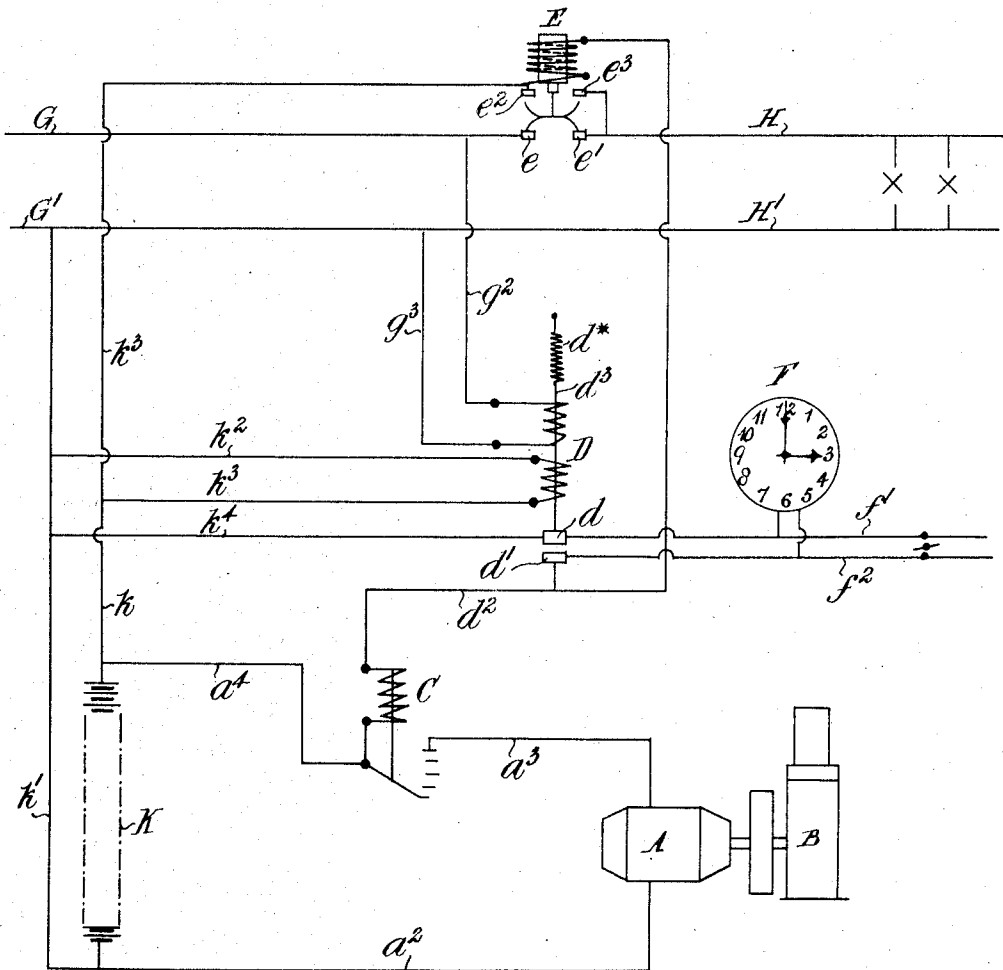


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 AUTOMATIC CONTROL OF ELECTRIC GENERATING SETS.  
 APPLICATION FILED FEB. 18, 1918.

1,386,972.

Patented Aug. 9, 1921.



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# UNITED STATES PATENT OFFICE.

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## AUTOMATIC CONTROL OF ELECTRIC GENERATING SETS.

1,386,972.

Specification of Letters Patent.

Patented Aug. 9, 1921.

Application filed February 18, 1918. Serial No. 217,874.

*To all whom it may concern:*

Be it known that we, LEO SUNDERLAND and GILBERT CECIL PILLINGER, subjects of the King of Great Britain and Ireland, and residents of Westminster, county of London, England, have invented a certain new and useful Improvement in Automatic Control of Electric Generating Sets, of which the following is a specification.

The purpose of this invention is to provide an electric generating plant to act as a stand-by or emergency set for ships, public buildings, and any other purposes, and to so arrange the system that immediately one source or the usual source of electric supply fails or falls below a predetermined voltage, the emergency set automatically starts up and comes into operation, and furnishes or continues the supply of electric energy to the lights or any other current-consuming apparatus. Further, in order to insure that the apparatus is always kept in good running order, means are made whereby the automatic set starts up, runs and stops at any predetermined time for a predetermined period, when, should the apparatus fail to work or be put out of order through any cause, visual or audible indication is given.

The invention, by way of example, is hereinafter described as an emergency or stand-by for lighting purposes, and the set or plant comprises an internal combustion engine, electrical generator, starting battery (which may be a primary or a secondary battery) and switchboard containing the necessary relays and automatic switching apparatus as shown on the accompanying diagrammatic drawing.

In the accompanying diagram:—

A is the dynamo or electric generator.

B is the internal combustion engine.

C is the magnetically controlled motor starting switch.

D is the relay having two separate windings, one of which may be wound in opposite polarity to counteract the other, one winding being connected to the usual source of supply, and the other connected to the battery or auxiliary source of supply.

E is the magnetically controlled change-over switch.

F is the time switch.

G and G' are the usual or ordinary source of supply.

H and H' are mains for supplying the lighting or other current-consuming device on the installation.

K is the starting battery or secondary source of electric supply.

The operation of the system is as follows:—

Let us assume that the installation is working under normal conditions, that is, current is being supplied to it from a source by means of the cables G and G' through the contacts *e* and *e'* on the magnetically controlled change-over switch E to the cable H, returning through the cable H'. The contacts *d* and *d'* of the relay D will be held apart by the core or armature *d*<sup>3</sup> of the relay by means of a spring *d*<sup>\*</sup>, the two windings on said relay being energized through the wires *g*<sup>2</sup>, *g*<sup>3</sup>, *k*, *k'*, *k*<sup>2</sup>, *k*<sup>3</sup>. These coils being wound in opposite directions neutralize the magnetic effect of each other, consequently there is no pull on the core or armature *d*<sup>3</sup> of the relay D. The spring *d*<sup>\*</sup> therefore holds the contacts apart.

Now let us assume that the source of supply G and G' failed or fell below a predetermined voltage. It will be seen that the magnetism of the two coils on the relay D no longer neutralize each other, by reason of the fact that the pressure in one has fallen, the result being that the other coil exercises a pull on the core *d*<sup>3</sup>, closing the two contacts *d* and *d'*, allowing current to pass along the wires *k'* and *k*<sup>4</sup> through said contacts *d* and *d'*, along the wire *d*<sup>2</sup> to the solenoid on the magnetically controlled motor starting switch C, causing the arm of this switch to rise, when current will pass from the battery K or other secondary source of electricity to the dynamo A, through the cables *a*<sup>2</sup>, *a*<sup>3</sup> and *a*<sup>4</sup>. This current will cause the dynamo A to act as an electric motor, which, being coupled to the internal combustion engine B, rotates this also until it fires and starts up, when it will then drive the dynamo A as a generator, sending current back through the wires *a*<sup>2</sup>, *a*<sup>3</sup> and *a*<sup>4</sup>, *k'* and *k*<sup>3</sup>. Meanwhile the coil of the magnetically operated change-over switch E is also energized, causing said change-over switch to operate, breaking the contacts *e* and *e'* and making the contacts *e*<sup>2</sup> and *e*<sup>3</sup>, thereby enabling the current which is passing through the wires *k*<sup>3</sup> to pass through the

contacts  $e^2$  and  $e^3$  to the cables H and H' which supply the lighting or other apparatus on this installation.

The change-over switch is maintained in position  $e, e'$  by the weight of the solenoid and arm of the switch itself, the coil E only being in circuit when the contacts  $d$  and  $d'$  are together, or when the contacts of the time switch are closed and the plant is working. The time switch F, which may be of any standard design, is set to start and stop the plant at a predetermined time each day. The contacts of the time switch are connected in parallel with the contacts  $d$  and  $d'$  of the relay D, and it will be seen, therefore, that when the time switch makes contact it will close the circuit  $k$  and  $k^4$  and  $d^2$ , causing the controller to operate and start up the plant. Likewise, when the contacts of the time switch break, the arm of the controller C will drop and current will cease to pass along from the generator to  $a^4$  and  $k^3$ . It may also be arranged that switches or pushes may be connected at any part of the installation for operating the relay D at any moment that may be desired through the wires  $f'$  and  $f^2$ . Should a breakdown of the main source of supply occur at the time during which the time clock is set to operate, the clock switch would make contact but not affect the operation of the plant should it be already running.

The relay may be modified, that is to say, instead of having two separate windings, it may be wound with one only, which would hold the contacts of the relay apart, but when the voltage fell below a predetermined point the spring acting against the magnet would close the contacts.

Having now described our invention, what

we claim as new and desire to secure by Letters Patent of the United States is:—

1. In an automatic electric generating system, the combination with the main line and secondary source of electrical energy, of a motor-generator, a prime mover therefor, an auxiliary circuit connected with the main line, and automatic means whereby the failure of voltage in the main line will cause the operation of the motor generator to furnish current thereto through the auxiliary circuit.

2. In an automatic electric generating system, the combination with the main line and a secondary source of electrical energy, of a change-over switch in the main line, an auxiliary supply circuit connecting with the main line directly and also through the said change-over switch, a combined motor-generator unit in the supply circuit, a starting circuit connected with the terminals of the secondary source of electrical energy and also with the motor-generator unit, a magnetically controlled motor starting switch in the starting circuit, a relay controlled switch also in the starting circuit, a differential relay for controlling the operation of said relay controlled switch, said differential relay including oppositely wound coils respectively connecting with the main line and the secondary source of electrical energy, and means electrically connected with the starting circuit for actuating the change-over switch to cut in the auxiliary supply circuit on the main line.

In testimony whereof we have affixed our signatures hereto this 31st day of December, 1917.

LEO SUNDERLAND.  
GILBERT CECIL PILLINGER.