Dec. 16, 1941. A. A. FOLEY ET AL 2,266,188

RHEOSTAT CONSTRUCTION

Filed Oct. 7, 1939

Fig. 1.

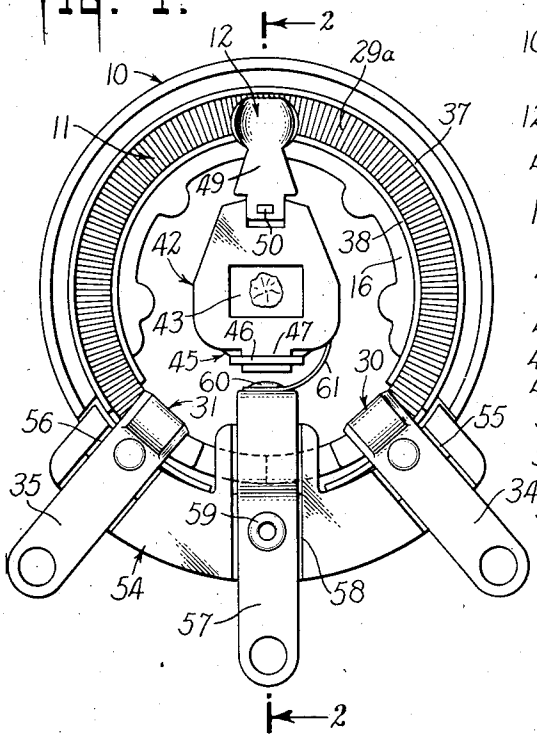


Fig. 2.

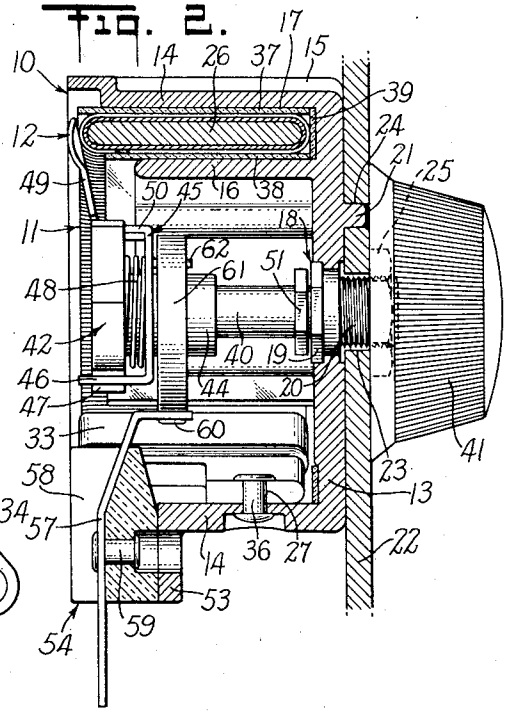


Fig. 3.

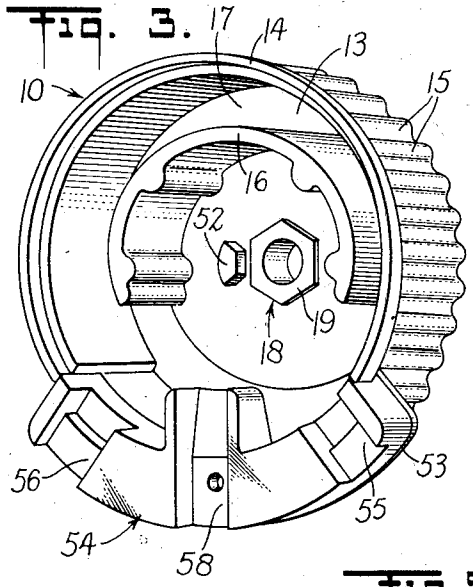


Fig. 4.

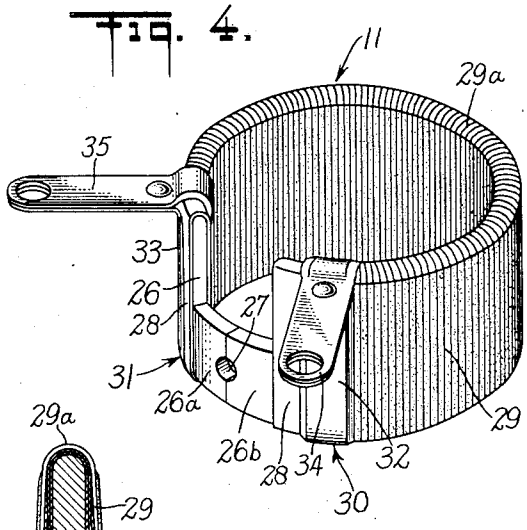
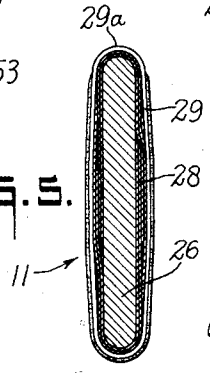


Fig. 5.



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RHEOSTAT CONSTRUCTION

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Application October 7, 1939, Serial No. 298,412

7 Claims. (Cl. 201—55)

This invention relates to resistor construction and more particularly to rheostat especially adapted for high capacity operation.

One of the objects of this invention is to provide a rheostat which will be simple, practical and thoroughly durable in operation. Another object is to provide a rheostat of the above character which may be manufactured from inexpensive materials at low labor cost. Another object is to provide a rheostat of the above character which despite a small and inexpensive construction is capable of enduring without danger or damage relatively high current capacities. Another object is to provide a rheostat in which heat generated by the resistance element while operating is rapidly and efficiently dissipated. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is shown one of the various possible embodiments of this invention,

Figure 1 is a plan view of the open side of our rheostat;

Figure 2 is a vertical sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a perspective view of the casing of our rheostat;

Figure 4 is a perspective view of the resistance element as assembled preparatory to installation in the casing shown in Figure 3; and

Figure 5 is an enlarged vertical section through the resistance element shown in Figure 4.

Similar reference characters refer to similar parts throughout the several views of the drawing.

As conducive to a clearer understanding of certain features of this invention, it might be pointed out that there has been an increasing demand for a rheostat relatively small and simple in construction and yet capable of carrying large currents without damage. Small rheostats such as those now in common use have a tendency to generate large amounts of heat not only damaging to the rheostat construction but also to other electrical parts which by necessity must be located closely adjacent thereto. The operation of such rheostats at very high temperatures is not only damaging to the apparatus but also is a constant fire hazard. Accordingly, the use of such rheostats has been limited by these deficiencies necessitating the utilization of large and cumbersome apparatus which is a distinct inconvenience where space factors are important. Furthermore, where the situation has necessitated the use of small rheostats to take care of relatively high currents, depreciation and resultant replacements have been annoying factors. One of the objects of this invention is to provide a rheostat construction in which the above-mentioned difficulties as well as many others are successfully obviated.

Referring now to Figure 1, there is shown a cup-shaped metallic casing generally indicated at 10 with a resistance element generally indicated at 11 concentrically mounted therein. A contactor generally indicated at 12 is rotatably mounted in the casing to slidably engage the resistance element 11. As best shown in Figure 2, the resistance element 11 is cylindrical in shape and adjacent the vertical wall of the housing 10; thus the element is in heat exchange relationship with the casing so that heat generated in the element may pass quickly to the casing and thus be dissipated in the atmosphere.

Casing 10, preferably a cast metal such as aluminum, is substantially cup-shaped having a bottom 13 and a vertical circular outer wall 14, as best shown in Figure 3. Fins 15 are preferably formed on the outer surface of wall 14 to provide greater heat radiating surface therefor. Extending from bottom 13 of the casing is an inner semi-circular projection 16 thereof, thus forming a channel 17 bounded by wall 14, bottom 13 and projection 16 in which the resistance element 11 is disposed (Figure 2) as will be more fully pointed out hereinafter.

A bushing generally indicated as 18 is embedded in bottom 13 of the casing provided with a nut-shaped inner portion 19 (Figures 2 and 3) and a threaded extension 20 projecting from the bottom as best seen in Figure 2. Preferably a lug 21 (Figure 2) extends from the bottom of the casing and thus the casing containing the entire rheostat construction may be mounted on a panel 22 with extension 20 extending through a hole 23 in the panel and lug 21 extending into another hole 24 thereof. A nut 25 (Figure 2) threaded on extension 20 holds the casing firmly in position on the panel 22. It will be understood, however, that various other expedients could be used in mounting the casing on a panel or other type of support. Preferably panel 22

is metal and thus capable of receiving heat by conduction from the casing.

Referring now to Figure 4, resistance element 11 comprises a cylindrical shaped metallic core 26 desirably made from some metal having high heat conducting characteristics such as copper or aluminum. The reduced ends 26a and 26b of the core meet to complete the cylindrical shape thereof and have formed therein a hole 27.

Core 26 is covered throughout its length except for ends 26a and 26b thereof with dielectric material 28, such material being capable of withstanding high temperatures and yet being highly conductive as far as possible. In practice, we have found electrical asbestos or high temperature cement well suited for this purpose.

Resistance wire 29 is wound about core 26 over the dielectric material 28 having its ends soldered or otherwise secured to metal tabs generally indicated at 30 and 31. Metal tabs 30 and 31 have portions 32 and 33 wrapped about the core over the material 28 and radially extending projections 34 and 35 for connection in the desired circuit. Wire 29 is held in position by a cementitious coating leaving the upper surfaces 29a thereof exposed for engagement with the contactor 12.

As best shown in Figure 2, resistance element 11 fits within the channel 17 between wall 14, bottom 13 and projection 16 and is secured in this position by a rivet 36 extending through wall 14 (Figure 2) and hole 27 in the ends 26a and 26b of the core 26. Thus, rivet 36 firmly holds the element in position and more particularly assures a direct contact between the ends 26a and 26b and the metallic casing 10 for efficient passage of heat therebetween. To insulate the wire 29 on the resistance element 11 from the casing 10 and yet provide for as much heat transfer as possible therebetween, we prefer to utilize sheet mica. Thus, as shown in Figure 2, between element 11 and wall 14 there is a mica strip 37 and a similar mica strip 38 is disposed between the element and projection 16. A circular strip of mica 39 rests on bottom 13 beneath the bottom edge of the element so that the element is surrounded on three sides by mica and thus a thorough electrical insulation therebetween is provided. However, mica strips 37, 38 and 39 are thin and thus allow ready heat transfer from the element to the casing 10. It will be understood that other types of dielectric material capable of heat conduction could be used with satisfactory results.

A shaft 40 is rotatably mounted in bushing 18, one end thereof being secured to the usual dialing knob 41 (Figure 2) on the outside of the panel. Contactor 12 is secured to the other end of shaft 40 as best shown in Figures 1 and 2. Contactor 12 includes a dielectric support generally indicated at 42 and secured to the end of shaft 40 in any desired manner, for example a riveted piece 43. Support 42 includes a projection 44 extending downwardly about the shaft 40 and the contactor arm 12 includes a flat circular piece generally indicated at 45 fitting about projection 44. A U-shaped upright projection 46 of metallic piece 45 fits about a small extension 47 (Figure 1) of support 42. Thus, the contactor arm 12 is supported in the position shown in Figure 2 and pressed downwardly by a compression spring 48 disposed between the support 42 and the piece 45. The brush 49 of contactor 12 is preferably riveted to an upright extension 50 of piece 45. Brush 49 may take any suitable shape but is preferably a stamping having upturned edges so that it may slide easily along the exposed surfaces of the resistance wire 29. Spring 48 constantly presses arm 49 against the wire about extension 47 of the support as a pivotal point. A stop 51 (Figure 2) is keyed to shaft 40 extending therefrom to engage a lug 52 (Figure 3) on bottom 13 thus to limit the movement of the contactor 12 in a counterclockwise direction as viewed in Figure 1.

A flange 53 extends radially from wall 14 of the casing adjacent an inset therein thus providing a support for a dielectric foundation piece generally indicated at 54 (Figures 2 and 3). Projections 34 and 35 of taps 30 and 31 extend through channels 55 and 56 in foundation piece 54. A tap 57 is secured in a channel 58 in the foundation piece by a rivet 59 and extends inwardly to be connected by way of a rivet 60 to a spiral spring 61. The other end of spiral spring 61 is connected in any suitable manner, for example riveting, to a lug 62 extending from piece 45. Thus, tap 57 is connected to contactor 12 and the opposite ends of the wire on element 11 are connected to taps 30 and 31.

Accordingly, resistance wire 29 on the resistance element is in close proximity to the metallic core 26 forming a part of the resistance element. Furthermore, the core 26 is connected by way of rivet 36 and ends 26a and 26b to the casing and the entire base of the casing rests upon the metal panel 22. The opposite sides of the resistance element are adjacent wall 14 of the casing and projection 16 thereof so that heat generated in the resistance element may pass to these parts of the casing.

Heat generated in any point of the resistance element 11 is immediately conducted by the core 26 thereof as well as by the wall 14 and the projection 16 throughout the length of the resistance element to effect an even distribution of the heat especially throughout the heated portion of the element, it being understood that only that portion of the element is heated which is in the circuit as determined by the position of contactor 12 on the resistance element. Thus, in Figure 1 approximately one half of the resistance element is in circuit, i. e. a half between the twelve o'clock and five o'clock position, and thus this part of the resistance element would be heated, the heat therein being evenly distributed throughout. More important, however, is the fact that heat generated in the resistance element during operation is rapidly conducted away from the resistance element to be dissipated in the atmosphere. Heat passing to the casing by way of ends 26a and 26b as well as the heat passing into wall 14 and projection 16 filters into all portions of the casing as well as the panel 22 to which the casing is connected. Thus, this large metallic surface exposed to the atmosphere dissipates heat rapidly and consequently operation of the rheostat results in a continuous cooling effect, which effect is utilized to greatly increase the current carrying capacity of the entire construction.

For example, in operation the rheostat may be adjusted so that only a portion of the resistance element is in the circuit. Thus, if contactor 12 were in the position shown in Figure 1, only one half of the resistance element would be in the circuit and this often happens in the normal operation of these rheostats. In such event, this smaller section of the resistance element must carry the entire current. Due to the marked

cooling characteristics of our rheostat, a much larger current may be carried safely thereby, even where the rheostat is in a circuit necessitating the use of only a fraction of the resistance element as described above.

It will thus be seen that we have provided a thoroughly practical rheostat construction in which the several objects hereinabove referred to as well as many others are successfully accomplished.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In rheostat construction, in combination, a cup-shaped housing formed of material having high thermal conductivity, means forming an annular chamber in said housing, means comprising dielectric material having high thermal conductivity for lining said chamber, a resistance element cylindrical in shape mounted in said chamber concentrically with the vertical wall of the casing, said element including a metallic core connected to said casing, and taps connected to and extending from said element.

2. In rheostat construction, in combination, a cup-shaped casing formed of metal having high thermal conductivity, a cylindrical resistance element including a metallic core mounted in said casing adjacent the vertical wall thereof, a thin strip formed of dielectric material having high thermal conductivity disposed between said resistance element and said vertical wall, said resistance element, said strip and said wall being contiguous, and means forming heat radiating fins on said wall.

3. In rheostat construction, in combination, a metal cup-shaped casing, a resistance element disposed in heat exchange relationship with a wall of said metal casing, said element comprising a substantially cylindrical metallic core concentric with the vertical walls of said casing and having its ends directly connected to said casing, a dielectric covering on said core, resistance wire wound around said covering, and means covering all but a small exposed portion of said wire for holding the turns thereof in spaced relationship.

4. In rheostat construction, in combination, a cup-shaped metallic casing, an arcuate projection formed integrally with the bottom of said casing and extending therefrom concentrically with the vertical wall of said casing to form an annular chamber therein, a thin mica lining for said chamber, and a resistance element mounted in said chamber contiguous to said mica lining, said resistance element including a metallic core directly connected to said casing.

5. In rheostat construction, in combination, a cup-shaped metallic casing, a resistance element cylindrical in shape mounted in said casing and concentric with the vertical wall thereof, said element having a metallic core riveted to said casing, and sheet mica disposed between the side and bottom portions of said element and said casing.

6. In rheostat construction, in combination, a cup-shaped metallic casing, a resistance element cylindrical in shape mounted in said casing and concentric with the vertical wall thereof, said element having a metallic core riveted to said casing, and sheet mica disposed between the side and bottom portions of said element and said casing, said casing having a cylindrical projection adjacent the inner surface of said element.

7. In rheostat construction, in combination, a cup-shaped metallic casing, a resistance element cylindrical in shape mounted in said casing and concentric with the vertical wall thereof, said element having a metallic core riveted to said casing, sheet mica disposed between the side and bottom portions of said element and said casing, and taps extending radially from the opposite ends of said element.

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