Aug. 16, 1938. K. HOWE 2,127,083

RHEOSTAT

Filed Nov. 13, 1935 2 Sheets-Sheet 1

Fig. 1.

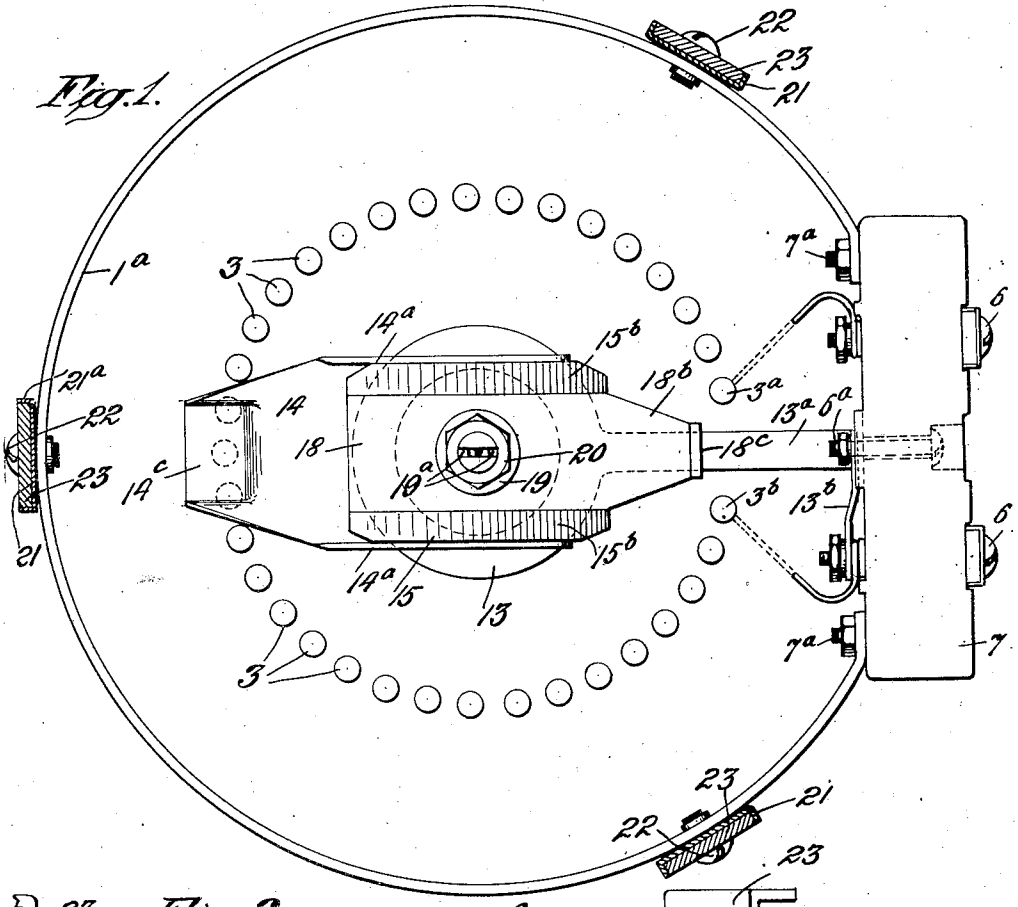

Fig. 2.

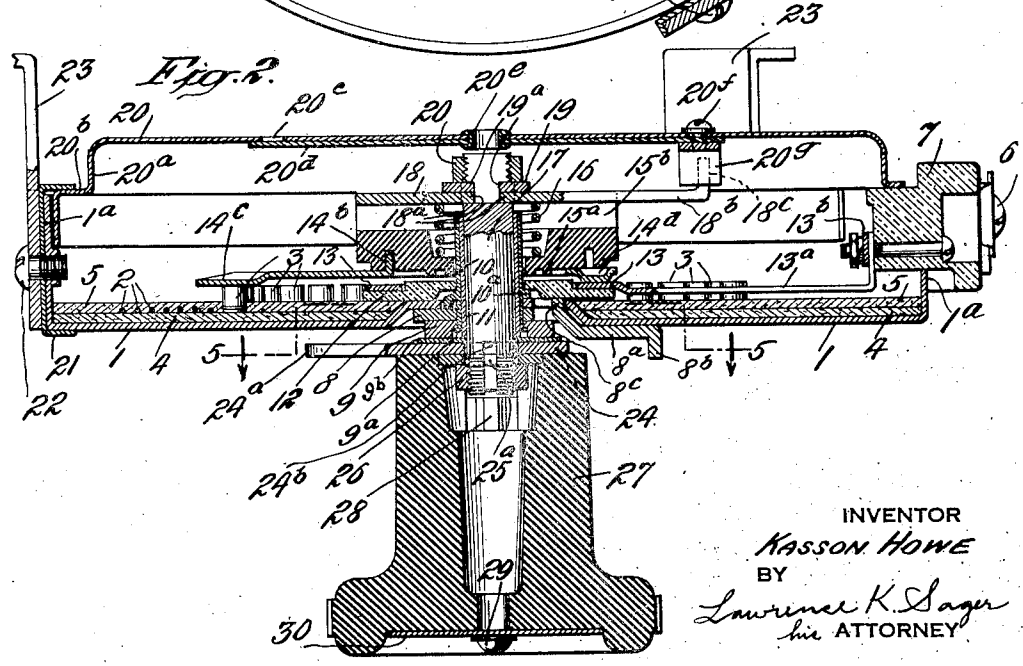

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Fig. 4.

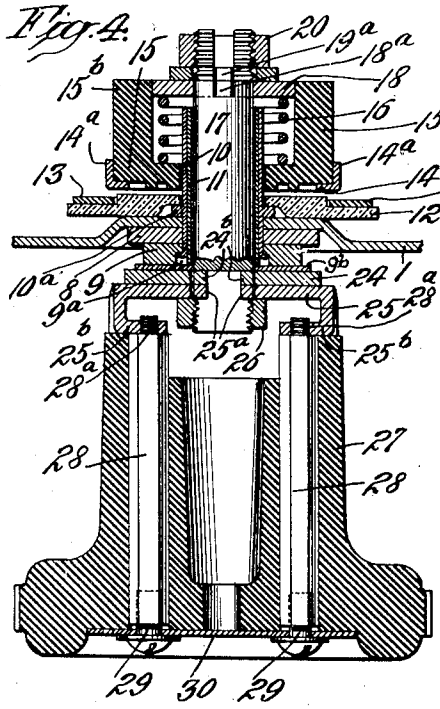


Fig. 5.

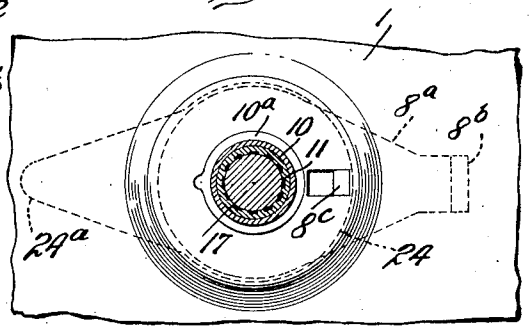
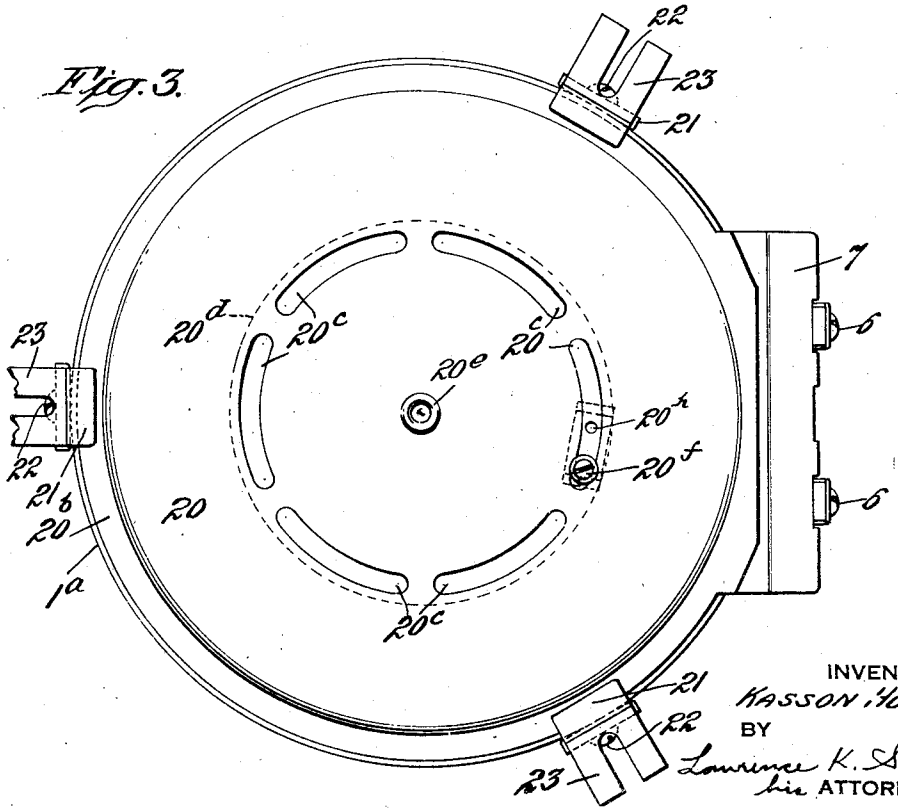


Fig. 3.



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2,127,083

RHEOSTAT

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Application November 13, 1935, Serial No. 49,499

10 Claims. (Cl. 201—48)

This invention relates to rheostats adapted for various uses and particularly to an improved form and relationship and mounting of the various parts.

The main objects of the invention are to produce an improved structure which will be durable and dependable with long continued use, and easily assembled and disassembled. Another object is to produce a structure having a balanced rigid contact arm and wherein the pressure imposed upon the rheostat contacts is maintained uniform in all positions and wherein the flexing of the contact arm for yieldably engaging the contacts and the imposing of an unbalanced strain on the arm are avoided. Another object is to make the operating shaft "dead" which adapts the rheostat for mounting back of a steel panel without the use of special insulating couplings. Another object is to avoid the use of set screws and to insure the firm locking of the parts together and the maintaining of their proper relationship under long continued use. Another object is to provide a sturdy stop on the front of the plate where the turning force on the shaft is applied and thus avoid extra strain on the bearing and other points while also relieving the contact arm of any strain. Another object is to completely inclose the rheostat. Another object is to provide a structure which is readily adapted for convenient panel or floor mounting, also for multiplate mounting, concentric multiplate mounting, for sprocket or chain driving, and for the housing of the terminals and for conduit fittings. Other objects and advantages will be understood from the following description and accompanying drawings.

Fig. 1 is a rear elevation of the rheostat with the rear cover plate removed and showing the supporting parts in section;

Fig. 2 is a central section on a horizontal line through Fig. 1, and also showing the rear cover plate in place;

Fig. 3 is a rear view of the assembled rheostat;

Fig. 4 is an enlarged section of a portion of Fig. 2 taken on a section at right angles to that shown in Fig. 2; and

Fig. 5 is a section on the line 5—5 of Fig. 2.

In the particular embodiment shown in the drawings, a plate form of rheostat is shown wherein a sheet metal plate 1 having a circumferential rim 1a supports the resistive conductors 2 and also the series of contacts 3 between which the various sections of the resistive conductor are connected. An insulating ground coat 4 is first applied to the inner face of the plate 1 and then the various sections of the resistive conductor 2 and the contacts 3 are placed upon the ground coat after which an insulating coating 5, preferably of vitreous enamel, is applied over the ground coat to cover and embed the resistive conductor sections and the base of the contacts 3 so as to hold them firmly in position. From the two end contacts 3a and 3b a conductor extends to the terminals 6 mounted on an insulating terminal block 7 which is inserted in a cut-away portion of the rim 1a and secured by bolts 7a to inwardly bent portions of the rim 1a. The terminals 6 afford convenient means for connection to the external circuit.

The plate 1 has a central hole for receiving the operating shaft and the central portion of the plate 1 is bent inwardly as shown in Fig. 2. Seated against the central indented portion of the plate is a metal disk 8 having a portion 8a extending upwardly from one side thereof and which portion has a forwardly bent end 8b to form a stop. The portion 8a is bent outwardly to conform to the indented portion of the plate 1 and then is again bent so as to extend closely along the face of the plate 1, as shown in Fig. 2. A portion of the disk 8 is cut outwardly from the central opening of the disk to some extent to form a lug 8c which is pressed inwardly to engage a slot in the indented portion of the plate. The stop is thus permanently fixed in position with reference to the plate. Outside of the stop disk 8 is located a washer 9 having an enlarged cut-away central portion 9a at its outer face. The bearing in the form of a long sleeve 10 passes through the central opening of the plate and through the disk 8 and washer 9 and extends some distance to the rear of the plate for supporting the operating parts. This bearing is formed with a flange 10a which engages the back of the plate 1 around the central opening and the front end of the bearing is peened over the washer 9 into the cut-away portion 9a of the washer, as shown in Fig. 2. The bearing sleeve is thus mounted in fixed position on the plate 1 and likewise serves to hold the stop 8, 8a, 8b in a permanent fixed position, as well as the washer 9. In order to prevent the bearing sleeve from turning, a portion of the plate 1 is cut away at some point where it surrounds the sleeve and a portion of the flange 10a is indented into this slot or opening, as shown in Fig. 2. The bearing is preferably lined with a graphitized bronze bushing 11 for insuring a good operating fit between the shaft and the bearing under long continued and frequent use.

On the inner face of the plate 1 and surrounding the bearing and engaging the flange 10a is an insulating disk 12. The outer portion and rear face of this disk is cut away to form a seat for a metal collector ring 13 which has a strip 13a extending outwardly therefrom to a terminal connection 6a mounted in the terminal block 7. A conducting wire or strip 13b connects the terminal 6a to one of the terminals 6, as shown in Fig. 1, for use as a series connected rheostat. The rheostat is readily adapted for use as a potentiometer by omitting the conducting strip 13b and replacing the terminal connection 6a by a third terminal like the terminals 6.

The contact arm 14 of the rheostat is in the form of a flat plate having outwardly bent sides 14a and has a large central opening to receive an insulating block 15 which is located between the sides 14a of the contact arm. The block 15 has an inwardly projecting circular portion which projects within the central opening of the contact arm and this inwardly projecting portion 15a of the block is cut with concentric spaces as indicated in Fig. 2 for increasing the surface leakage distance. A lug 14b is upset from a central portion of the contact arm and engages a hole in the inner face of the block 15. The insulating block and contact arm are thus held in fixed relationship to each other by the side portions 14a which embrace the sides of the block and the lug 14b which prevents relative longitudinal movement. The contact arm extends outwardly at one end and has a depressed portion 14c for engaging the series of contacts 3 successively as the arm is turned. The opposite end of the contact arm has another depressed portion 14d as shown in Fig. 2 which engages the collector ring 13 on the opposite side of the shaft from the engagement of the other end of the contact arm which engages the contacts 3. The contact arm is rigid throughout all parts and of good conductive material such as hard copper. In rheostats, where double concentric rows of resistor contacts 3 are used, the contact arm may have depressed portions 14c at its opposite ends for engaging the two series of contacts.

The central portion of the insulating block 15 is provided with an enlarged circular cavity in which is seated a spiral spring 16 which encircles the bushing 10 and serves to impose pressure to force the block 15 and contact arm inwardly so that the contact arm always engages the contacts 3 and the collector ring 13 with sufficient pressure to maintain a desirable electrical contact at all times and in all positions. The spring is thus insulated in such a way that it cannot carry current and by reason thereof it is not subjected to heating currents which might reduce its tension. Moreover, by reason of the contact arm making engagement with contacts at its opposite ends and by reason of receiving the spring pressure at its central portion, the pressure imposed upon the contacting portions is always balanced and approximately equalized in any position of the contact arm. In cases where the contact arm has oppositely extending portions of pronounced difference in length, the spring 16, instead of encircling the shaft, may be located to one side thereof and thereby apply the spring pressure to a more central portion of the contact arm. Also, the spring may be of other form than spiral and supported in any suitable manner.

The shaft 17 of the rheostat extends through the bushing and is threaded at its opposite ends as shown in Figs. 2 and 4 and is likewise slotted at its opposite ends for providing a locking engagement of the parts without the necessity of using set screws. For the purpose of holding the spring 16 in position and imposing pressure thereon and for locking the movable contact arm and block 15 to the shaft, a perforated plate 18 is slid over the inner end of the shaft and seats itself against the spring and between two outwardly extending side portions 15b of the insulating block. The plate 18 has two inwardly projecting lugs 18a on opposite sides of its central opening which project into the slot at the end of the shaft 17. Thus the plate 18 is locked to the shaft which plate in turn locks the insulating block and the contact arm to the shaft. Turning of the shaft will therefore result in turning the contact arm to any position desired. A washer 19 having lugs 19a which project into the slot in the end of the shaft, is located on the outer face of the plate 18 and the parts are locked in position by the end nut 20 on the inner end of the operating shaft. The use of set screws is thus avoided and also the fixed position of the contact arm and insulating block in relation to the operating shaft is insured and maintained without any chance of the parts working loose.

A sheet metal cover plate 20, which may sometimes be in the form of a skeletonized frame, is mounted on the back of the rheostat and has an inwardly bent rim 20a which is offset at 20b and fits within the rim 1a of the main rheostat plate and is cut away to fit over and bent to partially cover the terminal block 7. A saddle 21 with inward projections at its ends, embraces the rim of the plate 1 and the offset portion 20b of the cover plate and is held in place by a screw 22 which has a threaded engagement with the rim of the plate 1. Any number of these clips or clamps may be used, three being shown in the drawings spaced apart from each other around the periphery of the rheostat, for holding the cover in place; and supporting feet 23 may also be used as desired for mounting the rheostat in place. These supports 23 may be held in place by the screws 22 on the outside of the saddles 21, the saddles 21 being provided with outwardly extending bent edges 21a for maintaining the supports 23 in fixed position in relation thereto. The supports for the rheostat may be variously arranged to suit the particular requirements and may readily be mounted in multiple and likewise the shafts in a number of rheostats may be coupled together for multiple control.

The cover plate 20 has a series of separated circular slots 20c, as shown in Fig. 3 and on the inside of the cover plate is another circular plate 20d which is rotatably secured to the cover plate 20 by an eyelet 20e. The plate 20d is large enough to extend beyond the holes 20c of the cover and affords means for providing an adjustable stop for the contact arm at any desired intermediate position.

A screw 20f passes through any desired one of the openings 20c and through the plate 20d and engages a U-shaped angle piece 20g, as shown in Figs. 2 and 3. By loosing the screw 20f the position of this angle piece may be adjusted as desired through the range of any one slot 20c and by transferring the screw to another slot 20c, the range of adjustment may be extended to any portion of the cover plate. The plate 18 is provided with an extension 18b at one end and has an outwardly bent end 18c which is adapted to engage the stop 20g in its adjusted position. This

auxiliary stop is desirable in cases where a predetermined limit of adjustment is fixed for the control of any particular apparatus and the stop 20g is adjusted to such position that the arm 18b will engage the same at the limiting predetermined position. In order to obtain continuous adjustment of the stop 20g over all portions of the contact arm travel, the piece 20g is provided with two circumferentially spaced tapped holes 20h for receiving the screw 20f. When the limit of adjustment in one of the slots 20c is reached, the screw 20f may be transferred to the other hole 20h which permits adjustment throughout the space occupied by the portions of the cover 20 between the slots 20c. The U-shaped piece 20g may also be utilized for locking the contact arm assembly in any fixed position desired. The U-shaped piece 20g is of such dimensions that its extending portions may embrace the projection 18c of the plate 18. For locking the parts in any desired fixed position of adjustment, the U-shaped piece is placed to enclose projection 18c and the U-shaped piece is then fastened by its screw 20f to remain in any desired position.

The operating handle and the part which cooperates with the main stop 8b for limiting the rotation of the operating shaft at the resistance all out position and the resistance all in position, are mounted on the front end of the operating shaft close to each other. In front of the washer 9 on the shaft 17 is mounted a thrust washer 9b, as shown in Figs. 2 and 4. In front of this washer is mounted a plate 24 having a pointer 24a. This pointer also serves the function of cooperating with the main stop 8b at the extreme limiting positions of the contact arm. Within the central opening of this plate or pointer projects a pair of oppositely disposed lugs 24b which engage the slot in the front end of the operating shaft 17. Thus there is no opportunity for this pointer to work loose or change its position relatively to the shaft 17.

In front of the pointer on the shaft is mounted a metal strip or yoke 25 which extends across the face of the plate 24 and fits over the shaft and is provided with a pair of lugs 25a which extend into the slot at the front end of the operating shaft. It is thus locked to the shaft and maintained in position relatively thereto. The strip 25 is bent forwardly at its ends and again bent inwardly at its ends to form ears 25b as shown in Fig. 4. A nut 26 is screwed on the front end of the shaft 17 to hold the parts in position on the shaft as regards any longitudinal movement thereon. The handle 27 is of a general cylindrical form with a cored out central portion. It is provided with a pair of longitudinally extending holes at opposite sides through which extend hexagonal rods 28. The inner ends of these rods have reduced portions 28a which are threaded and engage threaded holes in the ears 25b. When these rods are screwed into place as shown in Fig. 4, the shoulders of the rods at the threaded ends seat against the faces of the ears 25b and thus form rigid supports for securing the handle in fixed position. The outer ends of these rods have threaded openings which are engaged by screw bolts 29. A circular face plate or name plate 30 covers the main portion of the outer end of the handle 27 and is located between the head of the screw bolts 29 and the outer ends of the rods 28 and thus serves to hold the handle in fixed position on the yoke 25.

In operation it will be evident that when force is applied to the yoke 25 for turning the operating shaft when adjusting the rheostat to different positions, the application of such force is applied to the shaft at a portion immediately adjacent to the pointer or disk 24, and when the latter strikes the stop 8b on either side thereof, there are no undue strains imposed upon the operating parts because the stop acts to oppose further movement of the shaft beyond its limiting positions in substantially the same plane as the application of the force for turning the shaft. It is apparent that the operating parts of the rheostat may be quickly and conveniently assembled and disassembled owing to the simplicity of relationship and relatively small number of parts. It is also evident that the structure is sturdy and dependable in long continued use without likelihood of the parts working loose or being displaced from their proper relative positions. Also, by reason of the rigid structure of the contact arm throughout and its balanced application of contact pressure, the maintenance of good electrical contact at all times and in all positions of the rheostat is assured.

Although a preferred form of the invention has been described, the same may be applied in various features thereof to other forms of rheostats than the particular type shown, and to a wide range of rheostats of different capacities; also various modifications may be made therein without departing from the scope of the invention.

The invention claimed is:

1. A rheostat comprising a rotatable shaft, a contact arm operated by said shaft, a stop mounted on the face of the rheostat, a pointer having a portion extending within an opening of said shaft and adapted to engage said stop, a plate having a portion extending within an opening of said shaft and having oppositely bent portions, operating means for rotating said shaft mounted on said oppositely bent portions and spaced thereby from the end of said shaft, and means for holding said pointer and said plate in position on said shaft.

2. A rheostat comprising a plate, a rotatable shaft, a contact arm operated by said shaft, a stop disc having a portion encircling said shaft and located on the front of the plate of the rheostat, and a bearing sleeve for the shaft extending through the plate of the rheostat and having a flange engaging one side of the plate of the rheostat and also having a portion bent over and in front of said encircling portion of the stop disc for holding said sleeve in fixed position on said plate and for likewise holding said stop disc in fixed position with reference to said plate.

3. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block, a plate fixed to said shaft to turn therewith, said last named plate having a locking driving connection with said block for rotating the same while permitting relative axial movement thereof, and a spring seated between said block and said last named plate to cause said block to impose pressure on said arm to maintain said arm in contact with said fixed contacts.

4. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid con-

tact arm coupled with said block and rotatably driven by said block, a plate fixed to said shaft to turn therewith, said last named plate having a locking driving connection with said block for rotating the same while permitting relative axial movement thereof, said block having a central recess formed in the rear face thereof, and a spring between said last named plate and said block and seated in said recess to cause said block to impose pressure on said arm to hold said arm in contact with said fixed contacts.

5. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block and having a central aperture of a size to prevent contact with said sleeve, said block having a channel formed across the rear face thereof, a plate fixed to said shaft to turn therewith and fitting in said channel to cause rotation of said block and arm, said channel being sufficiently deep to permit axial movement of said block with respect to said last named plate, and a spring seated between said last named plate and said block to cause said block to impose pressure on said arm to maintain said arm in contact with said fixed contacts.

6. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block and having a central aperture of a size to prevent contact with said sleeve, said block having a channel formed across the rear face thereof, a plate fixed to said shaft to turn therewith and fitting in said channel to cause rotation of said block and arm, said channel being sufficiently deep to permit axial movement of said block with respect to said last named plate, said block having a central recess on the rear face thereof, and a spring between said block and said last named plate and seated in said recess to cause said block to impose pressure on said arm to hold the said arm in contact with said fixed contacts.

7. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block, said contact arm extending to engage contacts on opposite sides of said shaft, a plate fixed to said shaft to turn therewith, said last named plate having a locking driving connection with said block permitting relative axial movement thereof, and a spring seated between said block and said last named plate to cause said block to impose pressure on said arm to maintain said arm in contact with said fixed contact.

8. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block, a plate fixed to said shaft to turn therewith, said last named plate having a locking driving connection with said block for rotating the same while permitting relative axial movement thereof, a spring seated between said block and said last named plate to cause said block to impose pressure on said arm to maintain said arm in contact with said fixed contacts, and a cover for the rheostat, said cover having a projecting stop and said last named plate being adapted to engage said stop to limit the movement of said arm.

9. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block, a plate fixed to said shaft to turn therewith, said last named plate having a locking driving connection with said block for rotating the same while permitting relative axial movement thereof, a spring seated between said block and said last named plate to cause said block to impose pressure on said arm to maintain said arm in contact with said fixed contacts, a cover for the rheostat, and an inwardly projecting stop mounted on the inner face of said cover and adjustable circumferentially, said last named plate being adapted to engage said stop to limit the movement of said arm.

10. A rheostat comprising a plate carrying fixed contacts, a sleeve fixed to said plate, a shaft journalled in said sleeve, an insulating block rotatably and slidably mounted on said sleeve, a rigid contact arm coupled with said block and rotatably driven by said block, a plate fixed to said shaft to turn therewith, said last named plate having a locking driving connection with said block for rotating the same while permitting relative axial movement thereof, a spring seated between said block and said last named plate to cause said block to impose pressure on said arm to maintain said arm in contact with said fixed contacts, a cover for the rheostat, a member having an inwardly projecting stop mounted on the inner face of said cover, and means for adjusting said member circumferentially comprising setting means carried by said member and extending through an arcuate slot in said cover, said last named plate being adapted to engage said stop to limit the movement of said arm.

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