E. L. CLARK.

COMPRESSION RHEOSTAT.

APPLICATION FILED MAR. 31, 1913.

1,201,255.

Patented Oct. 17, 1916.

3 SHEETS—SHEET 1.

Fig.1

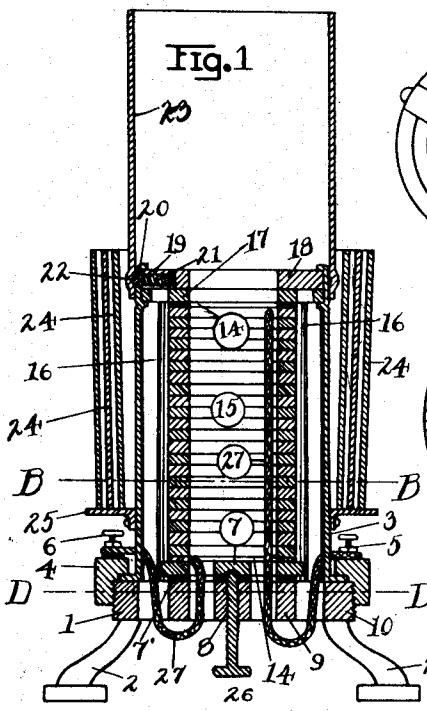
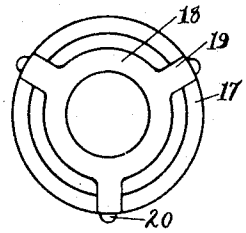


Fig.3



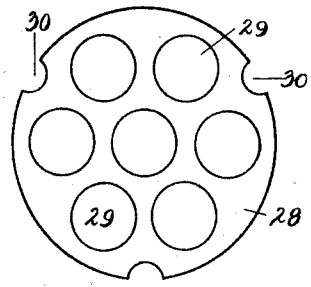


Fig.5

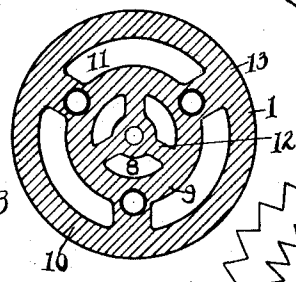
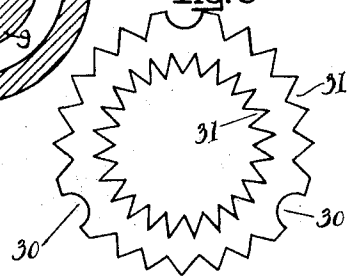


Fig.4

Fig.6



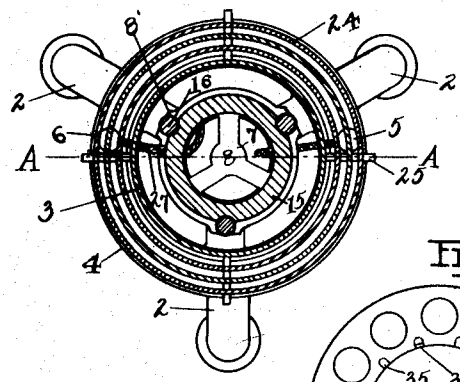


Fig.2

Fig.7

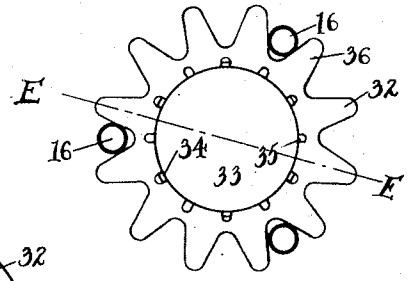


Fig.8

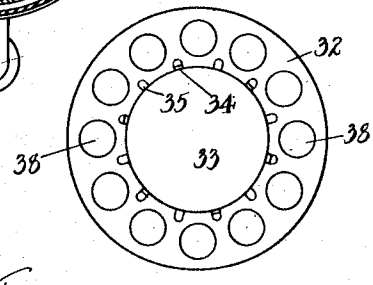
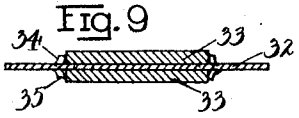


Fig.9



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3 SHEETS—SHEET 2.

Fig. 10

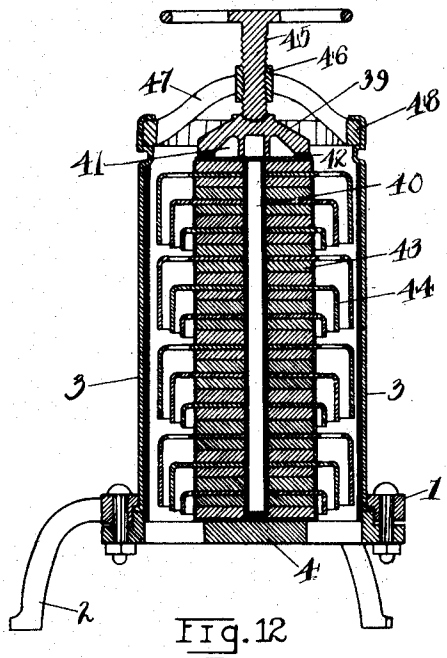


Fig. 11

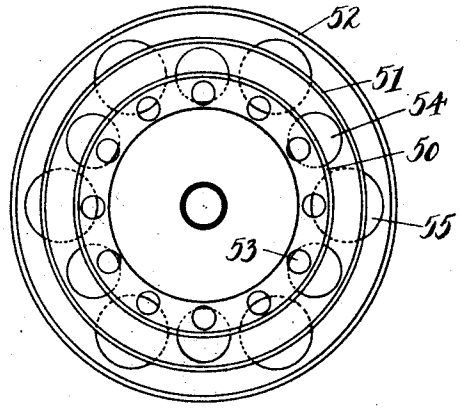


Fig. 12

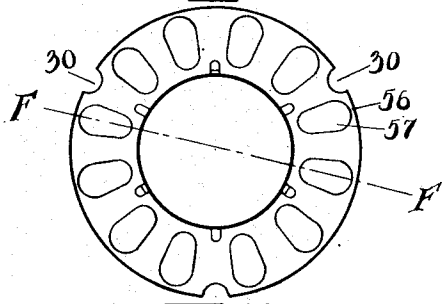


Fig. 13

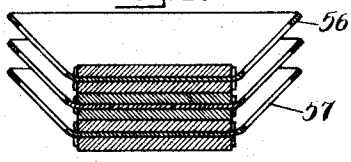


Fig. 14

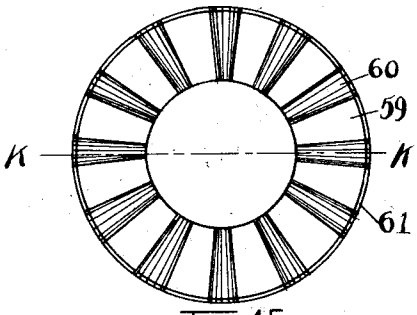
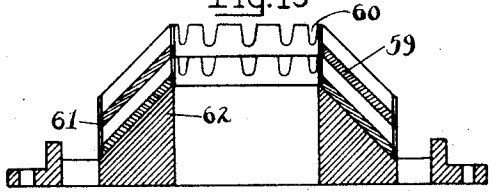


Fig. 15



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3 SHEETS—SHEET 3.

Fig. 16

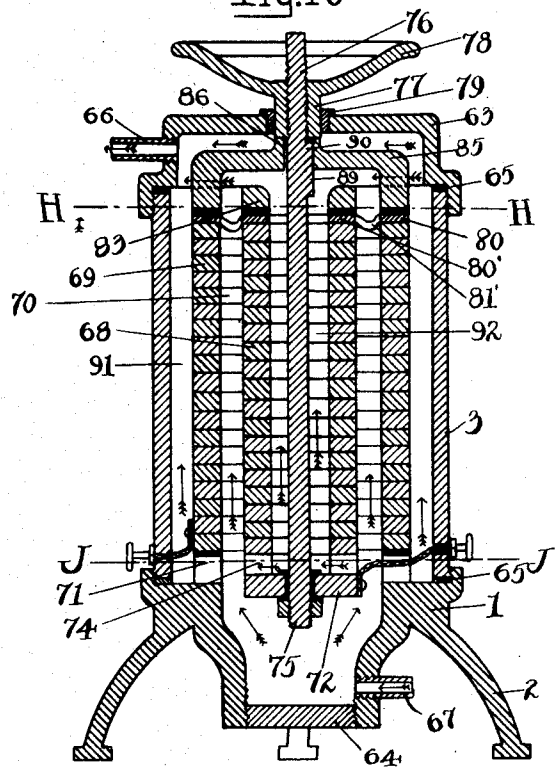


Fig. 17

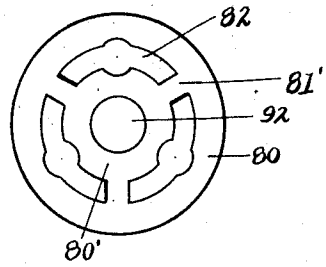


Fig. 18

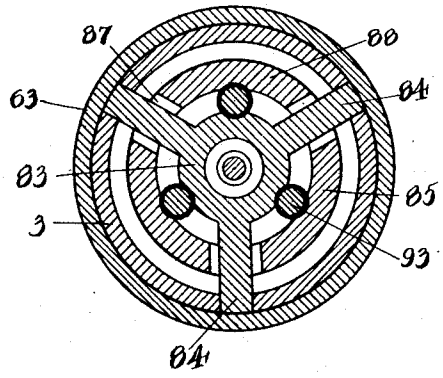
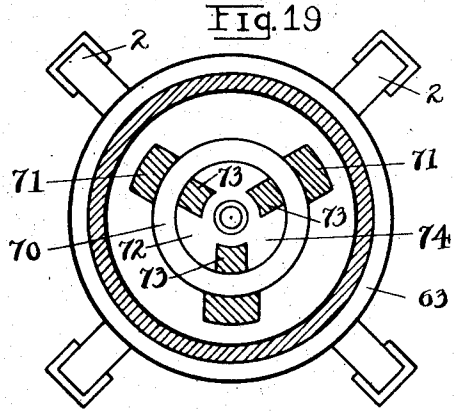


Fig. 19



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UNITED STATES PATENT OFFICE.

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COMPRESSION-RHEOSTAT.

1,201,255. Specification of Letters Patent. Patented Oct. 17, 1916.

Application filed March 31, 1913. Serial No. 757,777.

To all whom it may concern:

Be it known that I, EMERSON L. CLARK, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Compression-Rheostats, of which the following is a full, clear, and exact description.

This invention relates to improvements in compression rheostats, and particularly to the vertical type. The variation of resistance is secured by pressure applied to the resistance elements.

The principal object of this invention is to secure rapid cooling of the resistance elements so as to obtain a rheostat of large capacity and small volume.

Another object is to obtain forms of resistance elements that are adapted to ready radiation of the heat generated.

Other objects will appear in the appended description.

Referring to the drawings, Figure 1 is a cross-sectional view on the line A—A of Fig. 2 of one form of my improved rheostat. Fig. 2 is a cross-section of the rheostat shown in Fig. 1 on the line B—B. Fig. 3 is a plan view of the top members of the rheostat. Fig. 4 is a cross-section on the line D—D of Fig. 1 showing the construction of the lower frame. Fig. 5 is a plan view of a resistor which is adapted to be used in the rheostat of Fig. 1. Fig. 6 is also a plan view of another type of resistor. Fig. 7 is a modified form of resistor. Fig. 8 is a modification of the resistor shown in Fig. 7. Fig. 9 is a cross-sectional view on the line E—E of Fig. 7. Fig. 10 is a cross-sectional view of a modified form of rheostat. Fig. 11 is a plan view of one set of the resistors used in the pile shown in Fig. 10. Fig. 12 is another modified form of resistor which may be used in either Fig. 1 or 10. Fig. 13 is a cross-section on the line F—F of Fig. 12. Fig. 14 is another form of resistance element. Fig. 15 is a cross-section on the line K—K of Fig. 14. Fig. 16 is a cross-sectional view of a modified form of rheostat. Fig. 17 is a plan view of the conducting plate of Fig. 16. Fig. 18 is a cross-section taken on the line H—H of Fig. 16 and looking in the direction of the arrows. Fig. 19 is a cross-section on the line J—J of Fig. 16.

Referring to the rheostat shown in Figs. 1, 2, 3, and 4, the base 1 rests upon the legs 2, and supports a cylindrical metal case 3 which incloses the resistors. The case is joined to the base by the collar 4. Binding posts 5 and 6 are secured to the collar and are insulated therefrom in any well known manner. A compression member 7 rests on the base with a layer of insulating material 7′ between.

The base 1 has three hollow concentric rings 8, 9, and 10 spaced apart and joined by the webs or spokes 11 and 12. Each of the webs 11 has a threaded hole 13 in which the guide rods 16 are secured.

The compression member 7 consists of rings joined by webs similar to those of the base designated by reference characters 8, 9 and 12. The member 7 has lugs 8′ partly surrounding the rods 16 so as to hold it from turning. The insulation 7′ is shaped similar to the member 7.

A ring 14 of good conducting material is inserted between the compression member 7 and resistance rings 15. These rings are arranged between the non-conducting alining rods 16 which are threaded or otherwise fastened to the base 1 and top 17. Above the resistance rings another conducting ring 14 is placed which is insulated from the top member 17 shown in cross-section in Fig. 3.

Upon the top 17 is placed a ring 18 having a plurality of lugs 19. Catches 20 are fitted in each lug and are actuated by springs 21. Holes 22 in case 3 allow the lugs to project therethrough and support a hollow cylinder 23. By applying pressure on the cylinder 23, the catches may be moved inward and the cylinder pushed down to rest on the projections 25. Other cylinders 24 are shown surrounding the case and resting on the projections 25. By raising the cylinders 24, a chimney is obtained. The construction is similar to the well-known telescopic cup, each cylinder increasing in diameter toward the top. When the rheostat is not in use, all the cylinders may be lowered so that it will take up small space.

The adjusting screw 26 is threaded into the base 1 and engages the member 7. The conducting plates 14 are connected by flexible leads 27 to the binding posts 5 and 6. These leads are preferably covered with heat resisting insulating material.

In Fig. 5, a different type of resistor 28 is shown having a number of holes 29 therein. Registering notches 30 coöperate with the

rods 16 of Figs. 1 and 2 to keep the holes 29 in alinement. The shape of the base used with this form of resistor, would preferably be made so as to correspond with that of the resistor although different forms of bases could be used.

The resistor shown in Fig. 6 has registering notches 30 cut in the periphery for the purpose of alinement. This resistor is in the shape of a ring and has grooves or notches 31 of any form in the internal and external circumference to aid in radiation.

In Figs. 7, 8 and 9, two resistors are shown having metal radiating plates 32 (Fig. 7 and 8) and 37 (Fig. 9) fitted between two plates 33 of resistance material. The resistors are attached to the metal plate by means of lugs 34 and 35 punched alternately on opposite sides of the plate. The radiating plate 32 shown in Fig. 7 has a number of projectors 36 spaced around the circumference. In certain of these grooves the alining rods 16 are fitted. The radiating plate 37 shown in Fig. 8 has holes 38 punched in the periphery outside the resistance plates, and the registering rods 16 are passed through holes or notches which may be provided in the exterior edge for this purpose.

The modification shown in Fig. 10 consists of a case 3 preferably insulated on the interior. The base 1 and collar 4 are held together by bolts and supported by the legs 2 similarly to Fig. 1. In this form, however, the collar is arranged beneath the base. This rheostat is compressed from the top by the screw 45, which engages the member 39. A registering rod 40 properly insulated passes through the resistor plates and rests on the base 1, the other end fitting into the hole 41 in the member 39. Below the compression member 39 is placed a conducting plate 42 which is insulated therefrom. Between the resistors 43, cupshaped radiating plates 44 are fitted. Frame 46 is connected by the arms 47 to a ring 48 which is fitted in the case 3.

The pile of resistors shown in Fig. 11 is an enlarged view of that used in the rheostat of Fig. 10. Three inverted cup shaped radiating plates 50—51—52, of successively increasing diameter are arranged between the resistor blocks. A plurality of holes 53—54—55 are provided in the radiating cups. The holes in the cups are staggered in order to distribute the ventilating medium. The cups 50, 51 and 52 are of successively increasing depth so that when the resistors are placed therebetween, the tops will be approximately in a straight line. Another pile having cup shaped radiating plates placed between the resistors is shown in Figs. 12 and 13. The radiating plates 56 are in the shape of a truncated cone with openings 57 cut therein for the passage of the ventilating medium. Registering notches 30 are provided in the edges for alinement purposes. The manner in which the radiating plates are fastened to the resistors has been described in connection with Figs. 7, 8 and 9.

The resistor of Figs. 14 and 15 is adapted for use in the rheostats of Figs. 1 and 10 but the base as shown in Fig. 15 is preferably used therewith. The resistor 59 is a hollow truncated cone and has a number of grooves 60 formed in the inner or outer surface. The cooling medium passes up the outside of the cone and will be carried through the grooves to the inner channel. In order to prevent oxidation, the resistors may have a metal coating 61 at the edges. Base 62 is cone shaped to fit in the hollow portion of the resistors.

Figs. 16, 17, 18 and 19 illustrate a type of rheostat adapted for liquid cooling, water being preferable. The frame 1 is supported by legs 2. The case 3 is closed at the top by the cover 63 and at the bottom by the plug 64. The joints are made water tight by any means such as gaskets 65. An outlet pipe 66 is provided in the top and a similar inlet pipe 67 is fitted into the base. The resistors consist of two piles of concentric rings, 68 and 69. These rings have a space 70 for the passage of fluid between them. The outer rings 69 rest upon the projections 71 of the base 1 shown in Fig. 19. The inner rings 68 rest upon the radial lugs of the spider 72. The space 74 between the projections permits the passage of the cooling medium to the interior of the resistors.

The spider 72 is attached to one end of the adjusting rod 75 and is insulated therefrom. The other end 76 of the rod is threaded and coöperates with a threaded portion 77 of the adjusting wheel 78. A packing 79 makes a water tight connection between 77 and the top 63. Electrical contact between the two sets of rings is secured by the rings 80 and 80′ placed on top. The rings 80 and 80′ are connected by flexible conductors 81′. Spaces 82 are provided between the conductors to permit the passage of the cooling fluid. The inner rings 68 are compressed against the member 83 shown in Fig. 18 by means of arms 84 which rest in slots in the case 3. An insulating plate is placed between the arms and the resistor. The compression member or cap 85 has a hole 86 at the center to permit the rod 75 to pass loosely therethrough. The edge of the cap has openings 87 through which pass the arms 84 of the member 83. The segments 88 bear against an insulation plate which rests on the plate 80 and serves to compress the outer rings. The lug or key 89 on the rod 75 fitting in the key way 90 in the member 85 prevents the rod from turning. A space 91 is left between the

case and the outer rings and another space 92 is left between the inner rings and the adjusting rod. Both of these serve as passageways for the cooling medium. In order to keep the rings in alinement, the guide rods 93 (Figs. 17 and 18) are placed between the resistors and are fastened in the member 85.

In Figs. 1 and 2 the resistors are compressed by manipulating the screw 26.

The improved manner of ventilating which is a feature of this rheostat consists in drawing cold air in at the bottom and passing it up through the openings in the base 1. The air is brought into contact with both the interior and exterior surfaces of the rings and passes out through the openings in the members 17 and 18. A draft will be created which rapidly cools the resistors, due to the effect of the casing 3 and the telescopic chimney when extended. The compression screw 26 has been placed at the bottom so as to be accessible and to prevent it from being heated by the hot air at the top. As shown in Fig. 1 the stack 23 and 29 may be collapsed around the frame of the rheostat to rest on the lugs 25. When collapsed, the chimney will occupy very little space. In most cases, the height of the chimney will not be a disadvantage, but if the rheostat is to be used in a position where the additional height would be undesirable, it can be used with the chimney collapsed. The capacity of the rheostat, however, is greatly increased by the use of the chimney.

By use of the resistor shown in Fig. 5 a plurality of internal draft columns will be formed by the holes 29 in the resistors which will cool them uniformly. The elements are kept in alinement by means of the notches 30 which engage the rods 16.

The resistor shown in Fig. 6 possesses all the advantages of the ring type, and by means of the grooves 31 the surface exposed to the action of the cooling medium is considerably increased. The capacity of the rheostat will, therefore, be considerably increased. Registering notches 30 will also be required in this type of resistor to keep the grooves in alinement.

If a resistor is used having metal radiating plates interposed between the carbon resistors as in Figs. 7 and 8, the heat generated in the resistors will be conducted to the radiating plates. This heat will be dissipated by the draft of air. In the case of the resistor of Fig. 7, the plate is cut away or grooved so that the air may be passed through the cut away portions. Certain of its grooves may be used as registering notches.

The resistance member in Fig. 8 is similar to Fig. 7 except that holes instead of grooves are punched in the ring. Registering rods may be passed through certain of the holes.

The rheostat of Fig. 10 is operated from the top by the screw 45. Cooling is secured by means of a draft of air through the inverted cups 50, 51 and 52 which provide a large radiating surface. The holes 53, 54, and 55 allow the cold air which is admitted at the base, to be distributed through the plates located above to insure uniform cooling. The heated air passes out at the top of the inclosing case, and a draft is thus created as in the previous types.

Another method of providing a large cooling surface by means of radiating plates is that shown in the arrangement of Figs. 12 and 13. By means of cone shaped cup 56, the radiating surface is increased considerably over that of a flat radiating plate. The holes 57 which are cut in the plate are kept in alinement by registering notches 30.

The hollow truncated cone resistor of Figs. 14 and 15 is grooved for the circulation of air. Air is admitted to the outside of the resistor and also to the inside, but is emitted only from the inner channel. At the top of the rheostat the outside portion will be closed either by the case or by a baffle disk. Thus air passes up through the grooves 60 to the center hole and is emitted at the top. In this cone shaped resistor, it will be noted that the resistance elements will be prevented from slipping or getting out of alinement. The slant of the cone should be made small enough to insure that the resistance element will not split when pressure is applied. The metallic coating applied to the outside of the resistor is not readily oxidizable and will protect the resistor.

By water cooling a rheostat as in the modification of Fig. 16, the capacity is greatly increased. The capacity is also increased by the two columns of resistors without greatly increasing the space occupied by the rheostat. When the screw 76 is turned by the handle 78, the member 72 is raised, thus compressing the resistance elements against the member 83. This is held rigidly in the case 3 by the arms 84. The same compression will be transmitted to the outer ring 69, through member 85. Thus by turning the wheel 78, the compression member 72 is moved upward and the member 85 is moved downward. At the bottom, the outside rings are compressed against the radial lugs 71 on the base 1. The two piles are electrically connected by the two metal rings 80 and 80′ which are in contact with the exterior and interior rings. These rings must be connected by a flexible connection such as 81, since they move relatively during the compression of the piles.

Water admitted at the point 67 in the bottom will pursue a course through the rheostat as indicated by the arrows, viz: through the spaces 91, 92 and 70. At the base, the cooling medium can pass from the central ring 70 to the rings 92 and 93 because of the spacing between the projections 71 and 73

located respectively on the base and the member 72. The top is similarly open so that the water may be withdrawn from these spaces. By this means, water circulated through all parts of the device is substantially unobstructed. The two sets of resistors are shown as being connected directly in series, but they may equally as well be connected in parallel.

The two columns may be dimensioned to have the same cross-section. This would be particularly advantageous if they are connected in parallel as both columns would then take the same load.

Having described my invention, what I claim is:

1. In electric rheostats, a plurality of resistance plates forming a vertical pile, said plates having adjacent openings forming an upwardly extending passageway through said pile, a casing for the plates having openings at opposite ends communicating with said passageway to permit the circulation of a cooling medium therethrough, and means for compressing the plates.

2. In an electric rheostat, a vertical inclosing case having upper and lower end members, a plurality of resistance plates forming a pile supported by the lower end, said plates having adjacent openings forming a passageway through said pile, means connected between the end members for maintaining the plates in alinement, said ends having openings communicating with said passageway for the admission and removal of a cooling medium.

3. In an electric rheostat, a plurality of resistance plates forming a pile, an inclosing case for said resistors open at both ends and means spaced between the case and the pile and extending along the edges of the plate for maintaining them in alinement whereby a longitudinal channel communicating with the open ends is provided for the passage of a cooling medium.

4. In an electric rheostat, a plurality of horizontally placed resistors forming a vertical pile, means open at the top and bottom for inclosing the resistors to admit a cooling medium at the bottom and remove it at the top, and means for compressing the resistors operated at the bottom of the casing.

5. In an electric rheostat, a plurality of perforated resistance plates forming a pile, means for maintaining the perforations in alinement, a vertical inclosing case spaced apart from the plates, upper and lower members fastened to the case having openings therein corresponding substantially to the openings in said plates whereby a current of air is passed substantially unimpeded through the resistors and the space between the resistors and the case.

6. In an electric rheostat, a plurality of resistors, means for maintaining the resistors in alinement, a vertical inclosing cylinder having openings for the admission and removal of air and a hollow shaft adapted to be placed above the resistors whereby an increased draft is provided.

7. In an electric rheostat, a plurality of resistance plates, means for maintaining the plates in alinement, a compression member for said plates, a vertical inclosing member and a hollow collapsible shaft or chimney adapted to be placed above the plates, whereby an increased draft is produced therethrough.

8. In an electric rheostat, a plurality of resistors, means for maintaining the resistors in alinement, a compression member at the bottom of said resistors, a vertical inclosing member, a hollow collapsible shaft or chimney adapted to be placed above the resistors whereby an increased draft is produced therethrough.

9. In an electric rheostat, a plurality of plates forming a pile, an inclosing case having a stationary and a movable end member fitted therein adapted to admit a cooling fluid, a support for the casing and means for moving the movable member and the plates, whereby the pile is compressed against the stationary end.

10. In a compression rheostat, a pile of resistor plates with a plurality of openings therethrough and a plurality of notches in their edges, alining members fitting in said notches to maintain openings of the plates in alinement and form a passageway through the pile.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

EMERSON L. CLARK.

Witnesses:
IRA J. ADAMS,
H. G. GROVER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."