

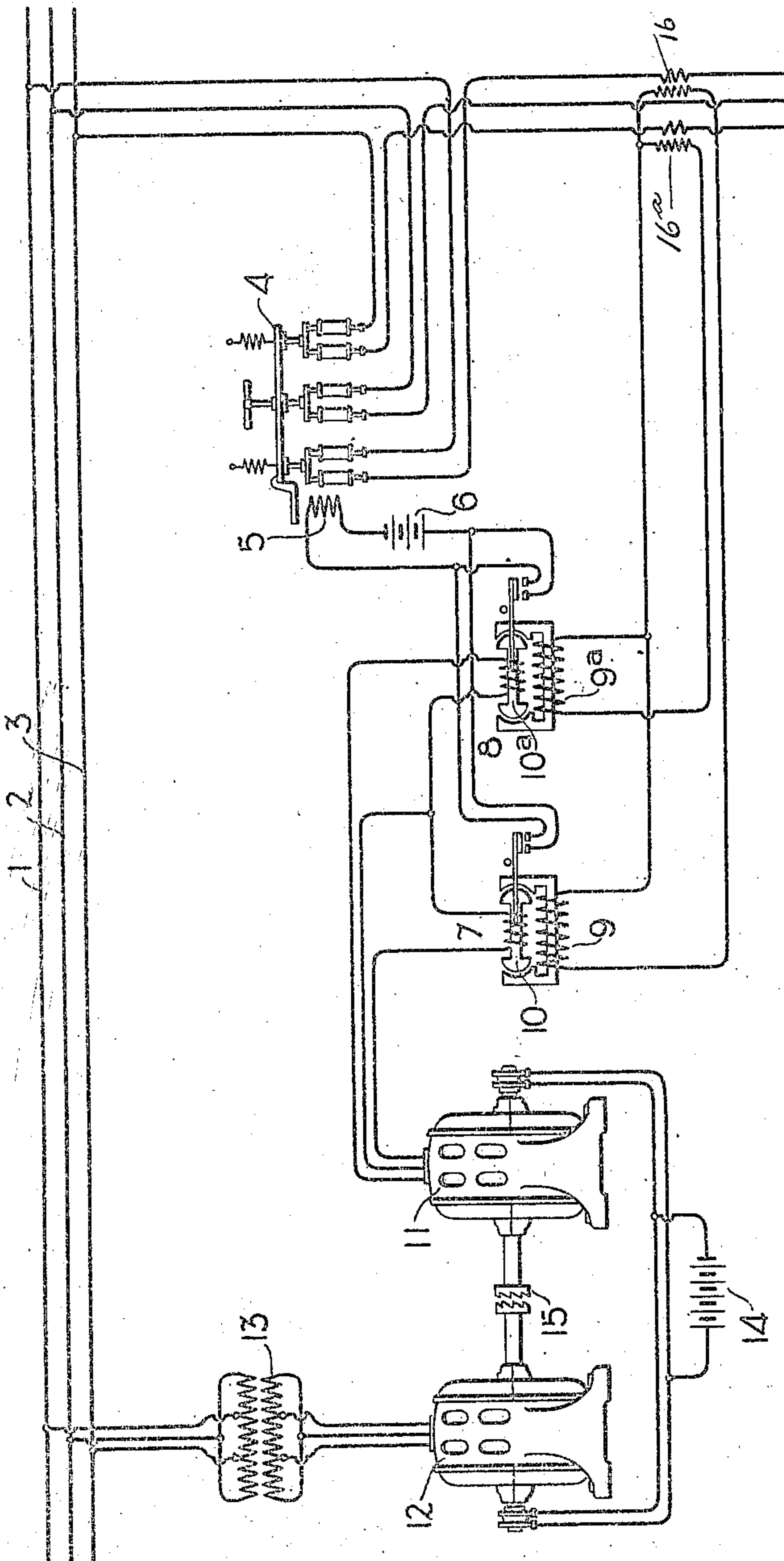
No. 819,627.

PATENTED MAY 1, 1906.

E. F. W. ALEXANDERSON.

PROTECTIVE MEANS FOR ALTERNATING CURRENT SYSTEMS.

APPLICATION FILED JULY 16, 1903.



Witnesses

Harry M. Tilden.
John W. Fry &

Inventor.

Ernst F. W. Alexanderson
by *Alb. H. Davis*

UNITED STATES PATENT OFFICE.

ERNST F. W. ALEXANDERSON, OF SCHENECTADY, NEW YORK, ASSIGNOR
TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROTECTIVE MEANS FOR ALTERNATING-CURRENT SYSTEMS.

No. 819,627.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed July 16, 1903. Serial No. 166,761.

To all whom it may concern:

Be it known that I, ERNST F. W. ALEXANDERSON, a subject of the King of Sweden and Norway, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Protective Means for Alternating-Current Systems, of which the following is a specification.

When several transmission-lines are running between a main and a sub station, some provision must be made so that if a short circuit occurs in one line that line will be cut out. At the main-station end of the line the overload-relays will take care of it, but at the substation some special device must be used—for instance, reverse-current relays. A reverse-current relay can be designed in different ways, but always contains one coil carrying a current equivalent to the line-current and one coil carrying a current equivalent to the potential of the line. The relays which have been used heretofore may fail to work if the short circuit is sufficiently severe to cause the potential of the line to drop down to zero. In such a case the potential-coil would lose its current. The problem is therefore to hold up the potential some few seconds until the relay has tripped the switch. This may be accomplished in the following way:

From a potential-transformer is driven a little synchronous motor-generator set, which feeds the potential-coil of the relay with alternating current exactly the same way as that coil would have been fed directly from the potential-transformer. The motor and the generator are coupled by a clutch, which drives in one direction only and permits the generator to run free if the motor stops. When the line is short-circuited and the potential drops down, the motor will use its momentum to feed current into the short circuit and will stop very quickly; but the generator will have enough fly-wheel effect to continue its synchronous motion for some seconds and will hold up the potential on the relay until it has tripped. One motor-generator set of course will serve for all the relays of the station.

My invention therefore comprises, broadly, a system in which a cessation of potential on an alternating-current line sets free stored energy to excite the potential-coil of a re-

verse-current relay. I prefer to store the energy given up by the alternating current itself; but this would not in all cases be necessary, as the fundamental feature of the invention is to provide for a temporary excitation of the potential-coil. The several novel features will be hereinafter more fully indicated.

In the accompanying drawing is shown diagrammatically a system embodying my improvements.

1 2 3 represent bus-bars, which may be in a substation or at other points where protection against reversal of energy-flow is required.

4 represents an automatic switch controlled by a trip-coil 5, energized by a local source, as 6, the circuit of which is controlled by relays 7 8. These relays should be sufficient in number to respond to a reversal on any phase of the system. Although a triphase system is shown, the invention is applicable to any type of alternating-current system. The relays, as usual, are provided with current and potential coils, as 9 10 9^a 10^a. The potential-coils instead of being derived from a potential-transformer directly, which is the ordinary practice, are excited by a generator 11, driven by a synchronous motor 12, operated through a transformer 13.

14 is a direct-current exciter for the motor and generator. Between the motor and generator is a clutch 15, adapted to disconnect them when line-potential fails. For example, two ratchet-faced members may be held together so long as the motor is driving; but when it lags or stops the generator, under its momentum, may run ahead. Thus the energy stored in the form of momentum by the ordinary operation will maintain potential on the coils 10 10^a of the relays and in case of a reversal of current in the series coils fed by transformers 16 16^a the trip-coil of the switch or circuit-breaker will surely be operated and the alternating-current circuit broken.

Many other ways may be employed for maintaining the charge of the potential relay-coils, which will occur to a skilled engineer.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An alternating-current system compris-

ing a switch or circuit-breaker, a reverse-current device for tripping the same provided with a series coil governed by current in the system, and a potential-coil energized by an energy-storing device.

2. The combination with an alternating-current system, of a reverse-current device comprising a current-coil, a potential-coil, and means for prolonging the action of the potential-coil when potential on the line ceases.

3. The combination with an alternating-current system, of a switch or circuit-breaker, a reverse-current relay for tripping the same having a current-coil and a potential-coil, and means for prolonging the magnetization of the potential-coil under cessation of potential in the system.

4. The combination with an alternating-current system, of a switch or circuit-breaker, a reverse-current relay for tripping the same having a current-coil and a potential-coil supplied by the system, and means between the lines and the potential-coil for delaying its demagnetization under short circuit in the system.

5. The combination with an alternating-current system, of a reverse-current relay controlling the same, said relay having a current-coil and a potential-coil, and a synchro-

nously-operated source of supply for the potential-coil.

6. The combination with an alternating-current system, of a reverse-current relay controlling the same, said relay having a current-coil and a potential-coil, and a synchronous generator for energizing the potential-coil.

7. The combination with an alternating-current system, of a reverse-current relay controlling the same, said relay having a current-coil and a potential-coil, and a synchronous motor-generator for energizing the potential-coil.

8. The combination with an alternating-current system, of a reverse-current relay controlling the same, said relay having a current-coil and a potential-coil, a synchronous motor, a generator operated thereby for energizing the potential-coil, and a slip connection between the motor and generator to permit the latter to run when the former slows down or stops.

In witness whereof I have hereunto set my hand this 3d day of July, 1903.

ERNST F. W. ALEXANDERSON.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.