

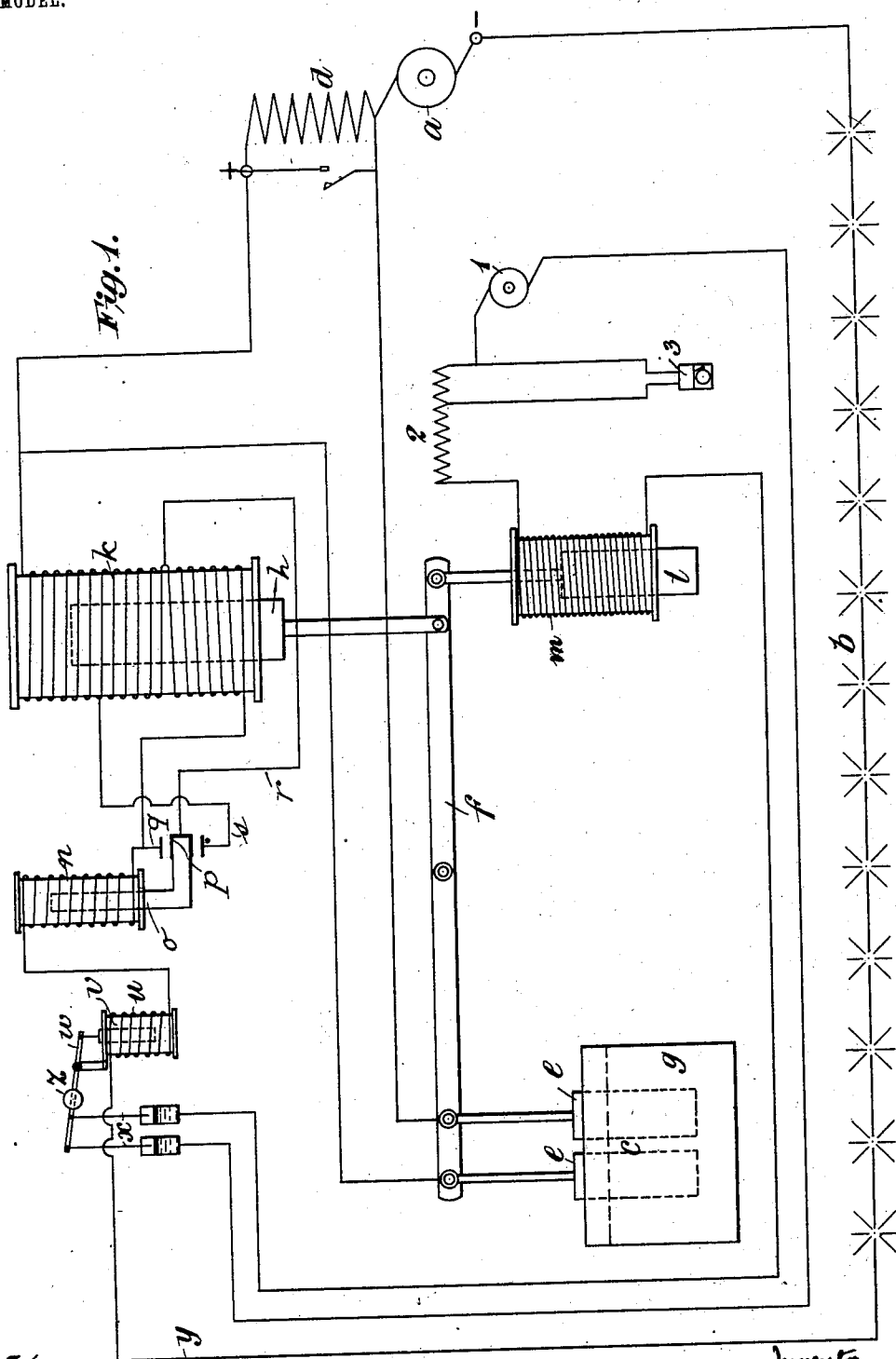
F. B. O'HANLON.

AUTOMATIC REGULATOR FOR CONSTANT CURRENT DYNAMOS.

APPLICATION FILED APR. 22, 1902.

2 SHEETS—SHEET 1.

NO MODEL.



Witnesses
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H. Van Heerenbrink

Inventor
Felix Bernard O'Hanlon
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2 SHEETS—SHEET 2.

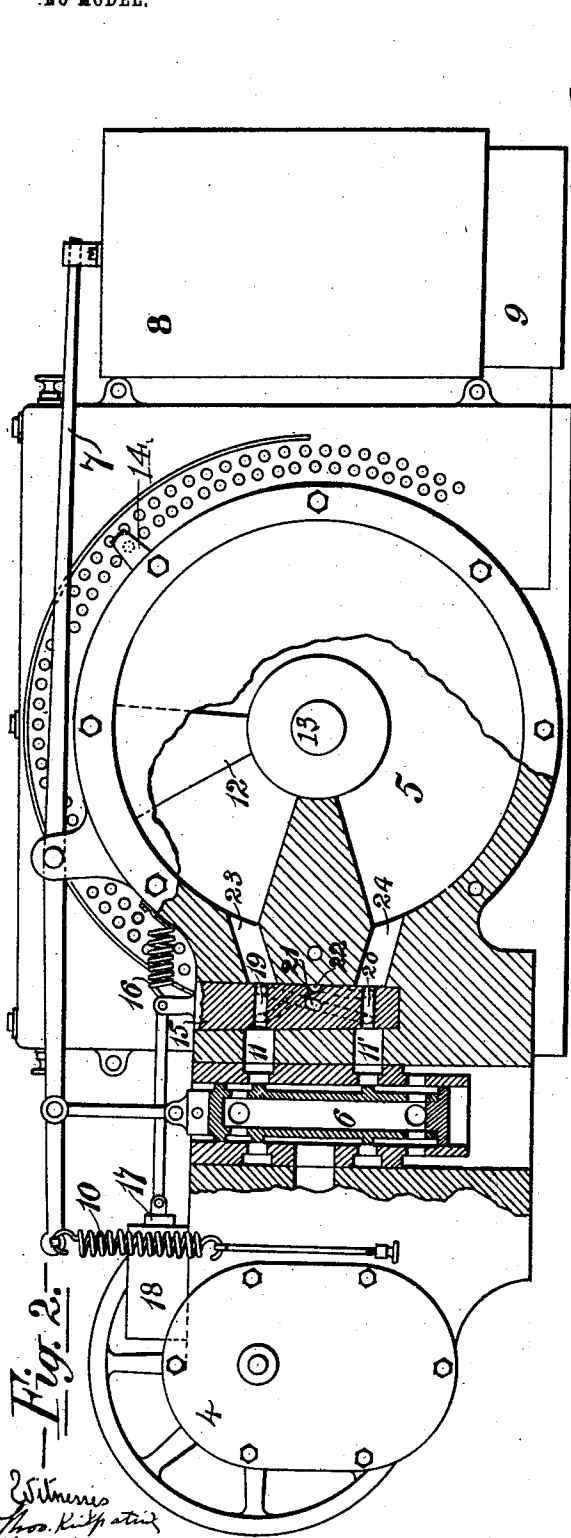


Fig. 2.

Witnesses
Thos. Kitching
H. van Heerebeek

Fig. 4.

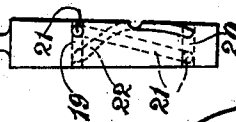


Fig. 5.

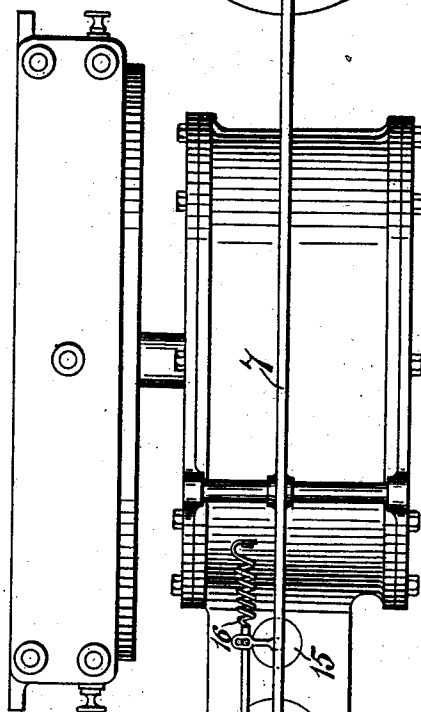
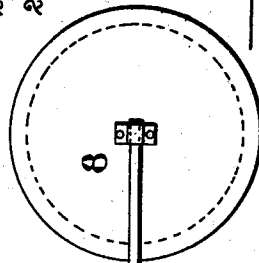
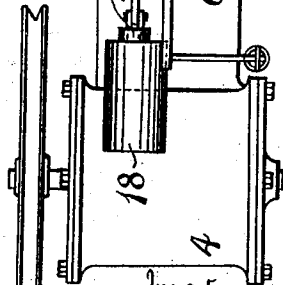


Fig. 3.



Inventor
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UNITED STATES PATENT OFFICE.

FELIX BERNARD O'HANLON, OF PORTADOWN, IRELAND.

AUTOMATIC REGULATOR FOR CONSTANT-CURRENT DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 722,535, dated March 10, 1903.

Application filed April 22, 1902. Serial No. 104,192. (No model.)

To all whom it may concern:

Be it known that I, FELIX BERNARD O'HANLON, electrical engineer, a subject of the King of Great Britain and Ireland, residing at 51 William street, Portadown, Ireland, have invented certain new and useful Improvements in Automatic Regulators for Constant-Current Dynamos, (for which I have made application for Letters Patent in Great Britain, No. 6,406, dated the 15th of March, 1902,) of which the following is a specification.

My invention relates to automatic regulators for series-wound dynamos supplying current to circuits in which the current has to be kept constant irrespective of the voltage or of the resistance of the external circuit.

The object of my invention is to provide an automatic regulator which will stop and in some cases prevent dynamos of the above type "flashing over"—that is, short-circuiting by discharging their current from brush to brush across the surface of the commutator.

Automatic regulators for increasing the strength of the field of a dynamo on an increase of the external load and weakening the field strength on a decrease of the external load, so as to maintain the current constant, have hitherto been constructed and generally consist of a mechanism operated by an electromagnet or solenoid the winding of which is in series with the main circuit. So long as the dynamo is working normally such regulators work more or less satisfactorily; but all series dynamos, and especially those of the open-coil type, are subject to flashing over, and when this occurs the current in the external circuit is reduced and the regulator immediately strengthens the field. Although the flash weakens the current in the circuit it greatly increases the current in the armature of the dynamo, and if the field is strengthened, as occurs with the ordinary regulators, the flashing over will continue and, indeed, be made worse. It thus becomes almost impossible for the machine to recover itself unaided.

My invention consists in employing in conjunction with field-regulating devices of the ordinary types an additional electromagnet operating a mechanical or electrical relay device adapted to automatically produce weakening of the field of the generator when the

current has fallen below a given value, and so give the generator a tendency to recover when flashing over occurs.

The accompanying drawings illustrate two methods of carrying my invention into effect.

Figure 1 is a diagrammatic view showing an electric method of regulation. Figs. 2 and 3 show my invention applied to a mechanical regulator.

In carrying my invention into effect according to one modification I provide any suitable form of regulator, such as that shown in Fig. 1, which operates as follows: A dynamo *a* supplies current to a circuit in which are a number of arc-lamps *b*. A variable resistance *c* is placed in shunt across the dynamo field *d*. This variable resistance consists of a pair of plates *e*, attached to one end of a pivoted lever *f*, which when operated raises or lowers the plates out of or into a vessel *g*, containing a suitable liquid. The lever is operated and the resistance in the circuit increased or decreased by a solenoid *k*, the core or armature *h* of which is attached to the opposite end of the lever *f* from that to which the plates *e* are attached, so that when the core is attracted the plates are put farther into the liquid and the resistance in shunt across the field diminished when the attraction of the solenoid for its core diminishes, the core falls, and the plates are lifted out of the liquid, thus increasing the resistance. The current in the main circuit after passing through the winding of solenoid *k* passes to a second solenoid *n*, fitted with a core *o*, to which is attached a contact-plate *p*, by means of which the direction of current passing through solenoid *k* is controlled. When the current in the main circuit is strong enough to cause the solenoid *n* to attract its core, the plate *p* is held in contact with the end of a conductor *q*, and the current after passing directly through about two-thirds of the winding of the solenoid *k* passes by way of a conductor *r*, contact-plate *p*, and the conductor *q* to the winding of solenoid *n*. When the current in the main circuit, however, is not strong enough to cause the solenoid *n* to attract its core, the core falls and the plate *p* makes contact with the end of a conductor *s*. This causes the current to alter its course, and instead of passing through two-thirds of

solenoid k it passes directly through only about one-third and then by way of conductor s , contact-plate p , conductor r through about another third of the winding of solenoid k , but in the opposite direction to that passed through first, the remaining third being cut out of the circuit, and neutralizes the effect of the solenoid k on the core h , the current then passing to the solenoid n by way of conductors t and q . The windings of the solenoids n and k are arranged so that when the dynamo is working normally they both attract their cores, and the plates e are to a certain extent immersed in the liquid, thus shunting a certain amount of the current across the field. If the current increases, the solenoid k attracts its core still more, thus putting more of the plates e into the liquid and reducing the resistance in the shunt-circuit, thereby weakening the field and tending to bring the current back to the normal. When the current in the main circuit falls, as it does when a "flash over" occurs, both the solenoids n and k fall and the plates e are raised out of the liquid, sending all the current through the field. This, instead of tending to return the current to the normal, tends to continue and increase sparking. To obviate this, I employ in combination with a regulator of the above type the following arrangement: The current after passing through the solenoid n is led through a third solenoid u , fitted with a core v , which has a lever w attached to it. This lever is pivoted near its mid-point and carries a weight z on the opposite end from the core v , which weight is adapted to overbalance the core when the attraction of the solenoid diminishes beyond a certain limit. A contact-making device x is attached to the same end of lever w as the weight z , which is adapted to complete an auxiliary circuit. This auxiliary circuit is supplied with current from any convenient source, such as a battery or small dynamo 1, and passes, when the circuit is made from the source through a suitable resistance 2, across part of which a warning-bell 3 may be placed, to a solenoid or electromagnet m , having a core or armature l , which is attached to and adapted to operate the lever f , carrying the plates e . After passing through the windings of solenoid m the current in the auxiliary circuit passes by way of the contact-maker x back to the source. When a "flash over" occurs, the current in the main circuit weakens and the solenoid u is no longer able to hold down its core against the weight z . The weight therefore falls and the auxiliary circuit is made. This energizes the solenoid m and causes it to attract its core l , thereby causing it to operate the lever f and return the plates e to the liquid, thus shunting most of the current across the dynamo-field and keeping the field weak, which will be found to stop and prevent any recurrence of the flashing over. The current in the main circuit after traversing the windings of solenoid u is led

by a conductor y through the lamps b back to the dynamo-brush.

Figs. 2 and 3 illustrate my invention as applied in combination with a mechanical dynamo-regulator operating as follows: A rotary pump 4 is driven by a belt from the shaft of the dynamo-armature and operates a small fluid-motor 5, adapted to be driven in either direction. The direction of motion of this motor is controlled by a piston-valve 6, operated by a lever 7, one end of which is attached to the core 8 of an electromagnet 9, the winding of which is in series with the main circuit, the other end of the lever being attached to and held down by a spring 10. When the current in the main circuit is normal, the pull of the spring on the lever is counterbalanced by the attraction of the electromagnet for its core and the piston-valve is held in a mid-position such that the fluid can circulate freely and return to the reservoir without entering the motor. When the current rises above the normal, the attraction of the electromagnet 9 for its core overbalances the pull of the spring 10 on the lever, the piston-valve is thereby lifted, and the fluid is forced into the motor through the port 11, causing the piston 12 to rotate in a clockwise direction. The shaft 13 of this piston has a rheostat-arm 14 attached to it, which when it is rotated cuts out a resistance which is put in shunt across the field, thereby weakening the field. This tends to reduce the current and bring it back to normal. When the current in the main circuit weakens, the electromagnet 9 is unable to hold down its core against the spring 10, which therefore pulls down the piston-valve, forcing the fluid to enter the motor through port 11' and causing the piston 12 to rotate in a counter-clockwise direction with the rheostat-arm, putting in the resistance and strengthening the field. This, as shown above, causes "flashing over" to continue if it has been the original cause of the weakening of the current. To obviate this I interpose between the piston-valve and the motor a two-way plug-valve 15, controlled by a spring 16, and the core 17 of an electromagnet 18. The winding of this electromagnet is in series with the main circuit and is so arranged as to be able to hold the plug-valve 15 against the spring 16 while the current in the circuit is normal in such a position that the ports or passages 19 and 20 through the valve are in line with ports 11 and 23 and 11' and 24, respectively, and allow of communication between the ports of the piston-valve and the ports of the motor-cylinder. When, however, the current in the circuit weakens to any extent—as, for instance, when a "flash over" occurs—the spring 16 overcomes the attraction of electromagnet 18 for its core and rotates the plug-valve until the inclined transverse ports 21 and 22 allow of communication between ports 11' and 23 and 11 and 24. This causes the piston and rheostat to rotate in a clockwise direc-

tion and still further weakens the field of the dynamo, thereby stopping the flashing over. Stops may be provided at each end of the travel of the plug-valve to insure of communication between the ports being effected.

It will be seen that the auxiliary device does not interfere with the normal working of the machine. It is designed to come into operation only when the current falls a certain amount—say about ten per cent. No amount of increase in the external load of a constant-current dynamo will make the current fall to such an extent. Even if the dynamo were suddenly switched from running light onto a circuit taking its maximum output the current drop would not in all probability be more than five per cent. The only cause which could possibly make the fall as much as ten per cent. in the external circuit would be a “flash over” or shunt-circuit across the brushes. When a “flash over” occurs, the current in the external circuit is greatly reduced, and most of the lamps will in all probability go out or have their arcs very much shortened. The auxiliary device, however, immediately weakens the field, and the action of the dynamo is practically the same as if the machine were starting from rest, the full load being very soon reached again.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with a regulator for a constant - current dynamo, a relay device adapted to automatically reduce the current

passing through the field of the dynamo against the action of the regulator when a “flash over” occurs; substantially as described.

2. In combination with a regulator for a constant-current dynamo, a variable resistance in shunt across the field of the dynamo operated normally by the regulator, and a relay device adapted to operate the variable resistance in opposition to the regulator but only when the current in the external circuit has been weakened by a “flash over” occurring; substantially as described.

3. In combination with a mechanical regulator for a constant-current dynamo, an electrical relay device adapted to reverse the action of the regulator, and to weaken the field-current when a “flash over” has occurred; substantially as described.

4. In combination with a fluid-motor regulator for a constant-current dynamo, a plug-valve controlling the flow of fluid to the motor, an electrical relay device for stopping “flashing over,” consisting of an electromagnet in the main circuit, and a spring, both adapted to operate said plug-valve and reverse the action of the regulator only when a “flash over” occurs; substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

FELIX BERNARD O'HANLON.

Witnesses:

ALBERT E. BARKER,
FRANCIS J. BIGNELL.