No. 723,261. PATENTED MAR. 24, 1903.

C. E. FREEMAN.

AUTOMATIC RELEASE DEVICE FOR RHEOSTATS AND HEATERS.

APPLICATION FILED DEC. 12, 1901.

NO MODEL.

Fig. 1.

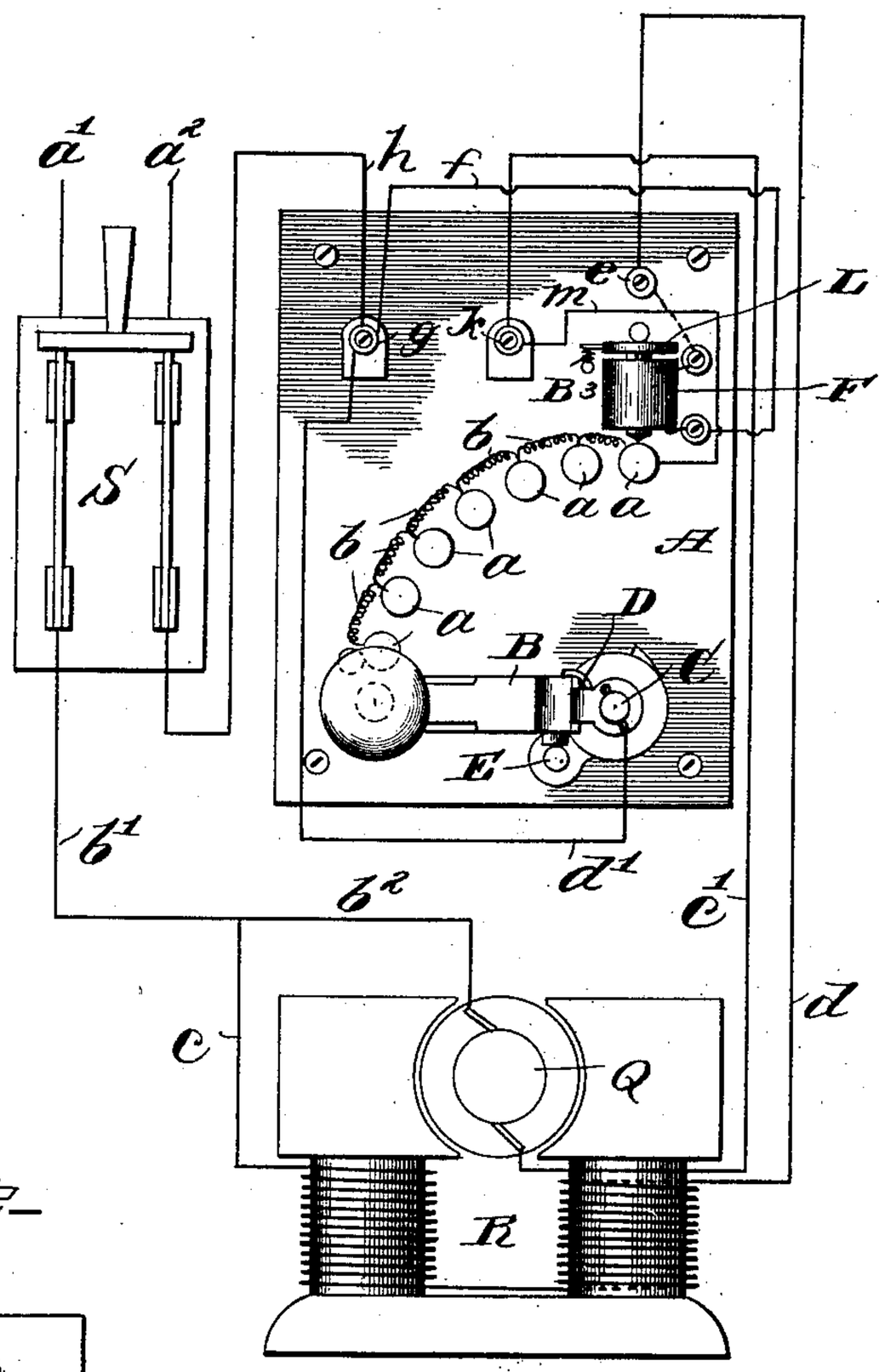


Fig. 3.

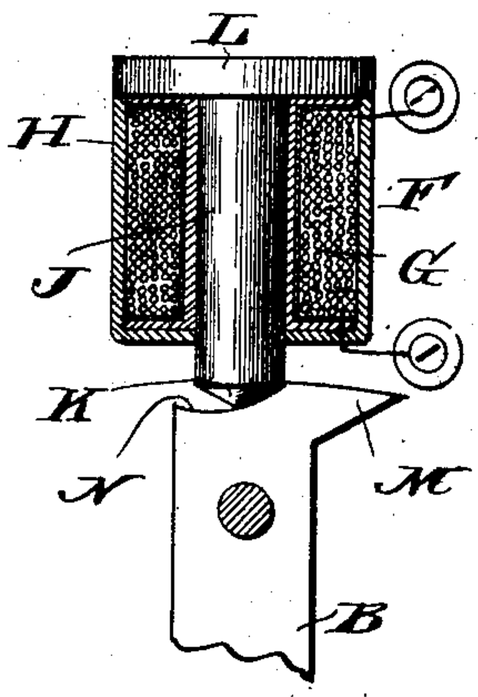


Fig. 2.

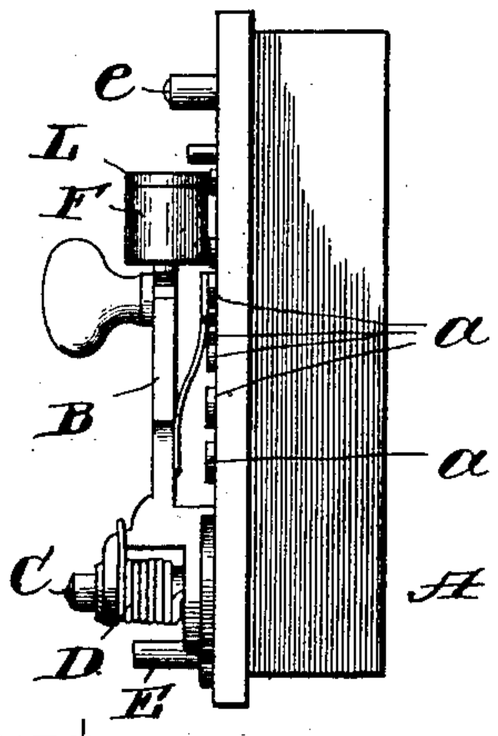
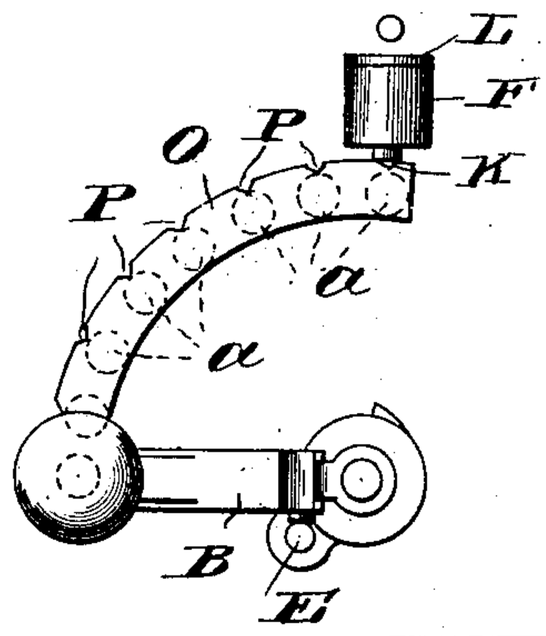


Fig. 4.



Witnesses.

G. A. Rauberschmidt

Charles H. Seem

Inventor.

Clarence E. Freeman

By Brown & Darby

Attys

UNITED STATES PATENT OFFICE.

CLARENCE E. FREEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO MAX C. KRUEGER AND McGUIRE MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC RELEASE DEVICE FOR RHEOSTATS AND HEATERS.

SPECIFICATION forming part of Letters Patent No. 723,261, dated March 24, 1903.

Application filed December 12, 1901. Serial No. 85,719. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE E. FREEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Automatic Release Device for Rheostats and Heaters, of which the following is a specification.

This invention relates to automatic release devices for rheostats and heaters.

The object of the invention is to provide means for automatically releasing the resistance-varying arm of rheostats or heaters.

The invention consists, substantially, in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views and reference-signs appearing thereon, Figure 1 is a view in plan, showing an arrangement of apparatus embodying the principles of my invention and in diagram the application thereof to a rheostat employed in connection with the shunt field-windings of a motor. Fig. 2 is a view in side elevation of an automatic release device embodying the principles of my invention. Fig. 3 is a detail view in section through the automatic release-magnet, showing the rheostat or resistance arm in engaging relation therewith. Fig. 4 is a detail view showing a slight modification embraced within the spirit and scope of my invention.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

Referring to the accompanying drawings, A designates a suitable insulating slab or plate, upon which is pivotally mounted a contact-arm B. C designates the pivot-pin upon which said arm is pivotally mounted. D designates a spring normally maintaining said arm in a retracted position against a stop E. The contact-arm B is arranged to operate over a series of contact-points *a*, arranged to control resistances *b* in the usual or any well-known manner.

F designates the automatic release-magnet. This magnet is in the form of a spool-coil G, (see Fig. 3,) inclosed within an iron casing H, through the longitudinal center of which is arranged a pin J of magnetic material, said pin provided with a curved or pointed end K and provided with a circular or disk-shaped head L, arranged to rest upon the upper surface of barrel H and constituting an armature for said magnet. The arm B is arranged to be engaged by the pin J when said arm is swung or rocked against the action of its retractile spring D in position to cut out resistances *b*, whereby said arm is locked in cut-out position, and the arrangement is such that when the circuit of magnet F is completed and current is traversing said circuit the attraction exerted upon the head L of pin J by the magnet is sufficient to maintain said pin J in engaging relation as a detent for arm B; but when the circuit of said magnet is broken the tension of spring D, tending constantly to return arm B to initial position, is sufficient to overcome the gravity of pin J, thereby releasing said arm B. In one form of construction, as illustrated in Fig. 3, for instance, the pin J is arranged to engage the end of arm B, and in order to facilitate the ready passage of arm B past the end of release-pin J said arm B is provided with an extension M, having a curved surface, which engages the projecting end of release-pin J to raise the same slightly, and said arm is provided with a recess or seat N, having curved walls, into which the pointed or curved end of detent J is received, as clearly shown in Fig. 3. Thus it will be seen that the tension of spring D when arm B is in engaging relation with respect to pin J is exerted in a line transverse to the length of pin J rather than in a direction to move said pin longitudinally; but when the attractive force exerted upon pin J by the energization of the magnet is removed by the breaking of the circuit of said magnet the gravity of said pin is quickly overcome by the tension of retractile D, and arm B is released and permitted to quickly return to its initial position.

In the form shown in Fig. 4 the arm B may be provided with a sector O, the edge of which is arranged to coöperate with the pro-

jecting end of pin J, and which edge is provided with a series of seats P, corresponding to the various contacts *a*, whereby the arm B may be swung to any desired position to cut out any desired number of the resistance-coils *b* and held or locked in the desired position, the release thereof being automatically effected upon breaking the circuit of magnet F, as above described, whereby the arm B is permitted to return to its initial position.

In Fig. 1 I have shown my invention as applied to a rheostat used in connection with a motor. Q designates the motor-armature, R the motor-field, and S the main switch. I will now trace the circuits as disclosed in said figure. When the main switch S is closed, circuit is completed from the main supply-wire a' through switch S, wire b', and, dividing, in case the motor is a shunt-wound motor, as shown, part continues through wire *c*, the motor-field R, wire *d*, binding-post *e*, through the magnet-windings G, wire *f*, to binding-post *g*, wire *h*, switch S to return-wire a^2. The other part of the circuit may be traced from wire b' through wire b^2, to armature Q, wire c', binding-post *k*, wire *m*, to the first contact *a*, thence through the resistances *b*, and when arm B is in contacting relation with any one of the contacts *a* the circuit continues through arm B, wire d', to binding-post J, and thence on to return-wire a^2, as above described. It will be seen that the resistance included in the motor-armature circuit is therefore dependent upon the position of arm B, and in starting up the motor the closing of the wall-switch S immediately completes the circuit of magnet F. If the main switch S is closed before arm B is moved from its initial position, as should be the case, then no current traverses the motor-armature circuit until arm B is moved into position to contact with the first of the series of contact-points *a*, and when in this position the current traversing the motor-armature also traverses all the resistances *b*, and as the arm B is moved over the contacts *a* the resistances are gradually cut out of the motor-armature circuit, thereby speeding up the motor, until finally when arm B is in position to be engaged by the release-pin J all the resistance in the motor-armature circuit is cut out. In practice the windings of the release-magnet are proportioned to the strength of the current traversing it, so that immediately upon the completion of the circuit of said magnet an attractive force is exerted upon release-pin J, tending to hold said pin in position to act as a retaining-stop for the arm. When the main switch S is operated to break the motor-circuits, the attractive force thus exerted upon pin J is removed, permitting the arm B to return to its initial position under the influence of its retractile, and in the construction shown in Fig. 4 the arm B may be held at any desired position and automatically released upon breaking the circuit.

While I have shown my invention as applied as a rheostat for electric motors, I do not desire to be limited in this respect, as my invention is equally well adapted for use in other relations where an automatic release or overload device is desirable.

It may sometimes be desirable to ascertain whether or not upon closing the main switch the circuit of the motor-field is completed before the rheostat-arm is moved from its initial or dead position to complete the circuit of the motor-armature. In prior constructions this result is accomplished only by testing the release-magnet to determine whether or not its circuit is completed. It may not always be convenient to so test the release-magnet. In the construction above set forth, wherein the release-pin J is a gravity-pin, it can be readily ascertained whether or not the circuit of the release-magnet is completed by the power required to manually lift or raise the pin. If the circuit of the release-magnet is not completed, only the gravity of the pin is required to be overcome; but if the circuit of the magnet has been properly completed, then more power is required to lift the pin, and in such case it will be known that the motor-field circuit is completed, thus insuring a completion of the motor-field circuit before the motor-armature circuit is completed. I have shown a simple means for accomplishing the same object without attempting to raise manually the locking detent or pin J, and which consists of a small spring B^3, (see Fig. 1,) interposed under the head L of the detent or locking-pin J, the tension of which spring is just sufficient to overcome the weight of said pin, and thereby hold the head of said pin slightly above the magnet-casing. With this construction upon completion of the motor-field circuit the magnet will be energized and the tension of spring B^3 will be overcome by the attraction exerted upon the head L by the magnet, thereby causing a click, which alone may be sufficient, or merely an inspection of the rheostat to see whether or not the head of the pin has been drawn down against the magnet-casing will show at once whether or not the motor-field circuit is completed.

From the foregoing description it will be seen that the tension which the release-pin J is required to resist when serving as a detent or lock for the rheostat-arm is not applied directly in the direction of length of the pin, and consequently not directly against the pull or attractive force exerted upon the pin by its magnet. It will also be seen that the contacting surfaces of the pin and arm or its sector are so shaped as to permit the arm to readily free itself when the circuit of the retaining-magnet is broken.

A construction such as above described I have found to be exceedingly efficient for the reason that the reluctance in the magnetic circuit of the magnet is exceedingly low. The pull on the head of the pin exerted by the

energization of the magnet varies with the square of the flux per unit area through the magnetic circuit, and for a minimum reluctance the required flux is produced by a minimum of ampere-turns for any given current; the reluctance depending inversely upon the cross-sectional area of the magnetic path, assuming that the magnetic path is confined to the magnetic material, it will be seen that with the construction as above set forth an automatic release device embodying my invention is inexpensive in manufacture, since it requires comparatively a small amount of copper for any given degree of pull required. In other words, the entire area of the head L of the pin J is acted upon by the magnet, or rather the entire line of said head forms part of the magnetic circuit, said line bearing at all points upon a portion of the magnet armor or casing. Therefore a minimum reluctance is secured and any required flux is produced by a minimum of ampere-turns for any given current.

Having now set forth the object and nature of my invention and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. An automatic release for rheostat-arms comprising a magnet-coil, a headed pin arranged to project loosely through said coil, the head of said pin forming a support for said pin and constituting the armature for said magnet-coil, the projecting end of said pin arranged to directly engage the rheostat-arm, as and for the purpose set forth.

2. The combination with a rheostat and its arm, of an automatic release device comprising a magnet-coil, a casing for said magnet-coil, a pin projecting loosely through said casing and coil and provided with a head at one end thereof, said head arranged to rest upon said casing to support said pin and forming the armature for said magnet, the projecting end of said pin operating to directly engage and lock said arm, as and for the purpose set forth.

3. The combination with a rheostat and its arm, of an automatic release device comprising a magnet-coil having a circular casing, a pin projecting loosely through said coil and casing and provided with a head at one end, said head resting upon said casing as a support for said pin and forming an armature for said coil, the other end of said pin extending through and beyond said coil and casing, said arm provided with a seat or depression adapted to receive the projecting end of said pin; all combined and arranged as and for the purpose set forth.

4. The combination with a rheostat having an arm and a retractile for said arm, of an automatic release device for said arm comprising a magnet-coil, a movable pin passing loosely through said coil and provided with a head forming a support for said pin and constituting the armature for said magnet, said pin forming a detent or lock for directly engaging said arm, as and for the purpose set forth.

5. The combination with a rheostat having an arm, and contacts over which said arm operates, of an automatic release device comprising a magnet-coil, a pin projecting loosely through said coil and having a head at one end, said head forming the armature for said magnet, the projecting end of said pin operating to engage and lock said arm, and means for returning said arm to initial position, as and for the purpose set forth.

6. The combination with a rheostat, of an arm, a retractile therefor, and an automatic release device for locking said arm against the action of said retractile and comprising a magnet-coil, a casing for said magnet-coil, a pin provided at one end with a circular head, said head arranged to rest upon said casing to form a support for said pin and serving as an armature for said magnet-coil, said pin having its other end projecting through and beyond said casing and coil to directly engage and form a detent for said arm, as and for the purpose set forth.

7. In an apparatus of the class described, an automatic release device comprising a gravity-pin provided with a circular head, a magnet through which said pin projects, the head of said pin forming an armature for said magnet and a support for said pin, whereby when the circuit of said magnet is completed an attractive force is exerted upon said pin, the other end of said pin projecting loosely through said magnet, means for normally overcoming the gravity of said pin, a rheostat-arm, a retractile therefor, the projecting end of said pin operating to directly engage and form a lock for said arm to retain the same against the action of its retractile, as and for the purpose set forth.

In witness whereof I have hereunto set my hand, this 3d day of December, 1901, in the presence of the subscribing witnesses.

CLARENCE E. FREEMAN.

Witnesses:
CHAS. H. SEEM,
S. E. DARBY.