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W. MacMILLAN.

ELECTROMAGNETIC SWITCH.

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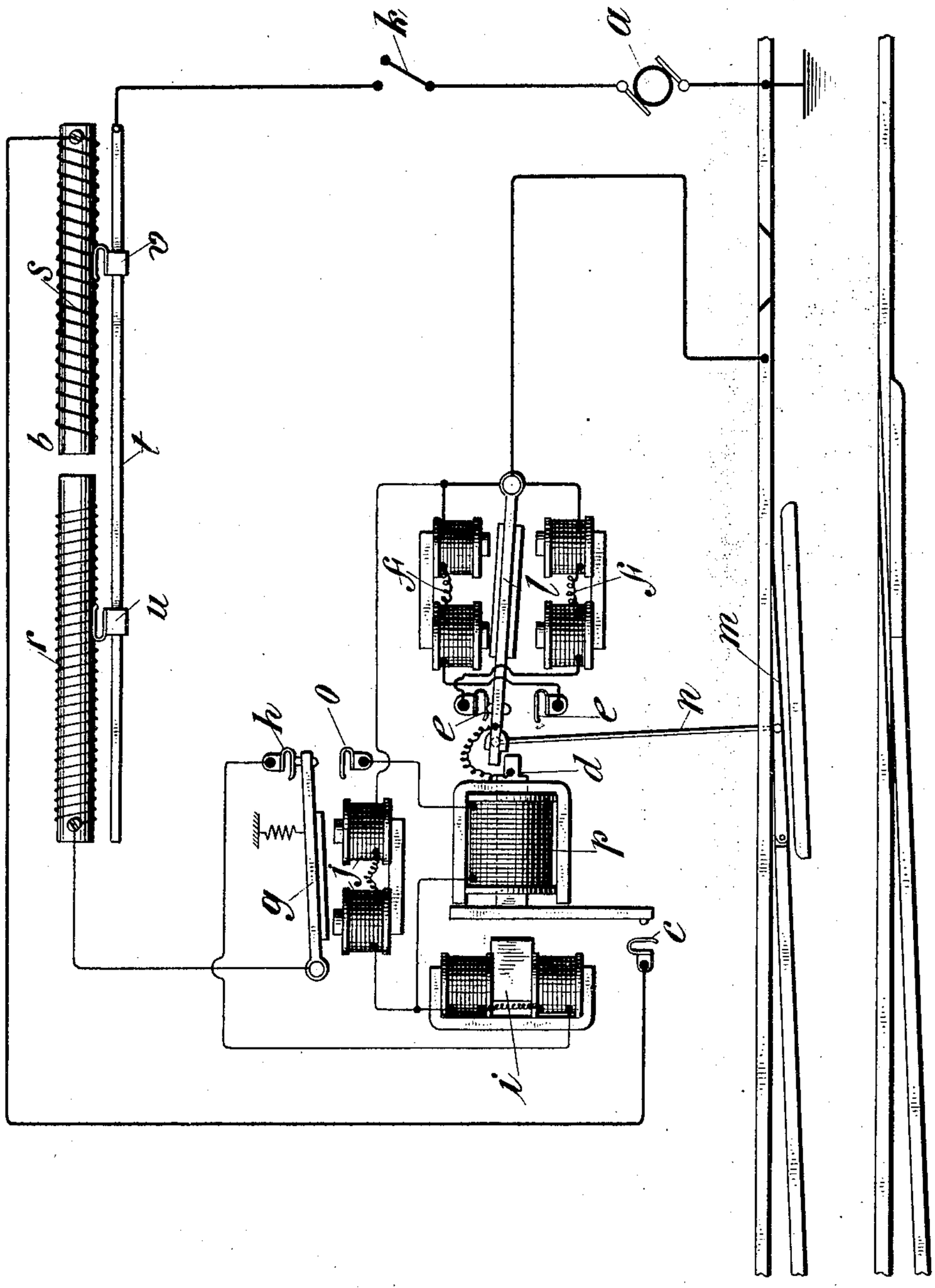

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ELECTROMAGNETIC SWITCH.

No. 897,215. Specification of Letters Patent. Patented Aug. 25, 1908.

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To all whom it may concern:

Be it known that I, WILLIAM MacMILLAN, a subject of the King of Great Britain, and a resident of the borough of Manhattan, of the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Electromagnetic Switches, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

One object of the invention is to provide an electrically operated switch which shall be particularly adapted for use upon electric railroads, such as trolley roads and the like. It is desirable to provide in connection with such switch mechanism a means of locking the switch tongue in both of its limiting positions so that it shall be prevented from rebounding or from working away for any reason from the rail against which it has been turned.

The improved mechanism, accordingly, embodies a locking mechanism for the switch tongue, this locking mechanism being adapted to lock the armature which moves the switch tongue and being so related to the rest of the switch operating mechanism as to permit all of the parts to be operated practically simultaneously as is desired. The parts thus operating substantially simultaneously or in extremely rapid succession, the locking device releases the armature, and the armature is drawn and locked again before a rebound thereof can possibly occur.

The invention also consists in embodying the several electro magnetic devices constituting the entire mechanism, in such convenient and compact form and in such simple relation to a controlling and operating circuit as to make the operation of the switch reliable and the manufacture and installation thereof comparatively simple.

In connection with the improved mechanism, moreover, an improved form of rheostat has been devised whereby the total current may be correctly proportioned between the operating and controlling circuit to secure the best results, and adjusted from time to time as conditions may require.

The accompanying drawing shows in diagram the different parts of the switch and their relation to each other.

In the diagram, the heavy lines indicate what will be referred to as the operating circuit, such circuit running from one side of a dynamo *a*, or other source of electrical energy, to a rheostat *b* presently to be explained, to a contact *c*, through a reciprocating core or bar *d* through one of the contacts *e* and one of the electro magnets *f* back to the other side of the dynamo *a*. The controlling circuit also starts from one side of the dynamo *a* and traverses the rheostat *b* from which it is delivered to an armature *g* and through a contact *h* to an electro magnet *i*. From the electro magnet *i* the controlling circuit traverses an electro magnet *j* and thence returns to the other side of the dynamo *a*.

As soon as the controlling circuit is closed through a switch *k* the magnet *i* is energized and throws the reciprocating bar *d* to the left, as seen in the diagram. This bar normally locks the armature *l* which moves the switch tongue *m* through a link *n* or the like, the locking being effected through a projection upon the rear end of the bar *d* which stands in the path of the end of the armature *l*. As soon however, as the bar *d* has been drawn forward by the magnet *i*, the projection upon the rear end thereof is withdrawn from the path of the armature *l* and at the same time the forward end of the bar *d* closes the contact *c* and completes the operating circuit which energizes one or the other of the electro magnets *f* and causes the armature to move. Hardly though has the electro magnet *i* become energized and drawn forward the bar *d*, when this same magnet loses its energy on account of becoming shunted, for the electro magnet *j*, being energized at the same time and by the same current as the electro magnet *i*, at once moves the armature *g* to open the operating circuit at the contact *h* and close it again at a contact *o*. This, as will be obvious, serves to shunt the electro magnet *i* and causes the current in the operating circuit to traverse a solenoid *p* which surrounds the reciprocating bar *d*. The energization of the solenoid *p*, which occurs as soon as the armature *g* has moved from the contact *h* to the contact *o*, causes the bar *d* to be drawn back again to its first position and to lock the armature *l* which, as has been seen, is moved immediately upon the closing of the operating circuit at *c*. It will be seen that the operation of all of the parts, as soon as the switch *k* is closed, is practically instantaneous. The electro magnets *i* and *j* being energized at the same time cause the bar *d* and the armature *g* to be moved together, and the bar *d* causes the operating circuit to be closed

at *c* sufficiently ahead of the closing of the controlling circuit at *o* to permit the armature *l* to be fully thrown before the bar *d* is returned to its first or locking position by the solenoid *p*. It will be seen from the diagram that the contacts *e* and their connections with the electro magnetic devices *f* will cause these electro magnetic devices to be energized alternately by the operating circuit so that each time the operating circuit is closed, the armature will be moved in a direction opposite to that in which it moved upon the preceding operation. This, as will be obvious, will move the switch tongue *m* first in one direction and then in the other. As embodied in practice, the controlling circuit will be arranged so as to receive current upon the closing of the switch *k* when the car is nearing a switch. For this purpose the trolley wire or third rail may be provided, as usual, with an insulated section which section is electrically connected with the trolley wire or third rail, as the case may be, by a connection which includes the controlling circuit. In this way the motor *a* of the car can receive no current, when the trolley has reached the insulated section, except such current as passes through the controlling circuit of the electric switch mechanism. Thus, as in common practice, the motorman will not turn on the current if he wishes the switch tongue to remain in the position in which he approaches it, but if, on the other hand he desires to throw the switch, he will permit the current to flow through the switch and through the motor *a* upon the car as he approaches the switch and passes the insulated section.

Referring to the rheostat *b*, this device will be seen to consist of two coils *r* and *s* of suitable resistance wire, and a conductor *t* upon which are two riders or slides *u* and *v*. The current is delivered from the dynamo *a* to the conductor *t* and from the conductor *t* to the coils *r* and *s*, by means of the riders *u* and *v* respectively, the coils *r* and *s* being insulated from each other. These riders *u* and *v* may be so adjusted upon the conductor *t* as to place more or less resistance in either the operating circuit or the controlling circuit, and the device offers a very practicable and simple means of maintaining proper current conditions within the switch operating mechanism.

I claim as my invention:—

1. In an electro magnetic switch, the combination of an operating circuit, a controlling circuit, a locking device, means in the controlling circuit for operating the locking device to unlock the switch, means in the controlling circuit for operating the locking device to lock the switch, and means in the controlling circuit to cause the first named means and the second named means to be operated in succession.

2. In an electro magnetic switch, the combination of an operating circuit, means in the operating circuit to operate a switch, a locking device for the switch, a controlling circuit, a magnetic device in the controlling circuit for operating said locking device to unlock the switch, a magnetic device in the controlling circuit for operating said locking device to lock the switch, and a magnetic device in the controlling circuit for causing the first named magnetic device and the second named magnetic device to operate in succession.

3. In an electro magnetic switch, the combination of an operating circuit, means in the operating circuit to operate a switch, a locking device for the switch, a controlling circuit, a magnetic device in the controlling circuit for operating the locking device to unlock the switch, a magnetic device in the controlling circuit for operating the locking device to lock the switch, and a magnetic device in the controlling circuit for cutting out the first named magnetic device and throwing in the second named magnetic device.

4. In an electro magnetic switch, the combination of an operating circuit, means in the operating circuit to operate a switch, a reciprocating bar to lock the switch, a controlling circuit, means in the controlling circuit to move the bar in one direction to unlock the switch, means in the controlling circuit to cause the bar to move in the opposite direction to lock the switch, and means in the controlling circuit to cause the first named means and the second named means to be operated in succession so that the bar will be moved first to unlock the switch and then to lock the switch again.

5. In an electro magnetic switch, the combination of an operating circuit, means in the operating circuit to operate a switch, a locking device for the switch, a controlling circuit, a magnetic device in the controlling circuit for operating the locking device to unlock the switch, said locking device being adapted when so operated to close the operating circuit, a magnetic device in the controlling circuit for operating the locking device to lock the switch, said locking device being adapted when so operated to open the operating circuit again, and a magnetic device in the controlling circuit for cutting out the first named magnetic device and throwing in the second named magnetic device.

6. In an electro magnetic switch, the combination of an armature for moving the switch, an operating circuit, a magnetic device in the operating circuit for moving the armature in one direction, a magnetic device in the operating circuit for moving the armature in the opposite direction, means controlled by the armature for throwing the magnetic devices into operation alternately, a locking device for the armature, a controlling circuit, a magnetic device in the control-

ling circuit for operating the locking device to unlock the armature, a magnetic device in the controlling circuit for operating the locking device to lock the armature and a magnetic device in the controlling circuit for causing the last two named magnetic devices to be operated in succession.

7. In an electro magnetic switch, the combination of an armature for moving the switch, an operating circuit, a magnetic device in the operating circuit for moving the armature in one direction, a magnetic device in the operating circuit for moving the armature in the opposite direction, means controlled by the armature for throwing the magnetic devices into operation alternately, a locking device for the armature, a controlling circuit, a magnetic device in the controlling circuit for operating the locking device to unlock the armature, said locking device being adapted when so operated to close the operating circuit, a magnetic device in the controlling circuit for operating the locking device to lock the armature, said locking device being adapted when so operated to open the operating circuit again, and a magnetic device in the controlling circuit for causing the last two named magnetic devices to be operated in succession.

8. In an electro magnetic switch, the combination of an armature for moving the switch, an operating circuit, a magnetic device in the operating circuit for moving the armature in one direction, a magnetic device in the operating circuit for moving the armature in the opposite direction, contacts controlled by the armature for throwing the magnetic devices into operation alternately, a reciprocating bar for locking the armature, a controlling circuit, a magnetic device in the controlling circuit for moving the bar in one direction to unlock the armature, said bar being adapted when so moved to close the operating circuit, a magnetic device in the controlling circuit for moving the bar in the opposite direction to lock the armature, said bar being adapted when so moved to open the operating circuit again, and a magnetic device in the controlling circuit for causing the last two named magnetic devices to be operated in succession.

9. In an electro magnetic switch, the combination of an armature for moving the switch, an operating circuit, a magnetic device in the operating circuit for moving the armature in one direction, a magnetic device in the operating circuit for moving the armature in the opposite direction, contacts in the operating circuit controlled by the armature for throwing the magnetic devices into operation alternately, a reciprocating bar to lock the armature, a controlling circuit, a solenoid in the controlling circuit through which said bar reciprocates, a magnetic device in the controlling circuit to draw the bar forward to unlock the armature, a contact in the operating circuit closed by the movement of said bar, and a magnetic device in the controlling circuit to cause the last mentioned magnetic device and the solenoid to be energized in succession.

10. The combination with a source of electrical energy, of an electro magnetic switch having an operating circuit, a controlling circuit, and a rheostat, said rheostat having a resistance coil for the operating circuit, a resistance coil for the controlling circuit, an adjustable finger for each coil, a conductor upon which said fingers are slidable to vary the resistance in both circuits, and a means to connect the source of electrical energy with said conductor.

This specification signed and witnessed this 28th day of January, A. D., 1908.

WILLIAM MacMILLAN.

Signed in the presence of—

HOMER H. SNOW,

LUCIUS E. VARNEY.