R. E. NOBLE & L. E. MITCHELL.

RHEOSTAT.

APPLICATION FILED FEB. 5, 1909.

929,001. Patented July 27, 1909.

2 SHEETS—SHEET 1.

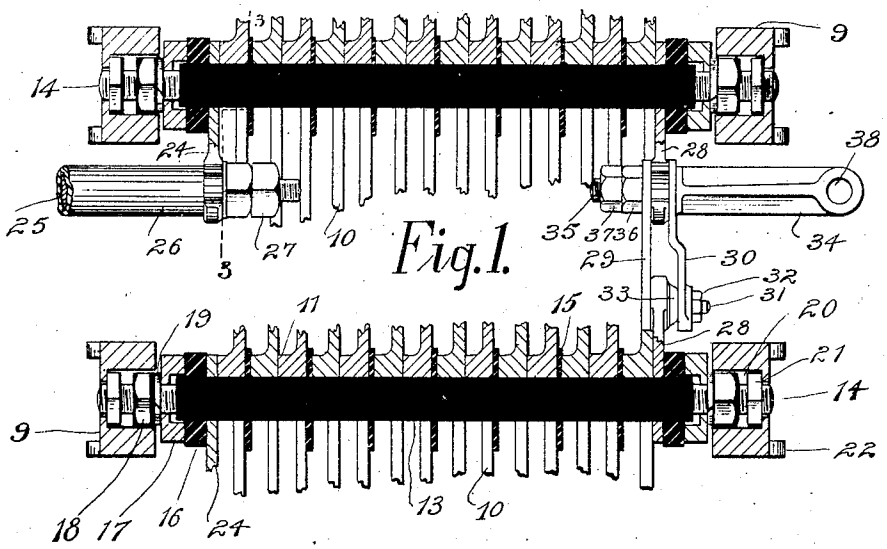

Fig. 1.

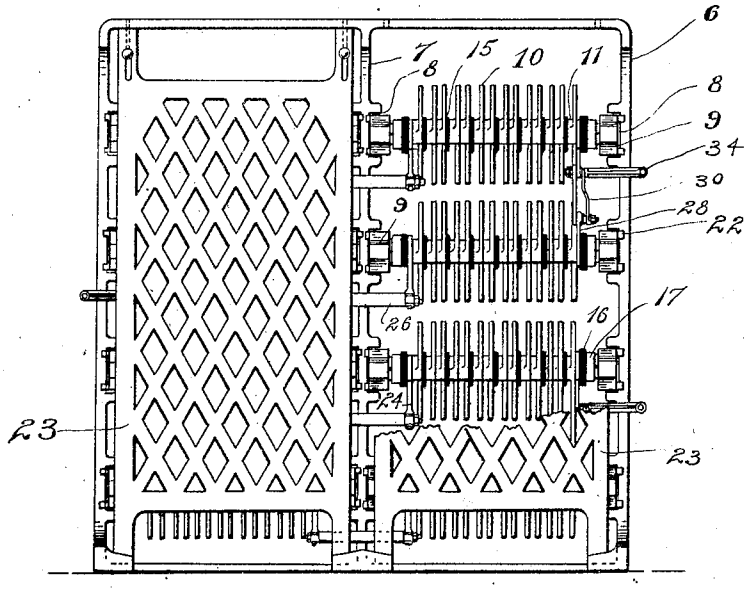

Fig. 2.

WITNESSES:

A. W. Fenstemaker

C. H. Crawford

INVENTORS

Ralph E. Noble and Louis E. Mitchell.

BY

Glenn S. Noble

ATTORNEY

R. E. NOBLE & L. E. MITCHELL.

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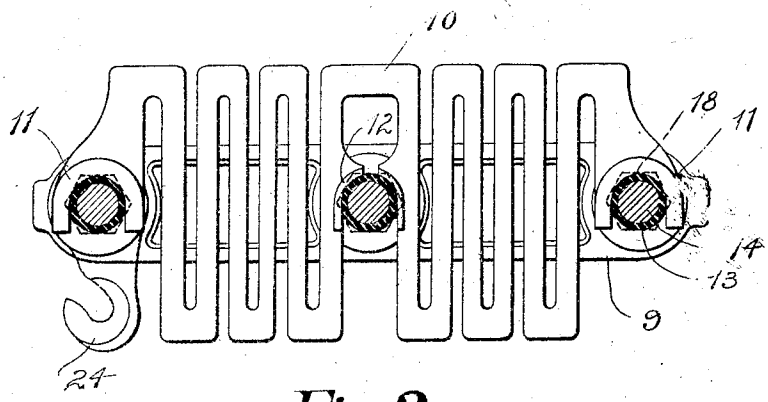

Fig. 3.

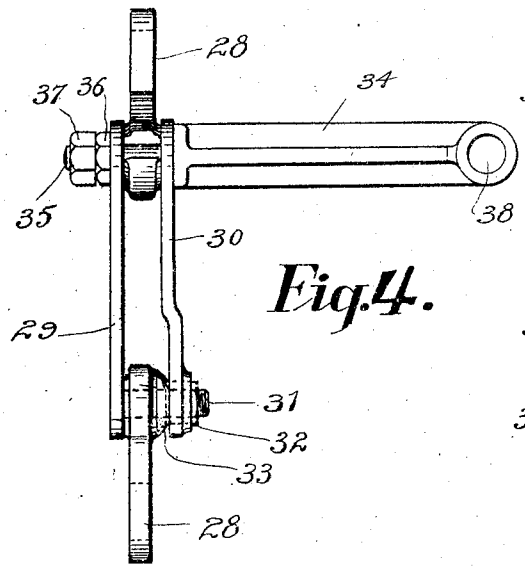

Fig. 4.

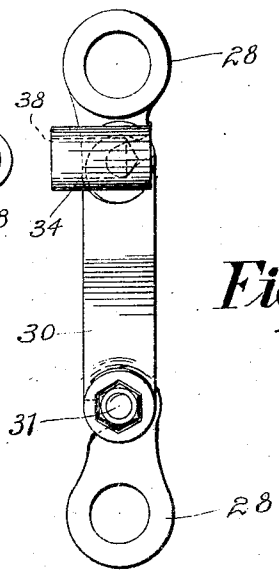

Fig. 5.

WITNESSES:

A. W. Fenstermaker

C. M. Crawford

INVENTORS.

Ralph E. Noble and Louis E. Mitchell,

BY

Glenn S. Noble

ATTORNEY

UNITED STATES PATENT OFFICE.

RALPH E. NOBLE AND LOUIS E. MITCHELL, OF CHICAGO, ILLINOIS, ASSIGNORS TO MORGAN-GARDNER ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

RHEOSTAT.

No. 929,001. Specification of Letters Patent. Patented July 27, 1909.

Application filed February 5, 1909. Serial No. 476,191.

To all whom it may concern:

Be it known that we, RALPH E. NOBLE and LOUIS E. MITCHELL, citizens of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Rheostats, of which the following is a specification.

This invention relates to rheostats or resistance adapted to be used in connection with controlling electric currents and more particularly with strong currents, such, for instance, as used in connection with street railway cars, locomotives, or the like. Such rheostats, in order to serve their purposes most fully, should not only be able to take care of the large current, which they are intended to regulate, without injury to the resisting grids or members, but should also be amply ventilated, in order to allow for the escape of the heat generated therein; should be rigid and substantial in construction; and should have the various parts so arranged that repairs may be easily made. Many of these features are lacking, to a greater or less extent, in rheostats which have been in use heretofore.

The objects of the present invention are to provide a rheostat embodying the desirable features above mentioned, and also one in which the parts are comparatively few in number, of a simple construction, and which may be readily assembled to form the complete device.

In the accompanying drawings, showing a rheostat embodying our invention—Figure 1 is a detail sectional view showing portions of two sets of grids with their connecting devices; Fig. 2 is a front view of the complete rheostat, with one of the front doors, or grates removed to show the interior construction; Fig. 3 is a sectional view on the line 3—3 of Fig. 1; and Figs. 4 and 5 are details showing the wire terminals and connectors for making connections with the grid members.

As shown in these drawings, 6 represents a rack or frame of sufficient size to hold the desired number of grid sections. In the present instance, this frame is shown with a central wall or division 7, in order to form two compartments for the grids or resistance members. The rack or frame 6 is provided with slideways or grooves 8 for receiving the grid resistance supports 9. For convenience in construction, and in making the desired electric circuits, the grids proper 10 are preferably arranged in a plurality of sections or piles. These grids are formed of some suitable material adapted to give the necessary resistance and are usually cast so as to give an elongated circuit in each grid, as indicated in Fig. 3. In order to support these grids so that they will be comparatively free from vibration and injury from jarring, they are provided with thickened or widened forked bearings 11 at the ends thereof and U-shaped bearings 12 at the centers thereof, these bearings being arranged in a vertical plane at about the centers of the grids, so as to give as little opportunity for vibration as possible. These bearings rest on insulating tubes 13 mounted on rods or bolts 14 which extend somewhat beyond the ends of such tubes.

In order to make proper circuits, insulating washers 15 are placed between the bearings or hubs 11, where it is desired to prevent the current from passing immediately from one hub to another, these washers ordinarily being placed between each alternate set of hubs, as indicated in Fig. 1. In order to bind the hubs or bearings tightly together to prevent movement of the same and to insure good electrical contact between the hubs which carry the current from one grid to another, we provide insulating washers 16 which fit over the ends of the insulating tubes 13 and rest against the adjacent hubs or connectors and which are in turn engaged by countersunk washers or caps 17 which are pressed inwardly by means of nuts 18 on the threaded ends of the bolts 14. In order to prevent these nuts from becoming loosened, and also in order to take up any slack or looseness between the grid hubs or washers after the same have been in use, we provide spring nut locks 19 which are inserted between the nuts 18 and the washers or caps 17. When the desired number of grids are thus secured together, they will be held firmly and rigidly, and the arrangement is such that the parts will be securely united regardless of slight inaccuracies of the sizes of the grid members. The grids thus connected together form units or sections, a plurality of which are preferably used in making the complete rheostat. In order to support these units or sections in the frame 6, the bolts or rods 14 engage with holes in the grid

resistance supports 9, these supports being provided with openings or recesses 20 which fit over the nuts 18 and also over spacing nuts 21, these openings conforming with the shape of the nuts, so that when the supports are in position, the nuts will be prevented from turning. After the grid sections or units have been tightly clamped together by means of the nuts 18, the spacing nuts 21 on the threaded ends of the rods 14 are turned to the proper position to engage with the bottoms of the recesses 20 to hold the supports 9 in suitable position to engage closely with the slideways 8 in the frame 6. The supports 9 are then placed in position on the rods 14 and then the entire unit or section slid into place in the frame. The supports 9 are provided with lugs 22 which are adapted to engage with the front edges of the sides of the frame 6 in order to aline the supports in the frame. When all of the sections have been inserted in position, the front grate or door 23 is placed in position, the edges of this door engaging with the ends of the supports 9, thereby holding them in the frame.

In order to make the desired connections between the banks or units of grids at the center of the rheostat, we provide connections 24, one end of such connections being in the form of an eye for engagement with the insulating tube 13 to make connection with the hubs or bearings 11, and the other end being in the form of a hook. Electrical connection between these hooked ends is made by means of bolts 25 and spacing pipes 26, as indicated in Figs. 1 and 2, the hooks on the connectors 24 being pressed into engagement with the pipes 26 by means of nuts 27 on the bolts 25.

In order to provide terminals for connections with the wires leading to the source of electric supply and to the motors, other connections 28, preferably of the same form as the connections 24, are inserted at the outer ends of the banks or series of grids, as indicated in Fig. 1, these connections also having hooked ends between which the circuit is completed by means of links 29 and 30. The link 29 is provided with a stud 31, as indicated in Fig. 4, for engagement with the end of the lower connection 28 and is held in position by means of a nut 32 which engages with the threaded end of the stud and presses against a spring washer 33 which rests against the hooked end of the connection 28. The link 30 is provided with a hole in the end thereof, corresponding in shape to the nut 32, so that this link may be used for screwing up the nut and, when all of the parts are finally adjusted, serves as a lock for said nut. The terminal proper 34 is provided at its inner end with a stud 35 which engages with the ends of the links 29 and 30 and with the hooked end of the upper connection 28. This stud is threaded on its inner end and is preferably provided with a nut 36 and a lock nut 37, so that the terminal will be held rigidly without liability of becoming loosened. The connections between the terminals and the wires may be made in any desired manner, for instance, as shown in the drawings, in which the end of the terminal is provided with a hole 38 into which the terminal wire is inserted and then soldered in position.

By means of our improved apparatus, it will be readily seen that by loosening the terminal connections from any one bank series of grids, such series may be readily slipped out of the casing, when the door is removed, for the purpose of adjustment or repairs. Then, if desired, the supports 9 may be removed, allowing the nuts 18 to be loosened, and when these nuts are loosened, any broken or defective grid may be raised out of its position without interfering with the other grids. When a new grid is inserted, the nuts may again be tightened without disarranging the spacing nuts 21. When the parts have been again placed into position, and the doors closed, the rheostat is ready for use; and, on account of the arrangement whereby nearly all of the nuts are locked, none of the parts are apt to be readily loosened.

Having thus described our invention which we do not wish to limit to the exact construction or arrangement shown and described, what we claim and desire to secure by Letters Patent is:

1. In a rheostat, the combination of a rack or frame, slideways in said frame, slides adapted to engage with said slideways, and a plurality of resistance grids mounted in said slides.

2. In a rheostat, the combination of a frame, slideways in said frame, grid resistance supports slidably engaging with said slideways, cross-rods engaging with said supports, a plurality of resistance grids or members mounted on said cross-rods, and means coacting with said rods for clamping said grids independently of said supports.

3. In a rheostat, the combination of a rod, an insulating tube on said rod, a plurality of resistance members engaging with said tube, caps at the ends of said rod adapted to protect the insulating tube, and means for pressing said caps longitudinally of said rod for clamping the resistance members together.

4. The combination of a rod, an insulating tube on said rod, a plurality of resistance members engaging with said tube and adapted to be supported thereby, insulating washers on the ends of said tube, caps on said rod for protecting the ends of said tube and for pressing against said washers, spring nut locks or washers engaging with said caps, and threaded nuts on said rod engaging with said yielding nut locks, for the purpose described.

5. In a device of the character set forth,

the combination of a plurality of rods or bolts, insulating tubes engaging with said rods, a plurality of resistance members having hubs or bearings engaging with said tubes, insulating washers arranged between some of said hubs and at the ends of said tubes, caps at the ends of said tubes for pressing the hubs and washers together, nuts on said rods for tightening said caps, spacing nuts at the ends of said rods, and supports engaging with said rods, said supports having recesses for receiving said nuts and preventing them from turning, the position of said supports being also determined by said spacing nuts.

6. In a rheostat, the combination of a frame, a plurality of grid resistance supports slidably mounted in said frame, and doors engaging with said supports for holding them in position.

7. In a rheostat, the combination of a frame, a division wall in said frame, slideways in the divisions thus formed, a plurality of resistance grids mounted in said slideways, electrical connectors engaging with the grids adjacent to the division wall, having hooked ends, and rods or bolts engaging with said hooked ends for furnishing electrical connection between the banks of grids in the separate divisions.

8. In a rheostat, the combination of a frame or casing, banks of resistance grids mounted in said casing, connections for making contact with some of said grids, a link having a stud at one end for engagement with one of said connections, a nut on said stud, a second link having an opening in the end for engagement with said nut, and a terminal connection having a stud engaging with the opposite ends of said links and with the other connection, whereby an electric circuit is made from said grids to the terminal wires.

9. In a rheostat, the combination of a plurality of rods for supporting resistance members, nuts on said rods for clamping said members longitudinally of said rods, and supports adapted to engage with the ends of said rods, said supports being provided with means for preventing the nuts from turning when the rods are in engagement with the supports.

10. The combination with grid resistance supporting rods having nuts at the ends thereof, of supporting members adapted to engage with said rods and with said nuts, said members being provided with recesses corresponding with the shape of said nuts, whereby such members may be used as wrenches for turning the nuts and will also serve to hold the nuts in position when the rods are in engagement with said members.

RALPH E. NOBLE.
LOUIS E. MITCHELL.

Witnesses:
WILLIAM A. NARTEN,
B. P. TRACY.