No. 701,012. Patented May 27, 1902.

R. W. BROWN & C. A. RHINE.

RHEOSTAT.

(Application filed Dec. 16, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 5.

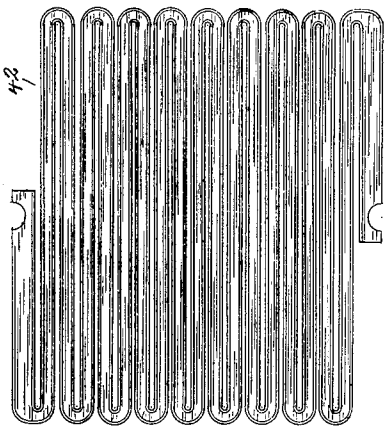


Fig. 6.

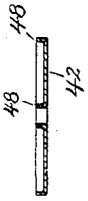


Fig. 17.



Fig. 2.

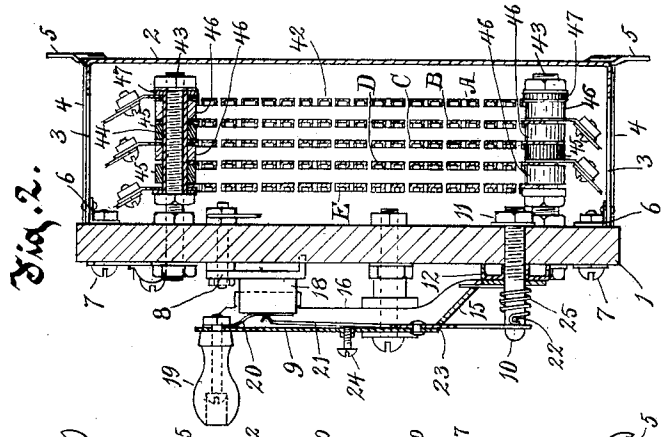


Fig. 4.

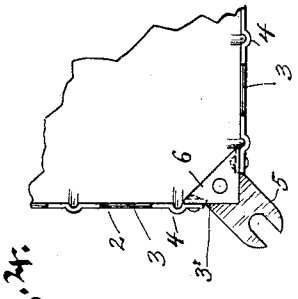


Fig. 19.

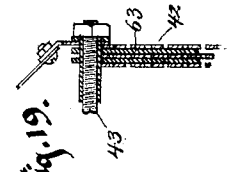


Fig. 1.

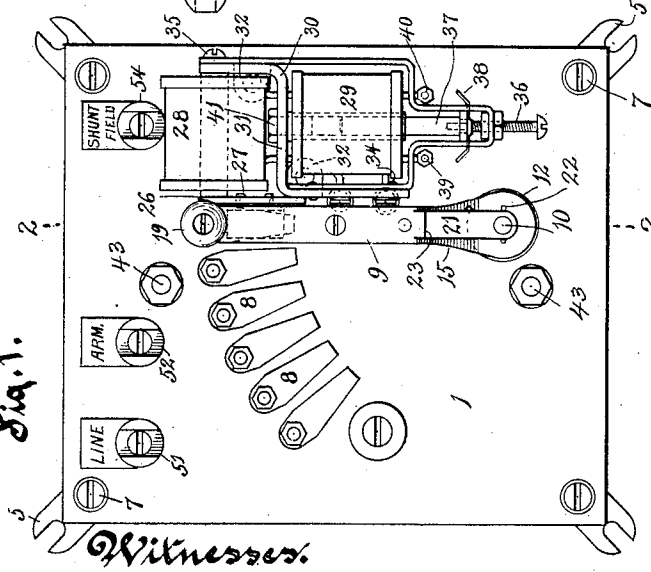
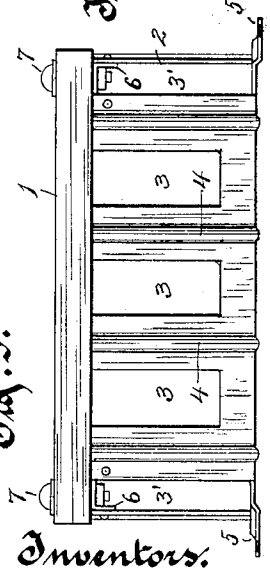


Fig. 3.



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(Application filed Dec. 16, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 15.

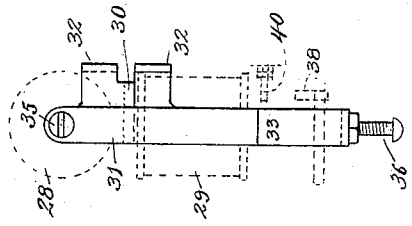


Fig. 16.

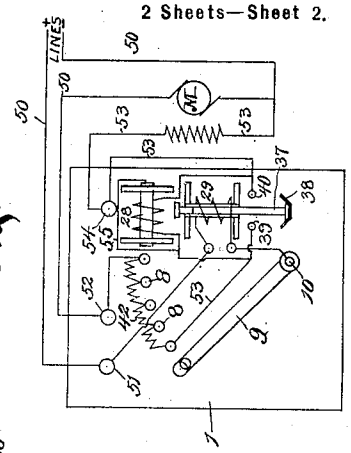


Fig. 14.

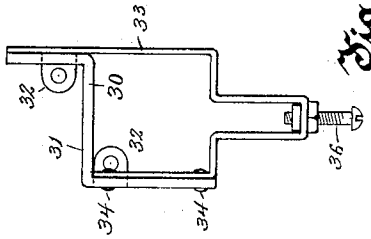


Fig. 18.

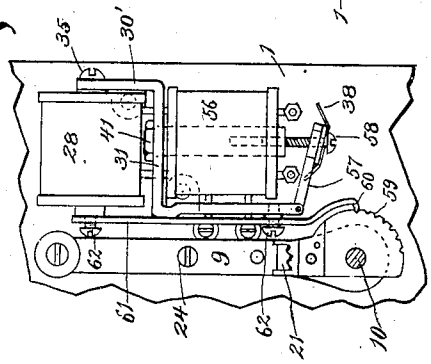


Fig. 7.

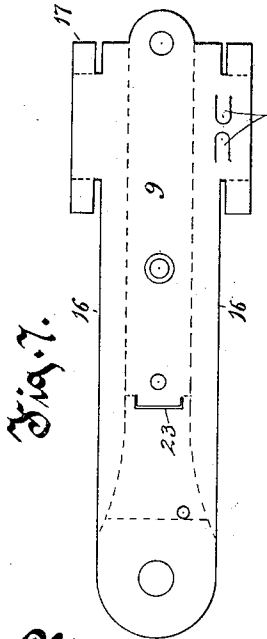


Fig. 8.

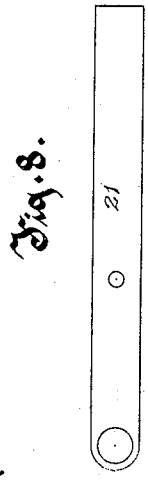


Fig. 9.

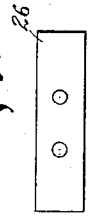


Fig. 10.

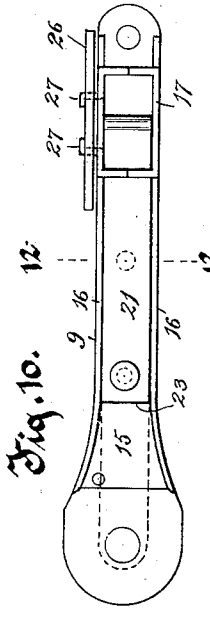


Fig. 11.

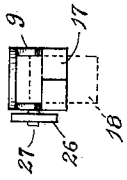


Fig. 12.

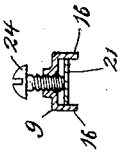
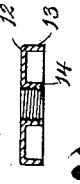


Fig. 13.



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UNITED STATES PATENT OFFICE.

ROY W. BROWN AND CHARLES A. RHINE, OF MILWAUKEE, WISCONSIN, ASSIGNORS TO UNION ELECTRIC MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A COPARTNERSHIP.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 701,012, dated May 27, 1902.

Application filed December 16, 1901. Serial No. 86,143. (No model.)

To all whom it may concern:

Be it known that we, ROY W. BROWN and CHARLES A. RHINE, residing at Milwaukee, Wisconsin, have invented a new and useful Improvement in Rheostats, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

Our invention relates to improvements in rheostats, and involves a special construction of parts of the device whereby a strong, durable, and effective rheostat may be provided at a minimum of cost, a novel disposition and arrangement of the parts of the rheostat, and other features incidental thereto.

In the drawings, Figure 1 is a front elevation of our improved rheostat. Fig. 2 is a section on line 2 2 of Fig. 1 looking toward the left. Fig. 3 is a view of the lower edge of the rheostat, the view showing only the bottom edge of the slate and the case attached thereto forming the box. Fig. 4 shows a fragment of the case looking at it from the front, the slate being removed. Fig. 5 shows the resistance medium of the rheostat, commonly known as the "grid." Fig. 6 is a section transversely of a section of the grid. Fig. 7 shows the blank cut from sheet metal for the switch arm or handle of the rheostat, lines on which the blank is to be bent being shown in broken lines. Fig. 8 illustrates a blank from elastic sheet metal for a support of the handle and for a spring to hold a copper contact-piece and a carbon-block to their work. Fig. 9 is a detail of an armature for the electromagnet. Fig. 10 shows the handle pressed or swaged to its completed form with related devices. Fig. 11 is an end view of the handle shown in Fig. 10. Fig. 12 is a section on line 12 12 of Fig. 10. Fig. 13 is a section of a metal collar mounted on a post and serving as a base and electric contact-piece for the handle. Fig. 14 illustrates a metal frame for the electromagnet and the solenoid. Fig. 15 is an edge view of the frame shown in Fig. 14 with related parts shown in broken lines. Fig. 16 is a diagram of electric connections for the rheostat. Fig. 17 is a section transversely of a section of a grid in slightly-modified form. Fig. 18 shows a modified form of parts of the device in which an electromagnet is employed in place of the solenoid shown in Fig. 1, the device being more especially adapted to be employed either as a controller or as a starter. Fig. 19 is a modified form of disposition of grids.

In the drawings, 1 represents a slate of the character commonly used in rheostats as a means for supporting other parts of the apparatus in insulation.

2 is a case made of sheet metal, preferably of steel, and so secured to the slate 1 as to form a box in which the grids or rheostat-resistances are inclosed. This case is struck up by swaging or pressure from sheet-steel theretofore cut in such form that the case has apertures 3 3 in its side walls and apertures 3′ 3′ at its corners, and also with strengthening-ribs 4 4 and with ears or lugs 5 5 at its corners, whereby the rheostat can be readily fastened detachably to a supporting wall or structure. Also sheet-metal corner-pieces 6 6 are provided which are in angle form and are secured to the case by rivets and provide for attaching the case to the slate removably by means of bolts 7 7. This form of case is strong and durable and affords ample ventilation for the rheostat.

A number of metal electric contact-pieces 8 8 are mounted in series in an arc on the slate 1. A swinging switch arm or handle 9 is pivoted on a post 10, set in the slate 1 and secured thereto by a nut 11, turning on the post against the under surface of the slate. A collar 12, made of sheet metal and provided with a screw-thread, turns on the post 10 against the outer surface of the slate 1 and aids in holding the post 10 in position in the slate. The collar 12 is formed of sheet metal by swaging up a rim 13 and a central hub 14 thereon, in which hub the screw-thread is made. The handle or swinging switch-arm 9 is pivoted at one end on the post 10 and bears electrically and revolubly on the collar 12 and projects to and is adapted to swing over the several contact-pieces 8 8. The switch-arm 9 is made from sheet metal, it being so swaged that there is an offset formed therein at 15. The longitudinal edges are turned inwardly, forming marginal ribs 16 16

and a carbon-holding frame 17, in which a block of carbon 18 fits movably; also, the switch-arm is provided with a terminal wood handle 19. To insure satisfactory electrical connection between the arm 9 and the carbon block 18, a strip of metal, preferably copper, 20, is employed, which strip is secured to the free end of the arm and rests on the block of carbon. An elastic sheet-metal spring 21 is mounted at one end revolubly on the post 10, which spring projects through a slot 23 therefor in the switch-arm 9, and its free end, formed with a transverse rib, rests on the copper strip 20 and holds the strip in proper contact with the block of carbon, while the strip 21 also serves, being sufficiently stiff therefor, to support the switch-arm in proper position. A screw 24, turning through the switch-arm 9 against the spring 21, is adapted to adjust the position of the spring with reference to the arm. A spring 25, coiled about the post 10 and secured at one end to the pin 22, bears against the arm 9 and holds it with the required firmness against the base-collar 12 and torsionally returns the switch-arm to its initial position. The carbon block 18 rides on the several contact-pieces 8 8. A metal armature 26 is mounted on projections 27, in the nature of lugs, cut of and turned outwardly from the material of the switch-arm, forming the carbon-box.

An electromagnet 28 and a solenoid 29 are mounted in a metal frame 30, that is secured detachably to the slate 1 adjacent to one of the contact-pieces 8 and to the switch-arm 9. The frame 30 consists of the bent and rather thick sheet-metal strip 31, provided with feet 32 32, integral therewith and formed from the same blank, and the bent metal strip 33, secured at one side to the strip 31 by rivets 34 34. This frame 30 is secured to the slate 1 detachably by screws or bolts through the feet 32 32 and through the slate. The core of the electromagnet 28 is secured in place by a screw 35 through the strips 33 and 31 and turning into the core. A prolongation downwardly of a portion of the strip 33 is provided with an adjustable screw 36, which screw serves as a stop for supporting and limiting the downward movement of the core 37 of the solenoid 29. A non-magnetic pin in the core end makes the contact with the screw. An insulated metal contact-piece 38 is secured to the lower extremity of the core 37 and is adapted when the core is drawn up to contact with the electric terminal contact-posts 39 40, and thereby to short-circuit the electrical circuit of which the posts are a part. The strips 31 and 33, of which the frame 30 is composed, are cut from sheet-steel or other suitable metal and are bent or swaged into form to construct the frame adapted to mount the electromagnet and solenoid therein and to be secured to the slate. The solenoid 29 is secured detachably to the frame by a screw 41, passing through the strip 31 and turning into the brass non-magnetic tubular axial member of the spool of the solenoid. The construction and disposition of the parts is such that the core 37 is reciprocable vertically in the solenoid 29, the metal strip 31 serves as a part of the magnetic members of the electromagnet 28 and the solenoid 29, and the armature 26 is adapted when the switch-arm is swung into the position shown in Fig. 1 to contact with the core of the electromagnet and with the frame member 31, serving magnetically.

The rheostat-resisting mediums consist of a plurality of grids 42, severally mounted parallel with but separated from each other on studs 43 43, fixed in the slate 1. These studs are screw-threaded and are provided with nuts turning thereon for securing them detachably in the slate and for securing the grids in place thereon. The grids are insulated from the studs by sleeves of insulating material 44 around the studs. The grids are separated from each other by rings or washers placed between each adjacent two of them around the studs 43, the washers 45 being of insulating material and the washers 46 being of metal. The insulating-washers on each stud alternate with the metal washers, the metal washers on one stud being placed between grids that have insulating-washers between them on the other stud; also, insulating-washers 47 47 separate the grids from the nuts on the stud. The grids are constructed integrally of sheet metal cut out and swaged up to the form employed, and the grids are advisably made of sheet metal of different thicknesses, varying according to the current-carrying capacity required in the successive steps of resistance. In the drawings the thickness increases regularly in the series of grids from one side of the series to the other side or member thereof, as shown in the series A, B, C, D, and E in Fig. 2. Each of these grids for giving it the desired length in compact form consists of the continuous and integral and reversely-extending strip of metal, (shown in Fig. 5,) which strip of metal for giving it the required strength and additional electrical capacity is provided with a continuous rib or ribs 48 48, struck up thereon throughout its entire length. In the form shown in Figs. 5 an 6 these ribs are marginal, while in the form shown in Fig. 17 the rib is medial. In the diagram shown in Fig. 16 an electric system is indicated, in which our improved rheostat is adapted to be employed. The plus-line 50 leads through a post 51 on the slate 1, and thence to and around the spool of the solenoid 29, and thence to the post 10 and onto the switch-arm 9. When the switch-arm 9 is in the position shown in Fig. 16, the circuit is broken. When the switch-arm 9 moves to any one of the contact-pieces 8, the line is continued through the resisting mediums 42 and thence by way of the post 52 to the motor M and thence to the other line of the circuit, also continued as 50 minus. A shunt-line 53 runs from the first contact-piece 8 to the electromagnet 28, forming the

coil thereof, and thence by way of the post 54 to the line 50 at the distant side of the motor. Another shunt-line in the shunt-line 53 runs through the posts or contact-pieces 39 and 40, and this shunt-line is closed by the contact-piece 38, thereby cutting out the electromagnet 28. A branch line 55 leads from the line 53 to the core of the electromagnet 28 and short circuits the resistance 42 when the switch-arm 9 comes to the electromagnet 28.

In Fig. 18 a modified form of construction is shown in which an electromagnet 56 is employed in the place of the solenoid 29 of Fig. 1. The supporting-frame 30′ consists of a single strip of metal bent substantially in the form of the strip 31 in the frame of Fig. 1. The electromagnet 56 has only a fixed core, and the contact-piece 38 is mounted on a swinging arm 57, pivoted conveniently in the lower end of the frame 30′. The downward movement of this arm and the contact-piece 38 is limited by a screw 58 turning into the core of the electromagnet 56, the screw serving as a stop. The swinging switch-arm 9 is provided with a segmental rack 59, constructed of sheet metal, riveted on the arm and concentric with its pivot, which rack is adapted to take therein a hook 60 on the lower end of an armature 61, suspended loosely and tiltably on screws 62 62, turning, respectively, into the magnet of the electromagnet 28 and into the frame 30′.

In the modified form of disposition of grids shown in Fig. 19 the washers 45 and 46 are omitted and an insulating material 63, preferably asbestos in sheets, interposed between the grids. This enables us to put more grids, and consequently more resistance, in the space that would be required by the grids when air-spaces only are provided between them.

The arrangement shown in the drawings of placing insulating-washers 45 between grids alternately with metal washers 46 on each stud may be varied by placing more than two grids in electric parallel, and consequently interposing metal washers between all the grids so employed in parallel.

What we claim as our invention is—

1. In a frame for a rheostat, a sheet-metal member in double-L form provided with supporting-lugs and adapted to support one or more magnets thereon.

2. In a frame for an electromagnet in a rheostat, a principal member consisting of a strip of sheet metal bent into double-L form having reversely-projecting end portions and a medial transverse portion at right angles thereto.

3. In a rheostat, a frame for an electromagnet and a solenoid, composed of two strips of sheet metal cut and swaged into form and riveted to each other and inclosing a substantially square space and projections therefrom at one angle thereof.

4. In a rheostat, a frame for an electromagnet and a solenoid, consisting of two strips of sheet metal so bent and riveted to each other as to inclose a space and an offset therefrom at one side thereof the frame of the offset projecting at one side of the space.

5. In a rheostat, a frame for an electromagnet and a solenoid, consisting of two strips of sheet metal so bent and riveted to each other as to inclose a space and an offset therefrom at one side thereof, and means integral with a strip of the frame for securing it to supporting means.

6. In combination in a rheostat, a strip of sheet metal bent in double-L form, and a plurality of magnets attached thereto one to a free terminal bar of the strip and the other to the medial transverse bar of the strip.

7. In combination in a rheostat, a strip of sheet metal bent in double-L form, a plurality of magnets attached thereto one to a projecting bar of the strip the other to the medial bar, and a swinging armature-arm hinged to the other projecting bar of the strip.

8. In combination in a rheostat, a strip of sheet metal bent in double-L form, a plurality of magnets attached thereto one to a projecting bar of the strip, the other to the medial bar, a swinging armature-arm hinged to the other projecting bar of the strip, and a tilting armature fulcrumed and supported on the last-mentioned bar of the strip.

9. In a rheostat, a switch-arm composed of a strip of sheet metal swaged into form with longitudinal strengthening marginal ribs and with a carbon-holding frame.

10. A switch-arm for a rheostat struck up from sheet metal, and having marginal strengthening-ribs, and a carbon-holding frame.

11. In combination in a rheostat, a switch-arm struck up from sheet metal having marginal ribs and a carbon-holding frame, and a flat spring alongside the arm between said ribs and passing through a slot therefor in the arm and adapted to bear on a carbon in the carbon-frame.

12. In a rheostat, a switch-arm struck up from sheet metal and so mounted at one end as to be capable of swinging in an arc, a concentric ratchet also of sheet metal secured to the switch-arm and an armature-actuated hook engaging said ratchet releasably.

13. In combination, a switch-arm for a rheostat struck up from sheet metal with marginal ribs and a carbon-holding frame, a flat spring secured to and parallel with the switch-arm between its marginal ribs, and an adjusting-screw turning in and through a struck-up bur on the switch-arm against the spring adapted to adjust the tension of the spring.

14. A rheostat-case struck up from sheet metal and having a rear wall and side walls with integral ears at the corners adapted for securing the rheostat to its support and with struck-up ribs on the side walls.

15. A resistance medium for a rheostat, consisting of a grid struck up from sheet metal in the form of a continuous strip having return-bends, a plurality of parallel medial sections, and parallel terminal sections provided

with lateral recesses for receiving supporting-studs therein.

16. A resistance medium for a rheostat, consisting of a grid struck up from sheet metal in the form of a continuous strip having return-bends and parallel adjacent longitudinal sections and having a longitudinal rib or ribs therein.

17. In combination in a rheostat, an integral holding-frame member, and a plurality of independent electromagnets mounted on the integral frame member, the frame member serving to support the electromagnets and forming a part of the magnet-yokes of both electromagnets.

18. In a rheostat, a switch-arm composed of a strip of sheet metal swaged into form with strengthening-ribs and with a frame for a contact-piece.

19. In combination in a rheostat, a switch-arm struck up from sheet metal having a contact holding-frame, and a flat spring secured to the arm and serving the double purpose of an additional support for the arm and of a spring bearing on the contact member.

20. In a rheostat, a resistance medium swaged from sheet metal with strengthening-ribs.

21. A resistance medium for a rheostat, composed of a plurality of sheet-metal grids each grid consisting of a single strip of metal, the strips of all the grids being of uniform width but of varying thicknesses, and connected up electrically.

22. In a rheostat, a frame for a solenoid composed of strips of sheet metal cut and swaged into form and riveted to each other and inclosing a substantially square space, and having a guideway for the solenoid-core extending from one side of the frame.

23. In a rheostat, a switch-arm composed of sheet metal swaged into form and having thereon a frame for a contact-piece.

24. In a rheostat, a switch-arm composed of two strips of sheet metal swaged into form and secured together.

25. In a rheostat, a switch-arm composed of two strips of sheet metal swaged into form and secured together, and a coiled spring between separated terminal portions of the two strips.

In testimony whereof we affix our signatures in presence of two witnesses.

ROY W. BROWN.
CHARLES A. RHINE.

Witnesses:
C. T. BENEDICT,
ANNA V. FAUST.