Sept. 4, 1945. W. F. PENROSE 2,383,987

RHEOSTAT

Filed Oct. 30, 1943

Fig. 1.

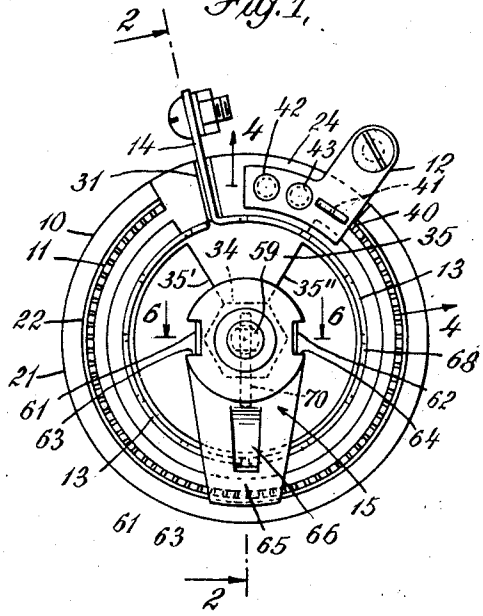


Fig. 2.

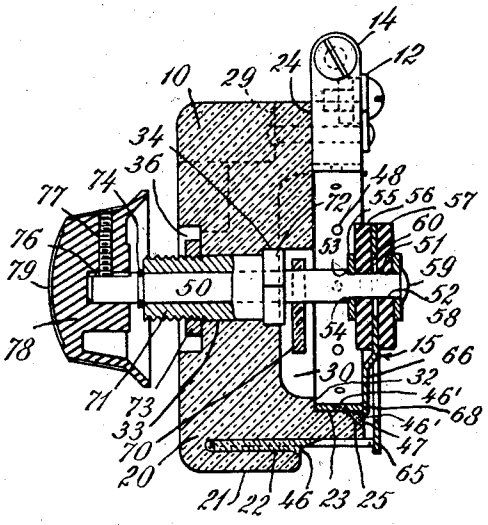


Fig. 3.

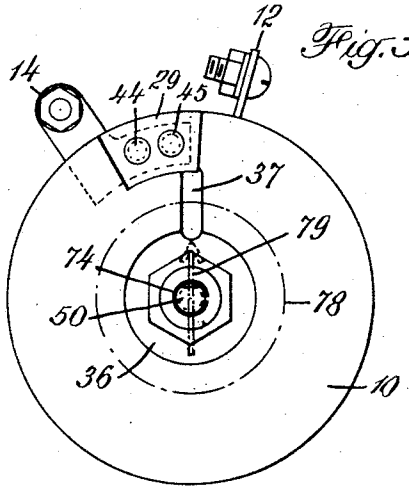


Fig. 4.

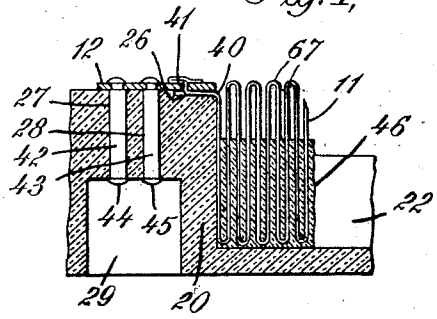


Fig. 5.

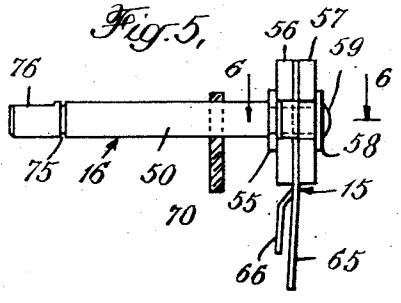
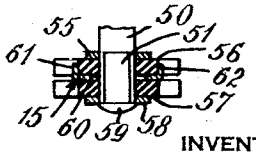


Fig. 6.



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RHEOSTAT

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Application October 30, 1943, Serial No. 508,292

7 Claims. (Cl. 201—56)

This invention relates to rheostats and has for its object certain improvements in the construction and assembly thereof. It contemplates a rheostat that may be economically manufactured and readily assembled; that is of unusually strong construction; and which dissipates heat quickly and thus avoids overheating.

The rheostat of the invention comprises an insulating base preferably circular in form, and having a recessed channel therein. A zig-zag resistance element generally circular cylindrical in form is arranged in the channel. The bends and contiguous portions of one side of the element are secured in the recessed channel, and the bends and contiguous portions of the other side of the element extend out of contact with the base freely exposed for the dissipation of heat. A sliding contact is movably secured to the base with the arm thereof in sliding engagement with the exposed ends of the zig-zag resistance element bends.

These and other features of the invention may be better understood by referring to the accompanying drawing in conjunction with the following description, in which:

Fig. 1 is a plan view of a rheostat illustrative of the invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a front view, with the turning knob shown in dotted lines;

Fig. 4 is a section on the line 4—4 of Fig. 1;

Fig. 5 is a detail of the sliding contact assembly of Figs. 1, 2 and 3; and

Fig. 6 is a cross-section on the line 6—6 of Fig. 5.

The rheostat shown comprises an insulating base 10, a resistance element 11, one end terminating in a terminal 12, a continuous contact ring 13 separated from the resistance element, one end terminating in a terminal 14, and a bifurcated sliding contact or brush 15 mounted upon an assembly 16.

Referring to the construction of the insulating base, it will be seen that it is generally circular in shape and is advantageously made of porcelain. The front part of the base consists of an enlarged, and for the most part solid, cylindrical portion 20 having an outer annular wall 21 separated from the interior of the base so as to form an annular recessed channel 22. The back part of the base consists essentially of an inner annular wall 23 extending beyond the outer annular wall, both of which terminate in a terminal portion 24. The inner annular wall is beveled, as shown at 25. The terminal portion of the base is provided with a recess 26 (Fig. 4), adapted to receive the lateral end of the resistance element, and two spaced holes 27 and 28, extending to a recess 29, for securing terminal 12.

The back part of the base is also provided with a cylindrical hollow interior 30, defined by the inner annular wall 23 and the terminal portion 24. The terminal portion is also provided with a recessed slot 31 to receive the terminal 14. The inner annular wall 23 terminates in an annular shoulder 32 against which the continuous contact ring 13 may rest. A round hole 33 extends through the center of the solid portion of the base, the back entrance to the hole having a recess 34 of predetermined size and shape. A stop or boss 35, generally V-shaped so that its sides 35' and 35'' are in substantial alignment with the center of the hole 33, is formed by a raised integral portion of the base, extending from the bottom of the hollow interior 30 adjacent the terminal portion 24. The reverse, or front, side of the base contains an enlarged circular recess 36 at the entrance to round hole 33, and a recessed direction slot 37 terminating with the recess 29.

As shown more particularly in Fig. 4, the resistance element 11 is folded back and forth upon itself, in a zig-zag formation, with or without metal to metal contact depending upon the type of resistance employed. The element is advantageously a relatively thin flat metallic ribbon which can be bent in this manner to any suitable length, the element as a whole being relatively straight when first formed but adapted to be bent into a circular generally cylindrical shape. In a presently preferred construction, the resistance element is made of nickel-chromium alloy, and its exterior surface is provided with a non-conducting oxide coating so that if bends of the element should contact one another, a short circuit is avoided. The cross-sectional area and the length of the element are predetermined to provide the desired amount of ohmic resistance. Its lateral end 40 is passed through a hole 41 in the terminal 12 and appropriately secured therein, as by compressing the end of the element in the hole, to make permanent contact with the terminal. The terminal, with the resistance element secured thereto, is placed in position in the base, as shown in Fig. 1, the lateral end 40 resting in the recess 26. A pair of rivets 42 and 43 is passed through the holes 27 and 28, respectively, and the free ends of the rivets are turned over to form heads 44 and 45, respectively, as shown in Fig. 4, to secure the terminal to the back of the base. Suitable plastic porcelain cement 46 is placed in the anular recess 22. The resistance element 11 is then bent around

the outside of the inner annular wall 23, and the lower portion of the element is inserted in the annular recess 22, the free end of the resistance element being brought to the terminal portion 24 of the base, as shown. This serves to embed the resistance element in the cement and to hold the same permanently in position in the recess after the cement hardens.

The terminal 14 is an integral part of the continuous circular contact ring 13, the free end of which does not contact with the remainder of the ring or its terminal. To mount this unitary structure, plastic porcelain cement 46' is first smeared on the inside face of the inner annular wall 23, the terminal 14 is inserted in the slot 31 and the bottom of the contact ring is pushed toward the annular shoulder 32. Additional porcelain cement 46' is then placed in the circumferential recess 47 formed by the ring and the beveled portion 25 of the inner annular wall. The ring is provided with a plurality of holes 48 which are filled with the cement 46' in order to hold the ring in position.

The sliding contact assembly 16 is shown in detail in Figs. 2, 5 and 6. It comprises a shaft 50, one end of which is flattened a suitable length to provide a pair of opposite flat faces 51 and 52, and shoulders 53 and 54, adapted to receive in succession: a metal washer 55 with a hole to fit snugly over the flattened end of the shaft so that the washer may rest against the shoulders, a larger insulation washer 56, the bifurcated sliding contact 15, a similar insulating washer 57, and a similar metal washer 58. These elements are held against one another by hammering the end of the shaft to form a head 59. The bifurcated sliding contact is provided with a shaft hole 60 substantially larger than the shaft so that it may be kept out of contact with the shaft itself. To this end, the sliding contact is provided with a pair of integral opposite ears 61 and 62, located between juxtaposed slots 63 and 64 in each insulation washer; and the ears are bent into the slots of the first insulation washer 56, thereby preventing the sliding contact from moving laterally against the shaft. The sliding contact is bifurcated, as shown, to provide an upper arm 65 and a lower arm 66, and is advantageously made of sheet copper which is sufficiently flexible to permit bending of the arms to make certain that the upper arm may slide in contact with the exposed ends 67 of the zig-zag resistance element 11 and the lower arm in contact with the exposed rim 68 of the contact ring 13, when the rheostat is completely assembled.

A stop pin 70 fits in the shaft a suitable distance from its end. The pin is in alignment preferably with the sliding contact and extends completely through the shaft so that the ends of the pin are freely spaced from a bushing 71 rotatably mounted on the shaft. The end of the pin in alignment with the sliding contact is adapted to be brought in engagement with sides 35' and 35'' of stop 35. The end of the bushing adjacent the stop pin is provided with an hexagonal head 72 adapted to fit snugly in the recess 34 of the base. The other end of the bushing is threaded to receive an hexagonal nut 73. A split washer 74 fits in a groove 75 of the shaft to hold the shaft in place. The other end of the shaft contains a flat face 76 to receive a screw 77 in a turn knob 78 attachable to the shaft. The knob has an arrow 79 to be kept in alignment with the sliding contact to indicate the position of its arms on the zig-zag resistance element and the contact ring.

The sliding contact assembly is initially assembled in the form shown in Fig. 5. The bushing 71 is then mounted on the free end of the shaft so that its hexagonal head 72 is in contact with the stop pin 70, after which the split washer 74 is fitted in the groove 75 of the shaft 50 to hold the bushing in place. The free end of the shaft and bushing are then inserted into the round hole 33 and are turned until the hexagonal head is fitted into the recess 34. The hexagonal nut 73 is then screwed onto the threaded end of the bushing until the nut is in engagement with the front of the base in the circular recess 38. The knob 78 is then mounted on the free end of the shaft, its screw 77 being brought to bear on the flat face 76 when the arrow is in substantial alignment with the sliding contact. Movement of the turning knob to the right or left causes a corresponding movement of the arms 65 and 66 on the exposed ends 67 of the zig-zag resistance element 11 and on the exposed rim 68 of the continuous contact ring 13, respectively.

An advantage of the ribbon or tape form of zig-zag resistance element is that it offers a maximum amount of heat-radiating surface for a given cross-sectional area. The size of the ribbon or tape and the size of the annular recessed channel in the base may be so coordinated as to provide an exact amount of ohmic resistance uniformly distributed over the space allotted to each step of the resistance. It is advantageous to secure the zig-zag resistance element and continuous contact ring to the base with a cement of substantially the same expansion and contraction characteristics as the base. A porcelain base and, hence, porcelain cement are suitable for the purpose. This greatly reduces the tendency of the cement to crack away from the base, and the resistance element and contact ring are, therefore, securely held in place.

It will be clear to those skilled in this art that the device just described is merely an example of the invention and that modifications are possible and feasible. The construction disclosed greatly facilitates and expedites the dissipation of heat from the zig-zag resistance element. Placing the bends and contiguous portions of one side of the zig-zag resistance element in the recessed channel and securely embedding the same in that position by filling the spaces between and around the element serves to leave it mounted in the base in an unusually strong manner. This construction virtually makes the resistance element an integral part of the insulating base itself.

The continuous stationary contact is mounted securely in the base in the manner shown so that it, like the resistance element, can withstand violent shaking and shocks without becoming loosened or separated from the base proper. Any other arrangement of contact may of course be employed including a flexible connection.

The rheostat of the invention lends itself to ready manufacture because of the simple manner in which the several parts may be prepared prior to their assembly.

I claim:

1. In a rheostat, the improvement comprising an insulating base, a recessed channel in said base, two lead-in terminals, a zig-zag preformed resistance element connecting one of said terminals, a continuous stationary contact securely mounted in said base and connecting the other

of said terminals, the bends and contiguous portions of one side of said zig-zag preformed resistance element being secured in said recessed channel, the bends and contiguous portions of the other side of said zig-zag resistance element being out of contact with the base and freely exposed for the dissipation of heat, a sliding contact having one arm in sliding engagement with the exposed ends of the zig-zag resistance element bends and another arm in sliding engagement with the continuous stationary contact, and means associated with the base for moving said arms simultaneously back and forth over said zig-zag resistance element and continuous stationary contact.

2. A rheostat according to claim 1, in which the recessed channel is substantially annular, and the sliding contact is secured to a rotatable shaft mounted in the base.

3. In a rheostat the combination of a base of insulating material having a recessed channel therein, with a zig-zag preformed resistance element having generally parallel contiguous portions joining bends at opposite sides thereof secured in said channel with one side thereof including bends and a substantial amount of said contiguous portions extending out of contact with said base and freely exposed for the dissipation of heat generated in said element, and a moving contact supported by said base in sliding engagement with an exposed portion of the said element.

4. In a rheostat the combination of a substantially circular cylindrical base of insulating material having an annular channel recessed therein adjacent its outer periphery, with a zig-zag preformed resistance element having generally parallel contiguous portions joining bends at opposite sides thereof secured in said channel with one side thereof including bends and a relatively large amount of said contiguous portions extending out of contact with said base and freely exposed for the dissipation of heat generated in said element, and a moving contact arm rotatably supported by said base in sliding engagement with an exposed portion of said element.

5. A rheostat according to claim 3, in which a stop formed by a raised portion of the base is provided in the hollow interior adjacent to the terminal portion adapted to stop movement of the sliding contact.

6. In a rheostat, the improvement comprising an insulating base, the front part of the base forming an enlarged essentially solid portion having an outer wall separated from the interior of the base to form an annular recessed channel, the back part of the base having an inner wall adjacent the recessed channel and extending beyond the outer wall, said inner and outer walls terminating in an essentially solid terminal portion, a hollow interior defined by said terminal portion and inner wall, two lead-in terminals secured to the terminal portion, a zig-zag preformed resistance element connecting one of said terminals, the bends and contiguous portions of one side of the zig-zag preformed resistance element being secured in said annular recessed channel, the bends and contiguous portions of the other side of the zig-zag resistance element being out of contact with the base and freely exposed for the dissipation of heat, a continuous stationary contact securely mounted in the hollow interior of the base and connecting the other of said terminals, and a sliding contact having one arm in sliding engagement with the exposed ends of the zig-zag resistance element bends and another arm in sliding engagement with the continuous stationary contact, said sliding contact being secured to one end of a rotatable shaft mounted in the base.

7. A rheostat according to the preceding claim, in which a bushing is rotatably mounted on the shaft, the bushing being stationarily secured to the base, and means at the other end of the shaft for rotating the same within the bushing.

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