April 10, 1962 R. C. NODDIN 3,029,350

COMBINED STARTER AND GENERATOR

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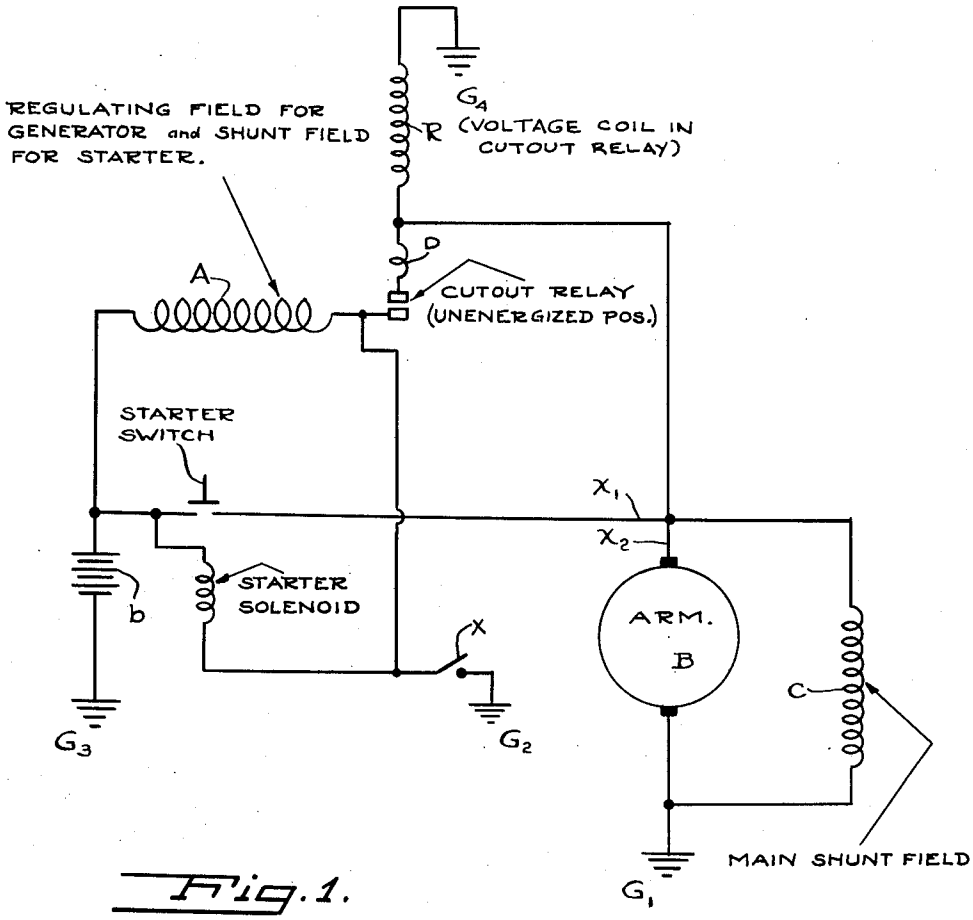


Fig. 1.

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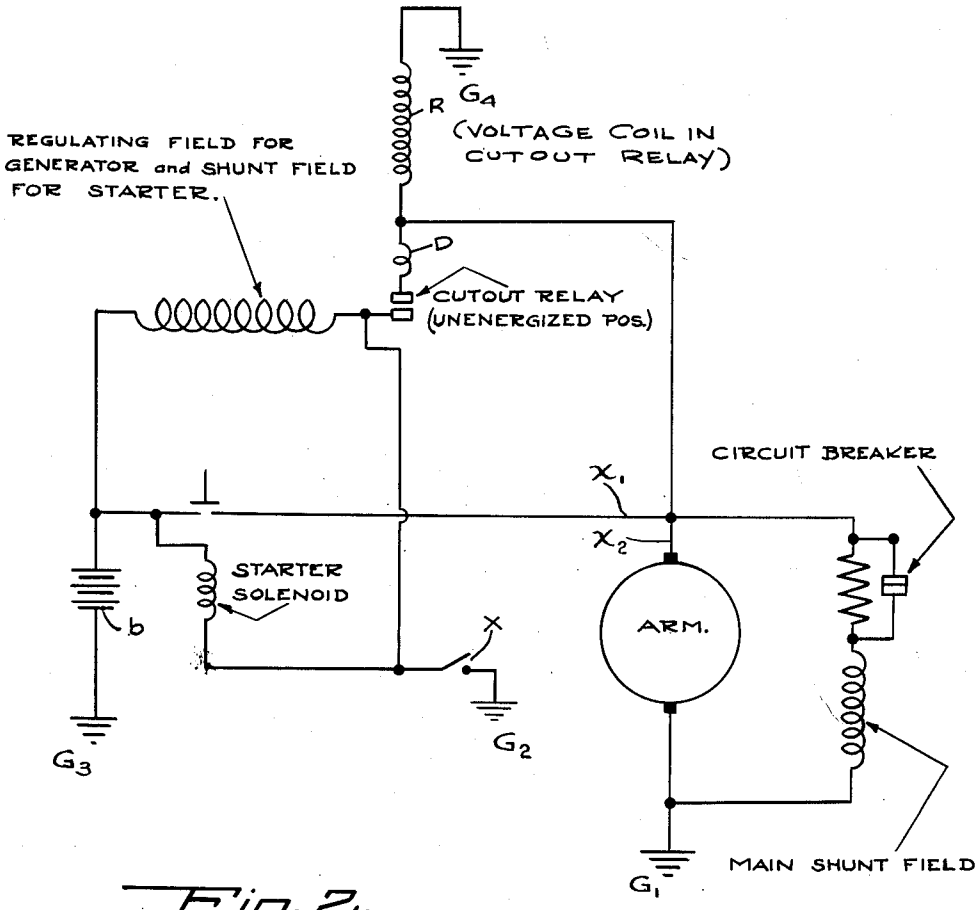


Fig. 2.

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COMBINED STARTER AND GENERATOR

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2 Claims. (Cl. 290—31)

This invention relates to a new and improved starter-generator system and has particular reference to the provision of such a system for use in accordance with small gasoline operated motors.

The principal object of the invention is to provide a new and improved starter-generator system for use in connection with small gasoline motors.

Another object is to provide a device of the type set forth which device includes means for utilizing the self-regulating field of the generator as a full shunt field during the starting of the electric motor which said device accompanies.

Another object is to provide an arrangement of the type set forth which device produces a higher starting torque than standard starter-generators.

Another object is to provide an arrangement of the type set forth which arrangement includes a flatter generator regulation characteristic than standard starter-generators.

Another object is to provide an arrangement of the type set forth which arrangement provides a less expensive winding in the many applications in which use of the series field is unnecessary.

Another object is to provide an arrangement of the type set forth that is less expensive and simpler to operate than standard starter-generators.

Another object is to provide an arrangement of the type set forth that utilizes the self-regulating field as a full field shunt during starting.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts shown and described as the preferred forms have been given by way of illustration only.

Referring to the drawings:

FIG. 1 is a schematic presentation of the starter-generator without the inclusion of a circuit breaker; and

FIG. 2 is a schematic presentation of the starter-generator with the inclusion of the circuit breaker.

Referring more particularly to the drawings wherein corresponding reference characters designate similar parts throughout, the arrangement shown in FIG. 1 comprises an armature connected through a suitable lead to a ground G_1, a main shunt field coil circuit connected across said armature, and a cutout relay or energized position connected through a suitable lead from the top of said armature.

The arrangement further includes a regulating field for the generator (or shunt field for the starter as it sometimes operates) connected through suitable leads to said cutout relay; said cutout relay being further connected through suitable leads to resistor R and thence to ground G_4. Said regulating field for the generator is further connected to the battery *b* which the system is regulating and thence to ground G_3 through suitable leads.

The arrangement also comprises a starter solenoid connected through suitable leads to the rest of the system including ground G_2, thus, completing the starter generator system.

The windings of said system are essentially the same as those of standard starter-generators with the aforementioned optional use of the series field.

The arrangement shown in FIG. 2 comprises the same

arrangement of component parts as the arrangement in FIG. 1 with the exception that said arrangement in FIG. 2 comprises a circuit breaker in addition to those components shown in FIG. 1.

Said circuit breaker is located immediately above the main shunt field of the starter-generator system and operates only when the ambient temperature rises to a predetermined limit.

In the drawings, R is the voltage coil in the cutout relay. D is the reverse current coil in the cutout relay and X is the switch for energizing starter solenoid coil and winding A.

In operation, the arrangement shown in FIG. 1 operates similarly to existing start-generator systems with the exception that the self-regulating field of the generator operates so as to be both a regulating field for the generator and a shunt field for the starter.

The field winding C is the main exciting winding used in generation.

The switch X is closed and this energizes starter solenoid coil and winding A. Starter solenoid coil A closes the starter switch to provide voltage to armature B. Winding A, when energized, provides a very strong shunt field during starting and during this period the cutout relay is open.

When the engine starts, switch X is opened, opening the starter switch and removing winding A circuit from ground G_2. As the engine speed has built up the voltage, the generated armature B voltage builds up because of self excitation in field C. At a predetermined level, the current in coil R will close the cutout relay thereby connecting the output of armature B to the battery through field A.

In operation, the arrangement shown in FIG. 2 operates similarly to the arrangement shown in FIG. 1 with the exception that the arrangement in FIG. 2 includes a circuit breaker which operates, in fact, as a current regulator. Said circuit breaker is closed during both the starting of the engine and the initial stages of generation; thus, permitting a rapid initial recharge of the battery.

During this condition of rapid charge and heavy shunt field current, the generator heat rises relatively rapidly until the predetermined safe thermal limit is reached, at which said circuit breaker opens. Then both the shunt field current and charging current drop, thereby, protecting the generator thermally and protecting the battery from overcharge.

This condition prevails until the generator is stopped or until said circuit breaker recloses beginning the cycle again. Excess reverse current during operation at idle speed with said circuit breaker open is prevented by a high setting voltage-wise on the cutout relay.

Thus, subject to these two innovations, the starter-generator operates as do existing ones.

From the foregoing, it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

I claim:

1. In a combined starter and generator for internal combustion engines, an armature, a main shunt field coil circuit connected across said armature, a second combined regulating and shunt field coil circuit and a switch and circuit connections constructed and arranged for selectively connecting said second field coil circuit to be selectively connected to said armature or said starter and to be used as a shunt field in starting and as a differential series field in generating.

2. In a combined starter and generator for internal combustion engines, an armature, a main shunt field coil circuit connected across said armature, a second combined regulating and shunt field coil circuit and a switch and circuit connections constructed and arranged for

selectively connecting said second field coil circuit to be selectively connected to said armature or said starter and to be used as a shunt field in starting and as a differential series field in generating, and a circuit breaker across said resistor in the main shunt field circuit and constructed and arranged to be opened by heat resulting from operation of the generator for lowering the generator output to prevent overcharge of the battery and overheating of the generator.

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