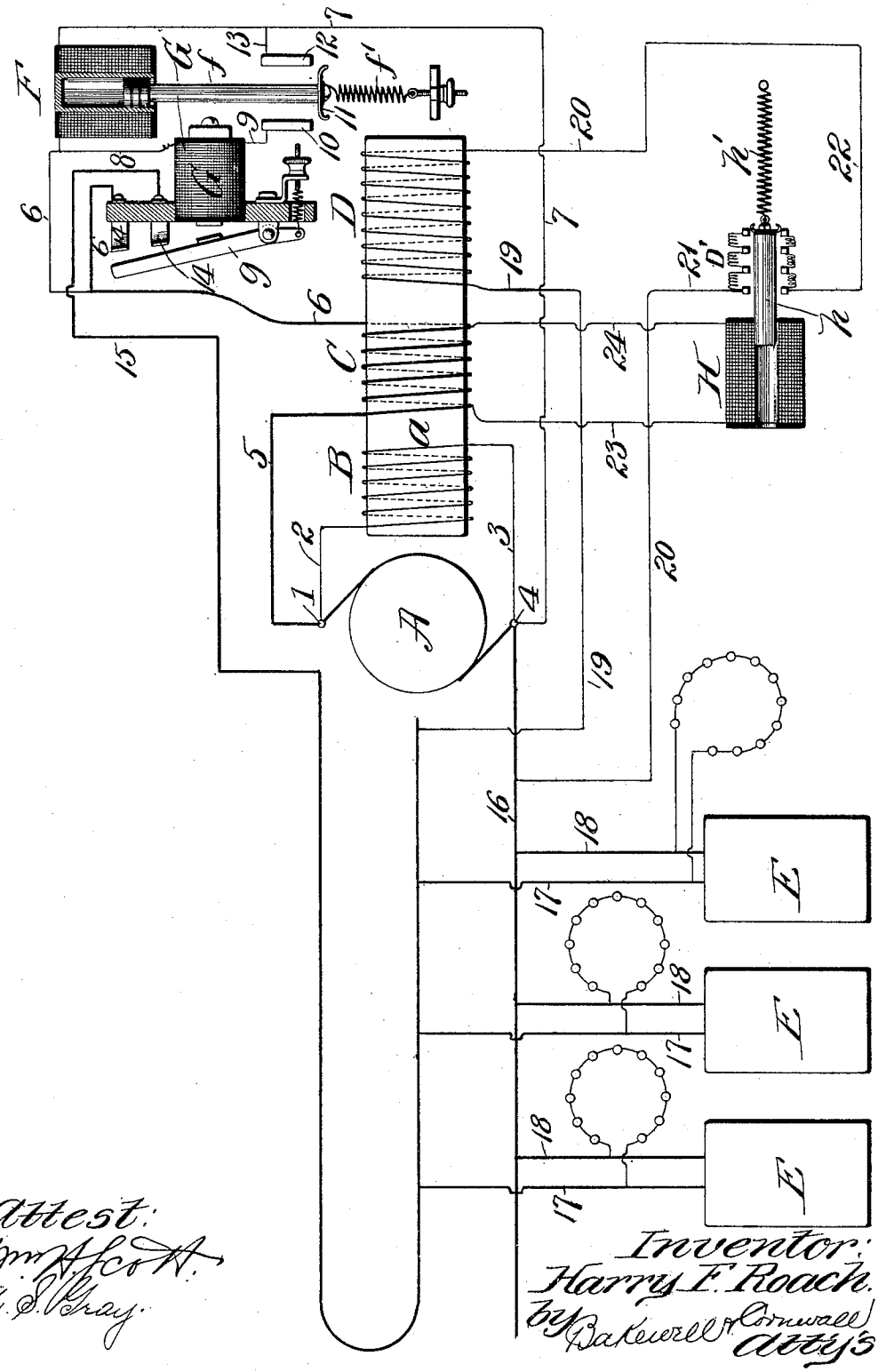
No. 656,266. Patented Aug. 21, 1900.

H. F. ROACH.

SYSTEM OF ELECTRICAL DISTRIBUTION.

(Application filed July 10, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

HARRY F. ROACH, OF ST. LOUIS, MISSOURI.

SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 656,266, dated August 21, 1900.

Application filed July 10, 1899. Serial No. 723,307. (No model.)

To all whom it may concern:

Be it known that I, HARRY F. ROACH, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Self-Regulating Dynamos, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing forming part of this specification.

This invention relates to a self-regulating dynamo, and particularly to that class in which the armature of same is driven at varying speeds, such as developed by the application of any variable-speed power, such as locomotive-driving machinery, &c.

The object of this invention is to provide a self-contained self-regulating dynamo which requires little or no attention and one which at all times is in readiness to be automatically thrown into operation without requiring manual manipulation of switches of any sort, said dynamo likewise automatically cutting in the working circuit when it has developed sufficient electromotive force.

With this object in view the invention consists in the construction, arrangement, and combination of the several parts, all as will hereinafter be described and afterward pointed out in the claims.

In the drawing the figure represents a diagrammatic view of the invention, illustrating an arrangement of a dynamo subject to variable armature speeds and circuits connected with said dynamo and a means connected therewith to automatically regulate the current-output of the dynamo and to maintain the same practically constant with a working circuit and batteries in multiple.

In said drawing, A indicates the dynamo, and *a* the field thereof.

B is the shunt-winding, which is in circuit with the main-circuit wires connected to the pole-terminals of the dynamo, and C indicates a series winding which is wound in the same direction as the shunt-winding B, as indicated by the arrows.

D indicates what I will term for the sake of distinction the "battery-winding," although said winding is in reality the main exciting-coil of the field and is energized partly by the main circuit under certain conditions and partly by batteries under other conditions.

The batteries which I have marked E and which in number may be one or more are in multiple circuit with the main dynamo-circuit and the winding D.

F indicates a solenoid in the armature-circuit, which solenoid constantly receives current whenever the dynamo is running and tends to move its armature *f* against an opposing spring *f'* and complete the circuit when the armature-circuit is strong enough for that purpose through a magnet G to attract an armature switch-blade *g* in order that the working circuit may be established only when the armature-circuit has sufficient value to be used in the working circuit. The object of this circuit maker and breaker in the working circuit is to cut in and cut out the working circuit when above and below predetermined voltages. The solenoid H is also constantly energized from the working circuit in such manner that its armature *h* is pulled against a spring *h'*, and carrying suitable contacts will cut in or cut out resistance D' to or from the battery-winding D. This solenoid H and its coöperating spring are designed to be operative to increase the range of regulation of the dynamo in addition to the self-regulating features of the coils B, C, and D, and this resistance D' in battery-coil D is practically normal within certain ranges, beyond which range the resistance is cut in or cut out, as the case may be, to assist in the regulation. In other words, this resistance device serves to establish new proportions between the windings of the battery-coil and the series and shunt coils when the armature reaches or exceeds a predetermined high speed.

The operation of the dynamo is as follows: The shunt and series coils being wound in the same direction oppose the battery-coil D, which battery-coil is the main exciting-coil of the field and is sufficiently energized at all times to insure the magnetization of the field of the dynamo, and thereby starting the current upon the rotation of the armature. Immediately upon the rotation of the armature the current generated by the dynamo is distributed through the shunt and series circuits and produces an opposing magnetiza-

tion of field, which results in partially neutralizing the effect of the coil D. It will of course be understood that the windings are so proportioned that at a given speed of rotation of the armature a given magnetic flux will be produced to insure the generation of a current of electricity having a predetermined electromotive force, at which point the solenoid F, shunted across the armature-circuit, will be energized sufficiently to cut in the working circuit. The batteries serve as additional features in maintaining a constant potential in the working circuit and are preferably connected in multiple circuit with said dynamo and its connections.

The winding D, which I have called the "battery-winding," is of practically-constant potential and preferably has in series or otherwise a resistance D′, which is variable only when the rotation of the armature is so rapid as to make the regulation of its circuit uncertain with respect to the coils B and C. In other words, I prefer that the coil D shall be normally effective at its full value, and in this normal condition the dynamo is regulated first by the shunt-coil B opposing the coil D in proportion to the speed of rotation, which coil B is assisted in such opposition by the series coil C, whose value varies in proportion to the load carried. However, when the armature of the dynamo is rotated at a high speed I prefer to cut in this resistance D′, depending upon the strength of the working circuit for the purpose of increasing the range of the machine and lessening the value of coil D and regulating the dynamo beyond the range of regulation by the coils B and C, which had heretofore taken care of such regulation independent of the resistance mentioned. This is accomplished by the solenoid H, which is energized by the working circuit under such conditions as to cut in and out resistance from the battery-coil D as required. By decreasing the voltage from the coil D, which is accomplished by the above switch, and causing it to pass through the respective resistances there is a tendency to cut down the machine by the partial neutralization of the field and maintaining such output constant. In fact, it is possible to use the solenoid H to assist in the regulation of the dynamo within a certain range under and up to a certain speed, or solenoid H and its controlled resistance may be employed in connection with coils B and C to cover a range above and beyond a certain high speed, which excessive high speed could not be well taken care of by the coils B and C of themselves.

It will be obvious that coil D may be a high-resistance coil and that its separate excitation gives to it what might be termed a "fixed value," in that it is energized by a current of practically-constant potential. I will now describe the several circuits leading to and from the several coils in order that the same may be followed on the drawing.

Starting from pole 1 of the dynamo, wire 2 leads to coil B and wire 3 leads from said coil to the other pole 4 of the dynamo. This constitutes the circuit which I have termed the "shunted-armature" circuit. From pole 1 leads a wire 5 to the series coil C, from which series coil leads a wire 6 to solenoid F, while the wire 7 runs from said solenoid back to pole 4 of the dynamo. Upon the energization of solenoid F wire 8, leading to magnet G, connects by wire 9 to terminal 10 and through contact 11 on the armature *f* of the solenoid to terminal 12 and wire 13 to return-wire 7. This energization of magnet G throws the switch-blade *g*, so that wire 6 is then connected through terminal 14 and said switch-blade to the supply-wire 15 of the working circuit. 16 indicates the return-wire of the working or main circuit, and the batteries E are arranged in multiple with this circuit, being connected thereto by means of the wires 17 and 18, respectively. Wire 19 leads from supply-wire of working circuit or from positive pole of battery to coil D, and wire 20 connects the other end of said coil with return-wire or negative pole of battery. Solenoid H is connected with the armature-circuit by wires 23 and 24.

I am aware that minor changes in the arrangement, construction, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

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

1. The combination with a dynamo and the armature and working circuits, of a separately-excited field-coil for the dynamo, and connected to the working circuit, of a shunt-coil opposed to said separately-excited field-coil, a series coil for assisting the shunt-coil in its opposition, both of said last-mentioned coils being in the armature-circuit, and means consisting in an electroresponsive device shunted across the armature-circuit for cutting in and cutting out said working circuit at predetermined voltages; substantially as described.

2. The combination with a dynamo and its circuit, of a separately-excited field-coil therefor, a shunt-coil opposed to said separately-excited field-coil, a series coil for assisting the shunt-coil in its opposition, resistance in the circuit of the separately-excited field-coil, and means energized by the dynamo-circuit for cutting in and cutting out said resistance; substantially as described.

3. The combination with a dynamo and the armature and working circuits, of a separately-excited field-coil for the dynamo, and connected to the working circuit, of a shunt-coil opposed to said separately-excited field-coil, a series coil wound in the same direction as the shunt-coil and for assisting the shunt-coil in its opposition, both of said last-mentioned coils being in the armature-cir-

cuit, means shunted across the armature-circuit for cutting in and cutting out said working circuit at predetermined voltages, resistance in the circuit of the separately-excited field-coil, and means energized by the armature-circuit for cutting in and cutting out said resistance; substantially as described.

4. The combination with a dynamo and its circuit, of a battery in multiple with said circuit, a field-coil which is separately energized by said battery, an armature shunt-coil in the field which is opposed to said battery-coil, and a differential series coil in said field wound in the same direction as the shunt-coil for variably assisting the shunt-coil in its opposition; substantially as described.

5. The combination with a dynamo and its circuit, of a battery in multiple with said circuit, a field-coil which is separately energized by said battery, an armature shunt-coil in the field which is opposed to said battery-coil, a differential series coil in said field for variably assisting the shunt-coil in its opposition, resistance in the circuit of said separately-excited field-coil, and means energized by the dynamo-circuit for cutting in and cutting out said resistance; substantially as described.

6. The combination with a dynamo and its armature-circuit, of a working circuit, a switch for cutting in and cutting out said working circuit, a solenoid in the armature-circuit for operating said switch at predetermined voltages, batteries in multiple with the working circuit, a field-coil for the dynamo which is constantly energized by said batteries, resistance in said battery-circuit, a solenoid for cutting in and cutting out said resistance, said solenoid being energized by the armature-circuit, a shunt-coil in the field opposing said separately-excited or battery coil, and a differential series coil likewise in said field, opposing said battery-coil; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 30th day of June, 1899.

HARRY F. ROACH.

Witnesses:
WM. H. SCOTT,
A. S. GRAY.