.

Another feature of the present invention is the function of the thermal switch, which prevents the operation of the choker whenever the engine is warm. A choker operating whenever the engine is started is unsuitable for demand starting generator plants if provision is not made for disabling the choker when the engine is sufficiently warm for starting without it for it is well recognized that the use of a choker when unnecessary tends to foul the engine and to interfere with starting because of an over-rich mixture.

By the use of this invention the battery is relieved of a heavy duty incident to automatically repeated starts with a cold engine until the engine is capable of running without the choker. The automatic choke giving a full choking effect during cranking and continuing a partial choke until the engine is warm, makes it possible for the automatic generating unit to respond promptly to the demand with a single cranking operation, even during cold weather conditions.

What I claim as new and desire to secure by Letters Patent is:

1. In an internal combustion engine having a carbureter, means for choking the air intake to the carbureter, a solenoid for operating said choking means, an electric starter for the engine having a starting switch, a circuit through the solenoid closed by the starting switch for making the choker effective when the starting switch is closed, means for continuing the circuit through the solenoid with added resistance after the starting switch is opened to make the choker partially effective, and means sensitive to the temperature of the engine for interrupting the solenoid circuit when the engine is warm.

2. In an internal combustion engine provided with a starter, solenoid means operating with the starter for choking the carbureter, means for weakening the solenoid for partially choking the carbureter after the starting operation, and means sensitive to the engine temperature for discontinuing the operation of the partial choking means when the engine is warm.

3. An internal-combustion-engine-driven generator capable of self starting, comprising a starting switch, a choker circuit including a magnetic choker controlled by the starting switch, a resistance interposed between the choker circuit contacts of the starting switch for continuing the choker circuit through such resistance when the starting switch is opened, a thermal switch sensitive to the temperature of the engine in the choker circuit for opening the choker circuit when the engine is warm, and an automatic switch in the choker circuit automatically closed when the starting switch is closed and continuing closed during the

operation of the generator but serving to automatically open the choker circuit when the generator is not operating.

4. An internal-combustion-engine-driven generator, mains supplied thereby, a battery, a starting switch for connecting the battery across the mains for starting the engine by the generator operating as a motor, a magnetic choker for the engine, a choker circuit including the choker and the battery and closed by the starting switch, a resistance connected between the choker circuit contacts of the starting switch to continue the choker circuit after the starting switch is opened, a thermal switch in the choker circuit sensitive to temperature conditions of the engine for opening the choker circuit when the engine is warm, and an automatic switch in the choker circuit closed by a solenoid coil controlled by the starting switch and held closed by a solenoid coil in the service mains but permitted to open the choker circuit when current ceases to flow through the service mains.

In testimony whereof, I affix my signature.

ANTON FRANK BROTZ.