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A. E. HOGREBE & V. O. STROBEL.

MOTOR CONTROLLING SYSTEM.

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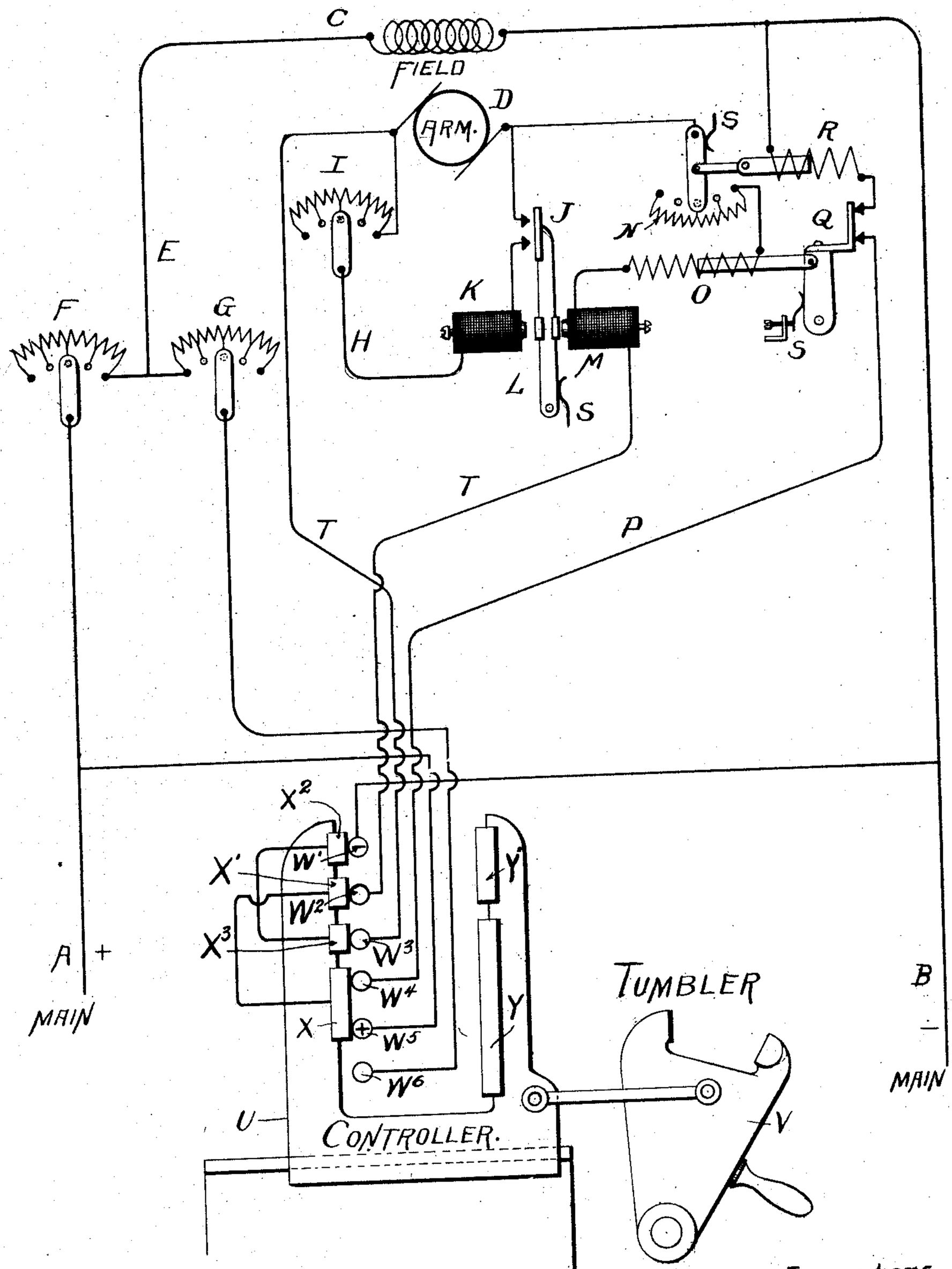

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UNITED STATES PATENT OFFICE.

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MOTOR-CONTROLLING SYSTEM.

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To all whom it may concern:

Be it known that we, ARTHUR E. HOGREBE and VICTOR O. STROBEL, citizens of the United States, residing at Philadelphia, Philadelphia county, Pennsylvania, have invented certain new and useful Improvements in Motor-Controlling Systems, (Case A,) of which the following is a specification.

This invention relates to a controlling system for motors requiring to be frequently started and stopped and reversed as, for instance, where a metal planer is operated by a reversing motor automatically controlled by the planer dogs to produce a slow cutting travel and fast backing travel for the table. In the present case we have chosen to illustrate our invention as adapted for application to a planer of otherwise ordinary construction.

The invention will be readily understood from the following description taken in connection with the accompanying drawing which is a diagram illustrating our system, the detailed parts being shown conventionally.

In the drawing:—A, indicates one supply main: B, the other supply main, the mains being assumed as having a usual main switch: C, the motor field: D, the motor armature: E, the shunt circuit through the field, constantly connected with the mains and energizing the field: F, a first rheostat, always in the shunt field circuit: G, a second rheostat adapted for connection with the shunt field circuit in parallel with the first rheostat: H, a short circuit across the armature: I, a rheostat in this short circuit: J, a normally open switch in the armature short circuit: K, an electromagnet in the armature short circuit: L, the armature-lever of magnet K, carrying the switch J, and tending, when moving in the direction of attraction of magnet K, to close switch J: M, a second electromagnet operating on the same armature lever and tending, when energized, to hold switch J open against the resistance of a spring tending to close it, this second electromagnet being in the main armature circuit: N, an automatic regulating rheostat in the main circuit of the armature: O, a solenoid in the main armature circuit: P, a shunt of the field circuit: Q, a normally closed switch in this circuit, this switch being opened by the action of solenoid O: R, a solenoid in this circuit to coöperate with rheostat N: S, springs acting on certain moving parts: T, the main armature circuit: U, the controller, considered as a whole, illustrated as a sliding structure: V, the usual reversing tumbler of a planer, connected with the controller to shift the controller from one to the other of its two positions: W, a series of six fixed contacts for the controller: X, a series of four movable contacts carried by the controller and coöperating with the fixed contacts when the motor is at high speed and the planer table making its backing stroke: and Y, a pair of movable contacts carried by the controller and coöperating with the fixed contacts when the motor is at slow speed and the planer table making its cutting stroke.

First rheostat F always in the field circuit is to be adjusted to give the motor the proper high speed suited for the fast backing stroke of the planer. Second rheostat G, in parallel with the first rheostat when the planer is making its cutting stroke, is to be adjusted to give the armature the slow speed suited to that stroke. Short circuit rheostat I is to be so adjusted as, when in closed circuit, to bring a suitable braking load upon the armature.

In the drawing the tumbler is in the usual position in which it has been put by the planer table at the end of the cutting stroke in bringing about the reversal of table motion and the armature is turning at its high speed and in direction corresponding with backing motion of the planer table, and the table is on its fast backing stroke. The rate of the backing speed may be adjusted at first rheostat F. When the tumbler is reversed then the controller, in reversing the motion of the armature, puts second rheostat G in parallel with the first rheostat in the field circuit; and the slow speed for cutting may be adjusted by means of this second rheostat. The two rheostats F and G are adjusted by hand to suit the intended working conditions, that is to say, the intended cutting and backing speeds of the planer table.

Taking the conditions as illustrated in the drawing the operation would be as follows:—

First: Field circuit is through first resistance F; armature short circuit is open at switch J; this switch is held open by magnet M energized by the main armature circuit; armature is running in backing direction at backing speed; planer table is making its

fast backing stroke, and moving to the left relative to the tumbler. The field circuit is from the positive main through rheostat F and the motor field to the negative main. The main armature circuit is from positive main A to contact point W^5, to controller segment X, to controller segment X', to magnet M, to solenoid O through variable resistance N and its rheostat arm, to the armature and from the armature to contact point W^3, controller segment X^3, thence to controller segment X^2 and to negative main B. The shunt circuit commencing at positive contact W^5 goes through segment X, contact W^4, switch Q which is closed, solenoid R and to the negative main.

Second: The planer table nears the end of its backing stroke, moving to the left; it engages the tumbler and shifts it somewhat to the left; the four moving contacts X of the controller leave the fixed contacts; all contacts of the controller are therefore momentarily open; the circuit through the field remains closed; all other circuits are open; the armature is turning by momentum in backing direction in the energized field; magnet M is deënergized; switch J is closed by its spring; short circuit H is closed across the armature; the armature now acts as a generator; short circuit rheostat I brings a load upon the armature tending to slow it and stop it; the armature stops or slows down sufficiently for safe reversal of current; the armature-stopping load in the short circuit is to have been suitably adjusted at short circuit rheostat I.

Third: Table has completed its backing stroke; tumbler has moved clear to the left; controller is moved to the left; contacts Y coöperate with the fixed contacts; magnet M is slightly energized and tends to open switch J; magnet K is strong but losing strength; magnet K is acting through shorter air gap than magnet M; switch J remains closed till magnet K weakens and magnet M strengthens sufficiently to open the switch; main current is now in reverse direction through armature; armature short circuit is open; field is energized by current through both rheostats F and G in parallel; current through field is thereby increased; armature turns in cutting direction at slow cutting speed. The circuits for forward running are as follows: The field is partly supplied from the positive main through resistance F and partly through the positive main through fixed contact W^5, segment Y, contact W^6 and resistance G. The main armature circuit may be traced through the line T in a reverse direction to the course described for backward running. The shunt circuit P is as before described.

Fourth: At the end of the slow cutting stroke a reversal is affected as before, the armature short circuit being closed prior to and during the reversal, and at reversal the field current is again through first resistance F alone.

Fifth: Switch Q is to have been adjusted to the proper load limitations of the motor; all regulating resistance will be in when the motor is starting; it will be quickly cut out by the action of solenoid R; during reduction of resistance the current may exceed the predetermined amount; then solenoid O opens switch Q; solenoid R is deënergized and resistance N is immediately cut in; switch Q closes when obstruction is past; resistance-reduction at N may then continue.

The controller has been illustrated as an automatic or machine-operated device, but it is to be understood the controller referred to in the claims does not necessarily involve machine-moved or automatic switching devices.

It is to be understood that the illustration is exemplifying only, many variations in arrangement being obvious to those skilled in the art. We have simply explained the principle of our invention and the best mode in which we at present comtemplate applying that principle.

We claim:—

1. A motor controlling system comprising a motor field, an armature, supply connections for furnishing current to the field and armature, a short circuit across the armature, a normally open switch in said short circuit, means for operating said switch at or before reversal of armature current, a pair of rheostats in parallel in the field supply connections, and a controller adapted to reverse the direction of current in the armature and to alternatively bring one or both of said rheostats into action, combined substantially as set forth.

2. A motor controlling system comprising a motor field, an armature, supply connections for furnishing current to the field and armature, a controller for reversing the direction of current in the armature, a short circuit across the armature, a normally open switch in said short circuit, means for closing said switch prior to and during reversal, a rheostat in the armature-supply circuit, means for automatically putting said rheostat to maximum resistance, an electromagnetic device controlling said rheostat, a normally closed adjustable switch controlling said electromagnetic device, and an electromagnetic device in the armature supply circuit coöperating with said switch and tending to open it, combined substantially as set forth.

3. The combination of a field, means for supplying the field through a single controlling device for one direction of rotation of the motor and through two controlling devices for the other direction of rotation, a main armature circuit including a magnet, and an

armature short circuit including a magnet and a single switch controlled by the two magnets and arranged to open and close the armature short circuit.

4. The combination of a closed field circuit, an armature circuit including an electro-magnet, a solenoid and a rheostat, an armature short-circuit including an electro-magnet, a switch controlled by the two electro-magnets and arranged to open and close the armature short-circuit and a shunt circuit including a switch arranged to open and close the shunt circuit and actuated by the solenoid of the armature circuit and a shunt solenoid arranged to actuate the rheostat.

5. The combination of a closed field circuit, an armature circuit including an electro-magnet, a solenoid and a rheostat, means for reversing the armature circuit, an armature short circuit including an electro-magnet, a switch controlled by the two electro-magnets and arranged to open and close the armature short circuit, and a shunt circuit including a switch arranged to open and close the shunt circuit and actuated by the solenoid of the armature circuit and a shunt solenoid in the shunt circuit arranged to actuate the rheostat.

6. The combination of a closed field circuit including a regulating device, a second field regulating device, a main armature circuit including an electro-magnet, a solenoid and a rheostat, a controller for reversing the field circuit, said controller having means for placing said second regulating device in the armature circuit in one direction of operation and for cutting it out in the other direction, an armature short circuit including an electro magnet, a switch controlled by the two electro-magnets and arranged to open and close the armature short circuit, a shunt circuit including a switch arranged to open and close the shunt circuit and actuated by the solenoid of the armature circuit, and a solenoid in the shunt circuit arranged to actuate the rheostat.

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