March 27, 1934. S. LEVEEN 1,952,679

RHEOSTAT

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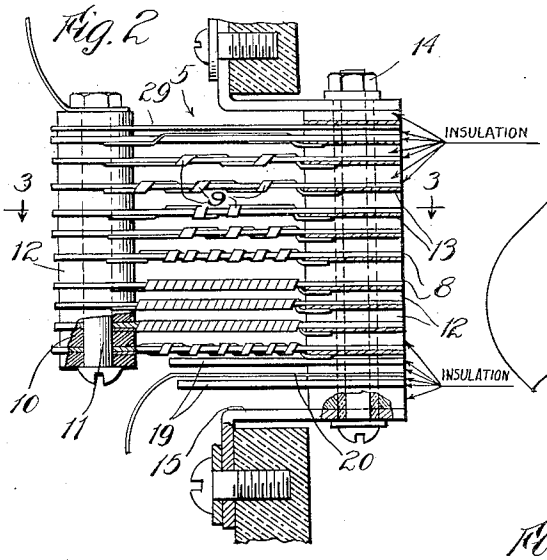

Fig. 2

Fig. 1

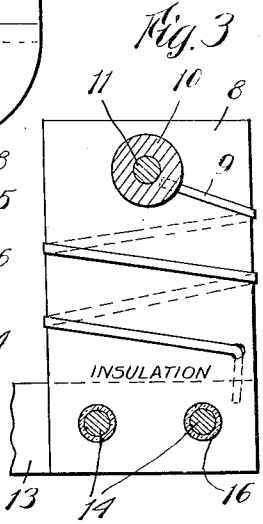

Fig. 3

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RHEOSTAT

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14 Claims. (Cl. 200—6)

This invention relates to rheostats for regulating the flow of electric current and has for its general object the provision of a rheostat which is extremely simple, compact and rugged in construction, which is adapted to vary an electric current in a relatively large number of steps, and which is exceedingly reliable in operation.

Another object is to provide a new and improved contact mechanism by which the resistance elements of the rheostat may be thrown into and cut out of the circuit governed by the rheostat.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawing, in which

Figure 1 is an elevational view of the rheostat and the actuating mechanism therefor, the rheostat being enclosed by a casing shown in section.

Fig. 2 is a section taken along line 2—2 of Fig. 1.

Fig. 3 is a section taken along line 3—3 of Fig. 2.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In the exemplary form shown in the drawing, the invention includes a resistance unit designated generally by the numeral 5 and a contact mechanism all mounted within a suitable casing 6 on a plate 7.

The unit 5 is composed, in the present instance, of a plurality of relatively thin plates 8 of insulating material such as mica, bakelite or the like. Around each of these plates is spirally wound a length of resistance wire in the form of a relatively thin, flat ribbon 9 whose ends terminate adjacent opposite ends of the supporting plate 8.

At one of their ends, the adjacent plates 8 are separated by metallic spacer washers 10 between which and the adjacent plate one end of the ribbon 9 is disposed. A bolt 11, extending snugly through the washers and holes in the plates 8, serves to clamp these parts and the ends of the ribbons 9 tightly together, the ribbons being thereby made electrically common at one of their ends. Thus the resistances are connected in parallel relation and the bolt 11 forms a binding post which constitutes one terminal of the rheostat.

At their opposite ends, the plates 8 are spaced apart by insulating pads 12 and thin, flat metal strips 13, all of which are clamped together by two spaced bolts 14. The corresponding end of each resistance ribbon 9 is extended to a point between its supporting plate 8 and the adjacent strip 12 so as to be firmly held in place by and electrically connected to the strip.

Preferably the strips 13 extend transversely of the plates 8, thereby minimizing the length of plate required to accommodate the desired length of ribbon.

The use of resistance wire in the form of a flat ribbon is advantageous in that such an element, when tightly wound, will retain its initial shape, thereby maintaining the adjacent loops properly separated. At the same time, such elements permit the supporting plates 8, and therefore the strips 13, to be disposed close together which lends to the compactness of the resistance unit and also to that of the contact mechanism, as will presently appear. The resistance unit as a whole is rendered extremely rugged in construction by reason of the fact that the ribbons 9 may be tightly wound and that their ends are firmly clamped in place without soldering or other means which might become loosened or displaced.

As shown in Fig. 2, the unit is mounted within the casing 6 on L-shaped brackets 15 secured to the bolts 14. By surrounding these bolts with tubes 16 of insulating material, the strips 13 are completely insulated from each other and the resistance unit as a whole is insulated from the casing 6.

It will be observed that the resistance unit above described provides a cantilever mounting for the strips 13 which constitutes part of the contact mechanism by which the resistance elements 9 may be thrown successively into the circuit controlled by the rheostat. In the present instance, these strips are relatively thin and flat, being made of resilient metal, such as phosphor bronze, and in various lengths so that they project progressively decreasing distances from their support. For a purpose which will later appear, the free ends of the strips are preferably arranged in a straight line and in effect form a continuous contact surface as shown in Fig. 1. The tip of each strip is bent slightly relative to the body portion in the direction of the adjacent longer strip as indicated at 17, thereby forming a slightly beveled end surface which constitutes a contact of the desired surface area.

A similarly constructed auxiliary strip 18 is clamped by the bolts 14 between two insulating plates 19 against a ribbon 20, which serves as the other binding terminal of the rheostat.

Owing to the rugged cantilever mounting thus provided and the inherent stiffness of the strips 13, the latter tend to straighten and maintain themselves in spaced parallel planes as shown in full line in Fig. 1. Because the strips are flat, the desired degree of stiffness and contact surface area may readily be obtained even though the strips are disposed relatively close together.

Means is provided which carries an elongated conducting surface arranged to move broadwise into abutting engagement with the contact ends of the strips 13 and 18 and possessing sufficient rigidity to cause flexing of the strips in a manner later described. The direction of movement and curvature of this surface is such that in the movement toward the ends of the strips, the latter will be engaged successively, the circuit being closed through the first resistance when the strip 18 and the adjacent strip 13 are first engaged. In the form herein illustrated, the conducting surface corresponds in width to that of the strips 13 and is of a length greater than that of the contact surface formed by the ends of the strips. It is of convex curvature and formed by an elongated curved plate 21 secured by insulated bolts 22 to and insulated by a sheath 23 from a rigid arm 24 which is pivoted within the casing 6 on a stud 25 located adjacent the end of the contact strip 18.

At its free end the arm 24 is pivotally connected to one end of a link 26 of adjustable length. The other end of the link projects through the side wall of the casing 6 for connection with the device with which the rheostat is to be actuated. Herein this device is in the form of a foot pedal 27 whose hub carries a rigid arm 28 which is connected to the link 26.

Normally, that is when the circuit controlled by the rheostat is open, the arm 24 is retracted to the position shown in full lines in Fig. 1, the ends of the strips 13 being then out of contact with the plate 21. Upon depression of the pedal, the plate 21 is carried toward the bent ends of the strips 13 thereby moving the convex surface of the plate bodily in a direction generally longitudinally of the strips but at a slight angle with respect thereto.

When the ends of the strip 18 and the longest strip 13 are engaged, the circuit will be closed through the first resistance element 9, that is the element whose insulated end is connected to the longest strip 13. As the movement of the arm 24 is continued, the adjacent strips are engaged thereby successively, thereby connecting their resistance elements into the circuit with the result that the current flow will be correspondingly increased. In such movement the strips initially engaged will be further flexed as indicated in dotted outline in Fig. 1 and their beveled ends will slide to some extent along the conducting surface. Beveling of the ends facilitates this slight wiping action during which firm contact between the plate 21 and the ends of the strips is maintained owing to the progressively increasing tension under which the plates are placed. If desired, the last strip to be engaged by the plate 21 may be connected to the binding post 11 through the medium of a short-circuiting conductor 29, thereby applying the full current to the circuit when the pedal has been depressed to the limit of its travel.

With the contact arrangement thus provided, the amount of wiping action between the interengaging contact members and the tendency toward sparking therebetween is effectually minimized but nevertheless is sufficient to keep the surfaces clean without excessive wear thereon. This slight wiping action may be attributed to the fact that one of the contact members, in this instance the plate 21, is of convex curvature which provides for a rolling engagement with the other contact member, namely, the ends of the strips 13. By virtue of the flexed character of the strips resulting from movement of the bridging conductor element after engagement in the plane of the strips and into abutting engagement with the ends thereof, a firm contact pressure is maintained throughout the full range of movement of this element. Moreover, by arranging the elements flatwise in parallel relation, a high degree of compactness is obtained.

I claim as my invention:

1. In a rheostat, a contact mechanism combining a plurality of elongated flat strips of resilient conducting metal disposed with their flat sides opposite each other in spaced parallel planes, means providing a cantilever mounting for each of said strips and insulating the strips from each other, and a contact member having a rigid conducting surface extending transversely of the free ends of said strips and arranged for bodily lateral movement toward said ends in a plane common to and extending longitudinally of said strips whereby to be brought into abutting engagement with said ends successively.

2. In a rheostat, a contact mechanism combining an insulating support, a plurality of flat strips of resilient metal mounted on said support in spaced parallel planes and projecting progressively increasing distances from the support, and means providing a conducting surface arranged to be moved broadwise toward the free ends of said strips in a plane common to and extending longitudinally thereof whereby to abut against said ends successively.

3. In a rheostat, a contact mechanism combining a support, a plurality of flexible members mounted on and projecting progressively increasing distances from said support, the free ends of said members providing electrical contacts which are disposed in a substantially straight line, and means providing a rigid conducting surface of convex curvature arranged for broadwise movement toward said contacts whereby to abut against the same successively.

4. In a rheostat, a contact mechanism combining a support, a plurality of flexible members mounted on and projecting progressively increasing distances from said support, the free ends of said members providing electrical contacts which define a substantially continuous contact surface, and means providing a conducting surface arranged for movement into abutting engagement with the contact ends of the successive members, one of said surfaces being substantially straight, the other being of convex curvature.

5. In a rheostat, a contact mechanism combining a support, a plurality of flexible members mounted on and projecting progressively increasing distances from said support, the free ends of said members providing electrical contacts which define a substantially continuous contact surface, and means providing a rigid conducting surface arranged for movement into abutting engagement with the contact ends of said members and adapted upon continuous movement toward said ends to engage them successively, the longest member being the first to be engaged.

6. In a rheostat, a contact mechanism combining a support, a plurality of flexible members

mounted on and projecting progressively increasing distances from said support, the free ends of said members providing electrical contacts which define a substantially continuous contact surface, means providing a conducting surface of a length greater than said first mentioned surface and of a width corresponding to the end surfaces of the individual contact members, and means supporting said last mentioned means for movement in the plane of flexure of said members whereby to carry said conducting surface broadwise into abutting engagement with the end of the longest contact member and then successively into contact with the other members.

7. In a rheostat, a contact mechanism combining a plurality of flat flexible contact members of substantial length, means providing a cantilever mounting for said members, means providing a rigid conducting surface adapted for abutting engagement with the free ends of the successive members, and a member carrying said last mentioned means and mounted to swing about a fixed axis extending parallel to the broader surfaces of said free ends whereby to carry said surface toward and away from said ends in a plane common to and extending longitudinally of the strips.

8. In a rheostat, a contact mechanism combining a support, a plurality of flexible contact members mounted on and projecting progressively increasing distances from said support, means providing a conducting surface adapted for abutting engagement with the free ends of said members by movement in a plane common to and extending longitudinally of the members, and a member mounted to swing about an axis disposed adjacent the end of the longest of said contact members and operable in such movement to move said surface first into engagement with said longest member and then into successive contact with the other contact members.

9. In a rheostat, a contact mechanism combining a support, a plurality of flexible contact members mounted on and projecting progressively increasing distances from said support, and an arm mounted to swing about a pivotal axis in any plane including said members, said arm carrying an elongated conducting surface of convex curvature which, in the movement of the arm toward said members, engages the longest contact member at a point adjacent said axis and then contacts the shorter members successively at progressively increasing distances from said axis.

10. In a rheostat, a contact mechanism combining a plurality of flat metal strips disposed in spaced parallel planes, and means providing a substantially rigid conducting surface extending transversely across all of said ends and adapted to abut against the free ends of said strips successively upon broadwise movement toward said ends in a plane common to and extending longitudinally of the strips, the contact ends of said strips being bent to facilitate sliding thereof along said surface.

11. In a rheostat, a contact mechanism combining a support, a plurality of elongated flexible contact members mounted on and projecting progressively increasing distances from said support, and means providing an elongated contact surface movable in the plane of flexure of said members and adapted for abutting engagement with the free ends of the successive members, said ends being inclined with respect to the body of the member and in a direction toward the adjacent longer member.

12. In a rheostat, a contact mechanism combining a plurality of elongated contact members, means providing a cantilever mounting for one end of said members, an arm pivoted to swing in a plane including said members and about an axis disposed adjacent the end of the terminal one of said members, and a current conducting surface on said arm adapted to abut against the end of said terminal member at a point adjacent said axis and then in its continued movement to contact the ends of the other members successively, the ends of all of said members being bent laterally toward said axis.

13. In a rheostat, a contact mechanism combining a support, a plurality of elongated metal strips arranged in spaced parallel relation with one end of each strip secured to said support, and a substantially rigid contact surface extending transversely of and over-lapping the opposite ends of all of said strips and mounted for bodily broadwise movement toward the latter ends in a direction generally longitudinally of but at an angle relative thereto whereby to abut against said ends successively and flex the strips laterally upon continued movement.

14. In a rheostat, a contact mechanism comprising a series of elongated resilient conductors supported at one end in parallel relation, and a bridging conductor element mounted in alinement with said series of conductors for movement in the longitudinal plane thereof into successive abutment with the ends of said conductors and acting thereby to flex the latter and cause sliding of said conductors along said bridging element under spring pressure to insure good contact thereof.

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