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No. 776,223. PATENTED NOV. 29, 1904.

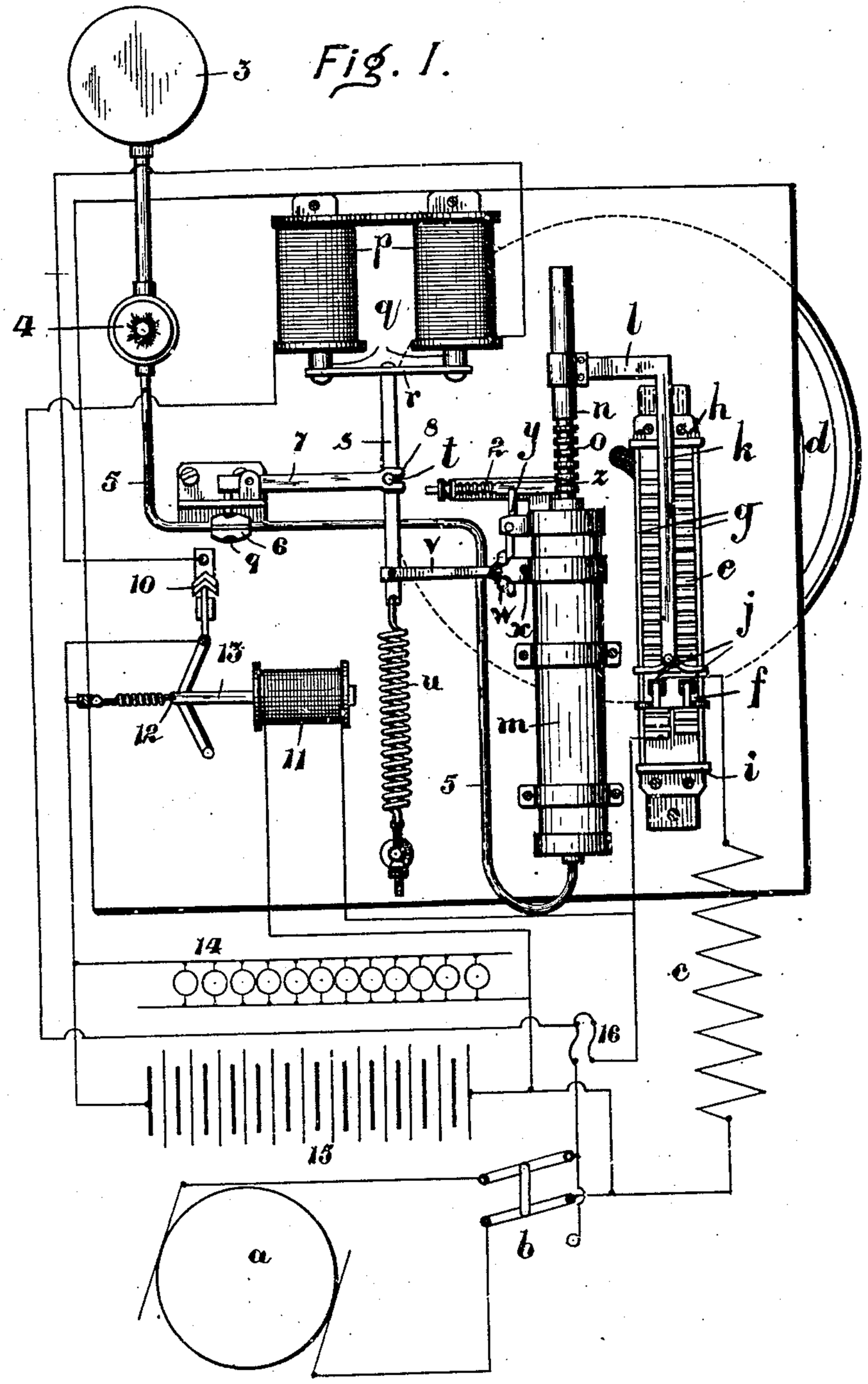
I. DEUTSCH.

MEANS FOR CONTROLLING THE VOLTAGE FROM ELECTRIC GENERATORS.

APPLICATION FILED APR. 30, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

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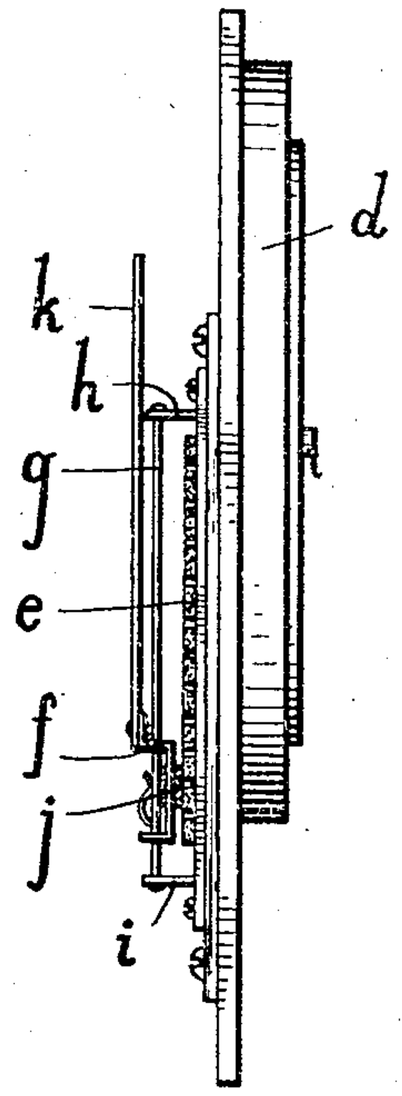

Fig. 2.

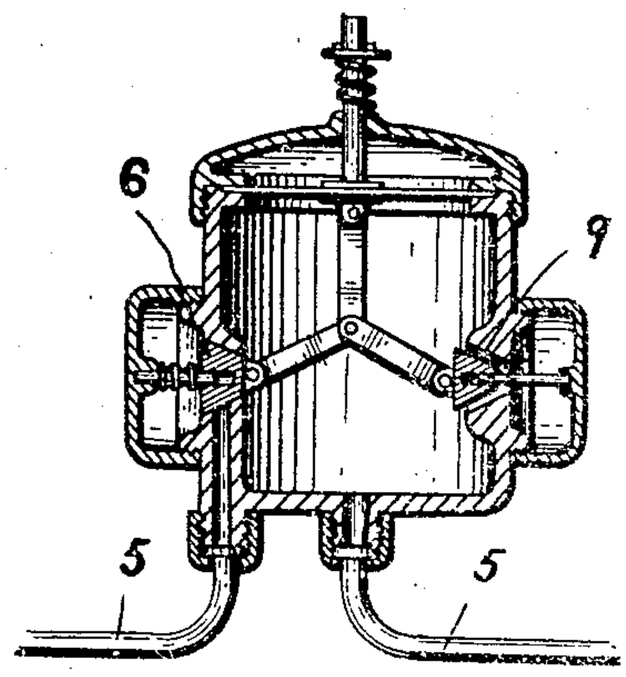

Fig. 3.

Witnesses.

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No. 776,223. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

ISIDOR DEUTSCH, OF MONTREAL, CANADA, ASSIGNOR TO ELECTRIC AND TRAIN LIGHTING SYNDICATE, LIMITED, OF MONTREAL, CANADA, A CORPORATION OF CANADA.

MEANS FOR CONTROLLING THE VOLTAGE FROM ELECTRIC GENERATORS.

SPECIFICATION forming part of Letters Patent No. 776,223, dated November 29, 1904.

Application filed April 30, 1903. Serial No. 155,080. (No model.)

To all whom it may concern:

Be it known that I, ISIDOR DEUTSCH, a citizen of the United States of America, residing at Montreal, in the district of Montreal, in the Province of Quebec, Canada, have invented certain new and useful Improvements in Means for Controlling the Voltage from Electric Generators, of which the following is a specification.

My invention relates to improvements in means for controlling the voltage from an electric generator, particularly those generators subject to sudden variations in speed; and the object of the invention is to cheapen the construction of such devices and to provide a noiseless mechanism which shall be positive as a regulator in its operations at a minimum expenditure of electric energy; and it consists, essentially, of a dynamo, a rheostat in the shunt field-circuit of said dynamo, a cylinder and piston operating therein having a rod preferably provided with annular grooves, a connecting-arm from said piston-rod to the contacts having connection with said rheostat, a solenoid, and suitable admission and exhaust valves and arms for the cylinder, the various parts being constructed and arranged in detail, as hereinafter more particularly described.

Figure 1 is an elevation of my arrangement of parts and shown partially diagrammatic to point out the connections. Fig. 2 is a side elevation of a portion of the mechanism, showing the contact-points. Fig. 3 is a sectional view of the admission and exhaust valves.

In the drawings, *a* is the dynamo designed to furnish the current.

b is the pole-changer, connected, as shown, to the dynamo *a* and to the circuit and designed to reverse brush connection with the reversal of rotation, and thereby enable the dynamo to generate when running in either direction.

The main circuit-wires starting from the pole-changer *b* branch out as desired, according to the uses to which the electricity is to be applied, and intermediate in the circuit the various devices forming parts of my apparatus are found in the order herein to be described.

c is the shunt-field of the dynamo.

d is the rheostat, located in series with the shunt field-circuit and connected, as shown in the drawings, by means of the contacts *e*, conveniently arranged in relation to the other mechanism. The contacts *e* are arranged in a vertical row apart from the actual rheostat and connected to the steps of said rheostat. This arrangement is preferable in order to more conveniently arrange the various parts of the mechanism.

f is a carriage sliding upwardly and downwardly on the rods *g*, which are securely supported by the brackets *h* and *i*, standing out slightly forward of the contacts *e*.

j represents contacts equivalent to a rheostat-finger, designed to move with the carriage *f* upwardly and downwardly on the rods *g*.

k is a rod attached to the carriage *f* and having the elbow *l* at its top end.

m is a cylinder having a piston operating the rod *n*. The rod *n* is provided with annular grooves *o* equidistant one from the other. The elbow *l* is securely attached to the top end of the piston-rod *n*, so that any movement whatsoever of the piston in the cylinder *m* will affect the position of the carriage *f* on the row of contacts *e*, and thereby cut in resistance in the circuit.

p represents solenoids, and *q* the cores thereof.

r is a bar connecting the cores of the solenoids.

s is an arm from the bar *r*, having the pin *t* projecting therefrom intermediate of its length.

u is a spiral spring connected to the end of the arm *s* and securely fixed at its other end.

v is an arm pivotally attached to the arm *s*, near to the lower end thereof, and having the T-shaped outer end *w* also pivotally attached in a projecting bracket *x* from the cylinder *m*.

y is a pivoted lever designed at one end to rest against the T-shaped head *w* and at its other end to engage the spring-held pin *z*.

The pin *z* is normally held by the spring 2 in engagement with an annular groove *o* around the piston-rod *n;* but the drawing of the solenoid-core or the tension of the spiral spring *u* will swing the T-shaped head *w* one way or the other, as the case may be, and throw the lever *y* over and hold the pin *z* out of engagement with the piston-rod *n*.

3 is an air-reservoir.

4 is a reducing-valve located intermediate of the length of the pipe 5, leading to the inlet-valve 6. The pipe 5 leads to the end of the cylinder *m*. The reducing-valve 4 is of any suitable construction and will not be described in detail herein, as standard constructions in this particular portion of my device are well known.

7 is a lever pivoted in proximity to the inlet-valve 6 and connected thereto and having the forked end 8, through which the pin *t* extends, so that it will be seen that the movement of the core of the solenoid will affect the passage of air to the cylinder.

9 is an exhaust-valve.

10 is an automatic cut-out operated by the electromagnet 11 and is here shown as being operated through the toggle-joint 12, which is pivotally attached to the core 13 of the magnet.

14 is a series of lamps located in the lamp-circuit.

15 is a storage battery or accumulator intermediate of the length of the main exterior circuit and designed to accumulate electricity from the dynamo.

16 represents safety-fuses.

Having described the arrangement and construction in detail, I shall now more particularly explain the operation thereof.

The armature of the dynamo as it revolves causes a difference of potential at the terminals of the cut-out magnet 11. When this difference of potential becomes equal to the voltage of the batteries, the magnetic influence of the magnet closes the switch contacts. The main circuit now closed by the cut-out, the current passes from the positive side of the pole-changer on and through the solenoid *p*, passing through the closed contacts of the cut-out 11, on through the accumulator 15, and back through the negative side of the pole-changer to the brush of the dynamo. In case the lights are on a portion of the current shunts to the lamp-circuit, and it will be here understood that the relative amount of current passing to the accumulator and lamp-circuits, respectively, depends upon the number of lamps lighted in the said lamp-circuit.

The arrangement thus far described is mostly known, and it is particularly concerning the operation of the rheostat with which this invention has to do. As my apparatus is particularly adapted to a railroad-train for lighting the passenger-coaches thereof, I shall confine my explanation to the construction and operation of the rheostat and regulator therefor to this application of the device.

Immediately preceding the movement of the train cut-out contacts will be open and the dynamo, which is driven from the car-axle, will be at rest. The lamps, if lighted, will be fed from the storage battery 15 alone, the latter having been charged before being placed in the circuit, though it must be here understood that the previous charging of this battery is not necessary to the working of my system, as it is quite possible to charge it *en route*. As the train moves slowly at the start, the dynamo begins to generate, and when the proper speed is reached the cut-out contacts close, as before described. The speed still increasing, the dynamo continues the generation of more and more current until its normal load is reached, and as the speed increases some means of preventing the overload is necessary.

When the normal current passes through the solenoid *p*, the magnetic influence or pull of its core *q* just balances the mechanical tension or pull of the spring *u*. If this normal current is exceeded, the magnetic pull is greater than the mechanical pull and the admission-valve 6 is opened, admitting air to the back of the piston. The piston is thus forced up and through the operation of the intermediate mechanism causes the contacts *e* to move upwardly and cut the resistance in the shunt field-circuit of the dynamo. The field is thus weakened and the load reduced as required.

When the train is traveling at its normal maximum rate, the balance between the magnetic and the spring pull on the solenoid-core *q* will be established and the piston is locked, and consequently the mechanism will balance and the contacts *e* will remain practically stationary during the continuance of the normal maximum speed aforesaid. It will be seen that such must be the case at any speed the train is traveling provided that speed be constant for a given time, for the position of the piston, and therefore the contacts *e*, is determined by the variation in speed only. As the train approaches the stop and gradually lessens speed the dynamo revolves more and more slowly, and in order to keep the load within given limits the field strength must be increased. The current decreasing, the magnetic influence of the solenoid and its core *q* becomes less and the pull of the spring *u* greater than the magnetic pull of the core *q*. This affects the arm and operates the valve 6. The admission and exhaust valves 6 and 9, respectively, control the supply of air to the cylinder *m* through the operation of said valves by the solenoid. The air in the cylinder *m* exhausts through the port 9 and the piston moves downwardly. The contacts *e* thus return to their normal position, gradually cutting resistance out of the field-circuit which was introduced when the train speeded

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up. As the train moves still more slowly the cut-out contacts open and everything resumes its original condition in readiness for the next run.

The supply of air or steam on a railway-train for the purpose of operating the piston governing the position of the contacts *e* is readily available, as there is always an air-reservoir which may be tapped, giving ample and sufficient pressure to insure the raising of the piston and holding the same in such position for as long as may be desired.

What I claim as my invention is—

1. In an apparatus for controlling the voltage from an electric generator, the combination with a generator having a main exterior circuit, emanating therefrom and a shunt field-circuit, of a rheostat located in series with said shunt field-circuit, a vertical row of contacts connected with the steps of said rheostat, a carriage traveling in suitable guides over said row of contacts, coacting contacts secured to said carriage, a cylinder, a piston and a notched rod extending therefrom beyond said cylinder and secured to the aforesaid carriage, an expansile-fluid reservoir having connection with said cylinder, means for governing the supply of fluid to the cylinder, and means for engaging said notched rod, as and for the purpose specified.

2. In an apparatus for controlling the voltage from an electric generator, the combination with a generator having a main exterior circuit emanating therefrom and a shunt field-circuit, of a rheostat located in series with said shunt field-circuit, a row of contacts vertically arranged and having connection with the steps of said rheostat, a carriage traveling in suitable guides along said row, a cylinder parallelly arranged to the said vertical row having a suitable opening in its lower end, a piston operating therein and a notched rod extending therefrom beyond the cylinder and secured to the aforesaid carriage from its top end, an expansile-fluid reservoir having connections to said opening in the cylinder, admission and exhaust valves located intermediately in said connections, a solenoid having a spring-held core, a pivoted lever operating said admission and exhaust valves from the spring-held core, a spring-held pin engaging said notched piston-rod, and a pivoted lever secured to the spring-held core and engaging the said spring-held pin, as and for the purpose specified.

3. In an apparatus for controlling the output of a dynamo driven at varying speed, the combination with the dynamo having a main exterior circuit emanating therefrom, and a shunt field-circuit, having a rheostat located in series therewith, of a cylinder, a piston operating therein, a piston-rod, a row of contacts respectively connected with each and every step of the rheostat, movable contacts coacting with the said row of contacts, a rod connected at its upper end to the piston-rod, and at its lower end carrying the said movable contacts, an expansile-fluid reservoir, suitable inlet and exhaust valves to the said cylinder, a solenoid having a spring-held core, and lever operated by the said solenoid, and regulating the pressure of expansile fluid in the cylinder to balance the movement of the solenoid in the continuously-varying speeds of the dynamo, as and for the purpose specified.

4. In a device of the class described, an automatic locking mechanism comprising a spring-pawl engaging teeth on a rod extending from a piston operating in a cylinder and a pivoted lever connected with the spring-held core of the solenoid to release from engagement the pawl, as and for the purpose specified.

5. In a device of the class described, an automatic locking mechanism comprising a spring-held pin designed to normally abut the piston-rod operating in a cylinder, a lever pivoted in a projecting bracket from the cylinder, and designed to engage the said spring-held pin at one end, a suitable bell-crank lever pivoted in a bracket from the cylinder and abutting the other end of the aforesaid lever, and pivotally held in proximity to the T-shaped head and operated from its other end by the spring-held core of the solenoid, as and for the purpose specified.

Signed at Montreal, in the district of Montreal, in the Province of Quebec, Canada, this 27th day of April, 1903.

ISIDOR DEUTSCH.

Witnesses:
J. E. S. BLACKMORE,
R. T. TROTTER.