Jan. 7, 1930. H. G. EISLER 1,742,462

RHEOSTAT

Filed April 2, 1924

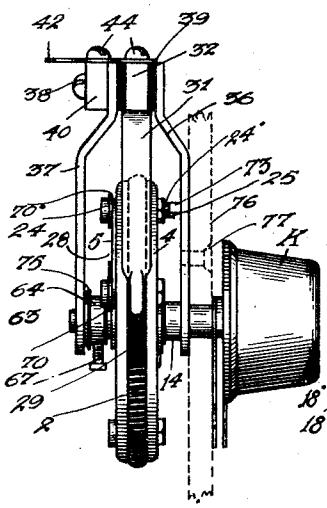

Fig. 2.

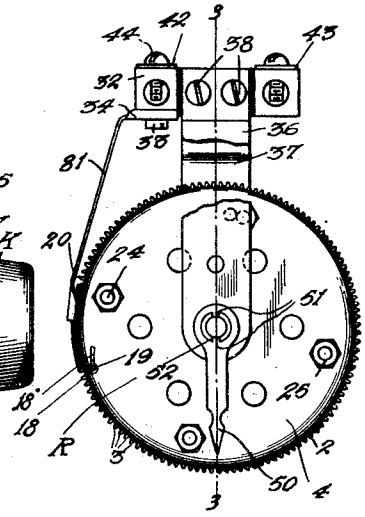

Fig. 1.

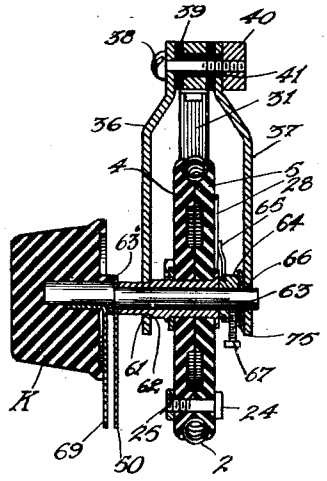

Fig. 3.

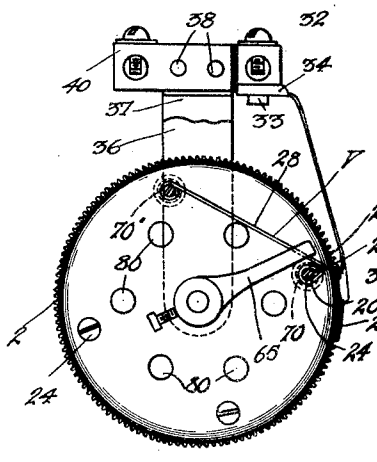

Fig. 4.

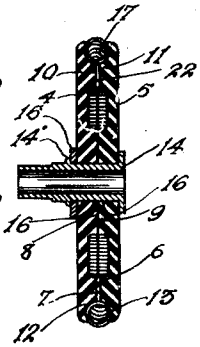

Fig. 6.

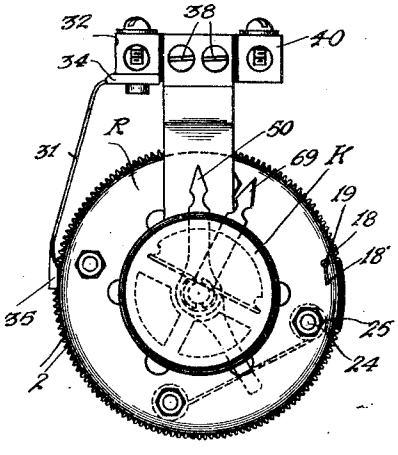

Fig. 5.

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By
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Patented Jan. 7, 1930 1,742,462

UNITED STATES PATENT OFFICE

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RHEOSTAT

Application filed April 2, 1924. Serial No. 703,600.

My invention relates to rheostats for varying the resistance in an electric circuit and is particularly adapted for use in controlling the filament of electron tubes and an object of my invention is to provide a rheostat which is simple in construction and operation but very durable and efficient.

The rheostat of my invention is provided with a helical resistance element, which element is connected in series with a vernier wire or resistance element, and a rotatable contact wiper is provided for wiping over the said vernier resistance element to include all or a certain portion of said vernier resistance element together with all or a part of the helical resistance element in circuit with the operating circuit in connection with which my rheostat is employed. An object of my invention is the provision of control and indicating means for indicating the amount of the vernier resistance element included in the operating circuit, and also to indicate the amount of the helical resistance element included in the operating circuit.

Another feature of my invention is the provision of a spring contact wiper which is so constructed that it insures positive contact with the helical resistance element of my rheostat even though said resistance element might become slightly out of alignment with the spring contact wiper or its contour be irregular at different places.

The above features as well as others, will be more fully pointed out in the ensuing specification, and for a more complete and clearer understanding of my invention reference may be had to the accompanying drawing, in which like reference characters in the several views denote like parts and in which:

Fig. 1 is a front plan view of the rheostat of my invention with certain parts thereof removed, and showing the same in its "off" or normal position;

Fig. 2 is a left side view of Fig. 1;

Fig. 3 is a sectional view of my invention along the line 3—3 of Fig. 1;

Fig. 4 is a rear plan view of the rheostat of my invention showing the same in its "off" normal position;

Fig. 5 is a front plan view of my invention showing the indicating means in different positions; and

Fig. 6 is a sectional view of the rotatable resistance element carrying unit of the rheostat of my invention.

Referring now more in detail to my invention as illustrated in the accompanying drawing, the rheostat of my invention comprises a helical wound resistance element or unit 2 of a predetermined resistance constructed of suitable resistance material and formed of a plurality of turns or convolutions 3. The rotatable supporting element R which carries the resistance unit 2 comprises a pair of disks 4 and 5 moulded of suitable insulating material such as bakelite, the inner faces 6 and 7 of which are provided with integrally formed hub portions 8 and 9, annular ring portions 10 and 11 and annular arcuate grooves 12 and 13 at their outer edges. The disks 4 and 5 are assembled to form the rotatable element R by placing the inner faces 6 and 7 of the disks 4 and 5 together and securing them in matched relation with each other by means of a sleeve member 14 which extends through aligned central orifices 16 in the hub portions 8 and 9 of the disks 4 and 5, the protruding end of which has a collar portion 14′ of its body upset by suitable means to secure the disks 4 and 5 together and also to hold the sleeve 14 in said orifices 16 against movement, a washer 15 being slipped on over the reduced end of the sleeve 14 and interposed between the collar portion 14′ and the face of the disk 4. The arcuate grooves 12 and 13 of the disks 4 and 5 form, when the said disks are assembled as just described, an annular circular channel 17, which contains the helical resistance unit 2 which is placed therein during the assembly of the disks 4 and 5 to form the rotatable unit R. The end 18 of the resistance unit 2 is secured to the disk 4 by extending through a suitable orifice 19 in the said disk 4 and its protruding end 18′ is bent over. The end 20 of the resistance unit 2 passes through a suitable orifice 21 in the disk 5 and its end 20′ is given one turn around the screw 24 under the stop washer 70 and then extended to and secured to another screw 24 under the stop washer 70′, the nuts

25 engaging screws 24 secure the said screws in position in the disk 5. The end 20' which extends through the orifice 21 and is stretched between and secured to the screws 24 forms the vernier resistance unit wire 28 of my rheostat. A plurality of aligned orifices 80 are provided in the disks 4 and 5 for ornamental purposes and also to reduce the weight of the rotatable unit R.

The thickness of the disks 4 and 5 through the annular ring portions 10 and 11 is slightly less than the thickness through the hub portions 8 and 9 so that when the disks 4 and 5 are assembled to form the rotatable resistance carrying unit R there is formed a slight gap 22 between the plane surfaces of the respective ring portions 10 and 11 due to this slight difference of thicknesses between the said ring portions 10 and 11 and hub portions 8 and 9 of the respective disks 4 and 5. Suitable aligned orifices in the disks 4 and 5 receive screws 24, and nuts 25 having screw threaded engagement with the screws 24 are turned down, and due to the gap 22 between the ring portions 10 and 11 of disks 4 and 5, as the nuts 25 are turned down the faces 6 and 7 of the disks 4 and 5 are drawn together and as the helical wound resistance unit 2 is of the same diameter as the diameter of the annular circular channel 17 formed by the annular arcuate grooves 12 and 13 of the assembled disks 4 and 5 this slight movement of the outer portion of the disks 4 and 5 in closing the gap 22 securely clamps the helical resistance unit 2 in the annular channel 17. An insulating member 29 is also clamped in the channel 17 and separates the ends 18 and 20 of the helical resistance unit 2 and is also adapted to be engaged by the spring contact wiper 31 associated with the resistance unit 2 when the rotatable unit R is in its off normal position.

The spring contact wiper 31 is secured to the terminal block 32 by a screw 33 which extends through a suitable opening in the said wiper 31 and has screw-threaded engagement with a suitable tapped orifice in the terminal block 32. To prevent rotation of the contact wiper 31 on the terminal block 32, a pair of flanges 34 are formed integrally with the wiper 31, said flanges adapted to engage the outer edges of the terminal block 32 whereby said wiper 31 is secured in position against rotation. The free end 35 of the wiper 31 is arcuate shaped and of a size to fit over and engage the exposed portions of the convolutions 3 of the resistance unit 2 when the rotatable unit 2 is in its off normal position. The arcuate shaped end 35 is adapted to permit the top portions of the convolutions 3 of the resistance element exposed above the periphery of the disks 4 and 5 to pass through it when the rotatable unit R is rotated, the wiper 31 possessing sufficient flexibility and the free end 35 being of such size and shape that the said wiper will always make contact with the resistance unit 2 even though there may be some irregularity in the size and shape of some of the convolutions 3 of said resistance unit 2. A pair of mounting legs 36 and 37 are provided between which the terminal block 32 is clamped by means of suitable clamping screws 38, the said terminal block 32 being suitably insulated from the mounting legs 36 and 37 by means of insulating strips 39. The clamping screws 38 pass through suitable orifices in the legs 36 and 37, terminal block 32, insulating strips 39 and have screw-threaded engagement with suitable tapped orifices in a terminal block 40, the said screws 38 being suitably insulated from the terminal block 32 by suitable insulating bushings 41. Suitable terminals 42 and 43 are secured to the terminal blocks 32 and 40 respectively by screws 44 which pass through suitable openings in said terminals and have screw-threaded engagement with suitable tapped orifices in the terminal blocks 32 and 40 respectively, said terminals 42 and 43 adapted to connect my rheostat in an operating electrical circuit. An indicator or pointer 50 is provided and is adapted to fit over the free end of the sleeve 14, and is secured thereon against rotation by means of a pair of lugs 51 formed integrally with said indicator 50 which engage suitable slots 52 formed in the end of said sleeve 14. The engagement of said lugs 51 in the slots 52 prevents longitudinal movement of the indicator 50 inwardly on the sleeve 14 and also prevents rotary movement of said indicator 50 on the sleeve 14 so that when the knob K is actuated the indicator 50 is caused to rotate with the rotatable unit R as a unit. The purpose of the indicator 50 will presently be pointed out.

The unit R and its supported parts as a whole are rotatably supported between the legs 36 to 37 and to position the same so as to be rotatably supported the unit R is inserted between the legs 36 and 37 with the insulating member 29 in engagement with the arcuate shaped end of the wiper 31. The free end of the sleeve 14 extends through a suitable opening 61 in the leg 36 so that the inner face of the leg 36 engages the shoulder 62 formed on the sleeve 14. A shaft 63 is now inserted through the central opening in the sleeve 14, through a collar 64 carrying the contact wiper 65, and then extends through a suitable opening 66 in the leg 37, the face 63' of said shaft engaging the end of the sleeve 14 to limit the further insertion of said shaft. The shaft 63 is of such size that it is permitted to rotate within the sleeve 14. The wiper 65 secured to the collar 64 is adapted to engage and make contact with the vernier wire 28 and to connect the resistance unit 2 and the vernier wire 28 in circuit with the terminal 43 through the shaft 63 and leg 37, the said collar 64 being secured on the shaft 63 against

rotation by a suitable set screw 67 which passes through a suitable tapped orifice in said collar 64 and into engagement with the shaft 63. A button or knob K is secured to one end of the shaft 63 in any suitable manner, and an indicator or pointer 69 is suitably secured in the knob K, said indicator 69, knob K, and shaft 63 adapted to be rotated as a single unit. The knob K has a portion *k* which engages the indicator 50 to prevent longitudinal movement of said indicator 50.

Having described the apparatus which comprises the rheostat of my invention, I will now describe in detail its operation. As illustrated in Fig. 1, the rotatable unit R is in its "off" or normal position, the contact wiper 31 engaging the insulating member 29 and the contact wiper 65 of the vernier unit V engaging the vernier wire 28 and the stop washer 70 secured to the screw 24 by the nut 25 (Fig. 4) so that the vernier resistance wire 28 is not included in circuit with the resistance unit 2. To move the rheostat off normal the actuating knob K is grasped and turned in a clockwise direction with reference to Fig. 1, and as the knob K is secured to the shaft 63 the said shaft 63 is also rotated and the contact wiper 65 being secured on the shaft 63 against rotation said wiper 65 will also rotate with the shaft 63 and knob K. The shaft 63 will rotate within and independently of the sleeve 14, at this time and the rotatable unit R will remain in its normal position. The contact wiper 65 will now disengage the stop washer 70 and will move over the vernier wire 28 to include the same in circuit with the resistance unit 2, but no resistance will be included in the operating circuit due to the fact that contact wiper 31 is engaging the insulating member 29. While the contact wiper 65 is moving from the stop washer 70 toward the stop washer 70′ the rotatable unit R is unaffected and remains in its normal position but just as soon as the contact wiper 65 engages the stop washer 70′ secured to the screw 24, and the knob K is continued to be rotated in a clockwise direction, the said contact wiper 65 of the vernier unit V engaging the stop washer 70′ the rotatable resistance unit R will be rotated from its normal position to bring the convolutions 3 of the resistance unit 2 into engagement with the contact wiper 31 whereby the resistance of the electrical circuit in which my rheostat is used is increased. The knob K may continue being rotated in a clockwise direction until the end 24′ of the screw 24 engages the stop pin 73 suitably secured to the leg 36, and when rotated to this position the minimum amount of resistance 2 of my rheostat will be included in the operating circuit. The screw 24 having a protruding end 24′ is the only screw which protrudes through the nut 25, so that no other screw 24 will engage the stop pin 73. The indicator 50 will now be in one position to indicate that practically none of the resistance unit 2 is included in the operating circuit, and the indicator 69 will be in another position to indicate that all of the vernier resistance wire or element 28 is included with the resistance unit 2 in the operating circuit. Now should the resistance in the operating circuit be desired to be decreased the knob K will be moved in a counter-clockwise direction whereby the contact wiper will move out of engagement with the stop washer 70′ and will gradually cut the vernier resistance wire 28 out of circuit which will be entirely cut out when the contact wiper is brought into engagement with the stop washer 70, and continued rotation of said knob K in a counter-clockwise direction will cause the rotatable unit R to be rotated to gradually increase the amount of the resistance unit 2 included in the operating circuit. The rotatable unit R is unaffected by the counter-clockwise rotation of the knob K until the wiper 65 engages the stop washer 70 whereupon the rotatable unit R is rotated. When the rotatable unit R has been rotated to cut in the approximate amount of the resistance unit 2 desired in the operating circuit the knob K may then be rotated in a clockwise or a counter-clockwise direction to further increase or decrease the resistance until just the right amount of resistance is cut in the operating circuit to obtain the maximum efficiency of the electron tube which is in circuit with my rheostat and controlled by said rheostat.

The indicator 69 secured to the knob K is so positioned relative to the indicator 50 secured to the sleeve 14, and rotatable with the unit R that when the wiper 65 is engaging the stop washer 70 the said indicator 69 will coincide with the indicator 50 which will indicate that the vernier resistance wire 28 is not included in the operating circuit. Now when the knob K is rotated and the wiper 65 moves away from the stop washer 70, the indicator 69 will move away from the indicator 50 in a rotary direction thus indicating that the vernier resistance wire 28 is being cut into the operating circuit to increase the resistance in said operating circuit. The indicator 50 will remain inert until the wiper 65 engages the stop washer 70′ whereupon the rotatable element will rotate with the knob K and shaft 63 if rotation of the knob K is continued. The indicators 69 and 50 will at this point travel in the same rotary direction and will not coincide but on the contrary will have their free ends separated in a rotary direction of a distance approximately equal to the shortest distance between the stop washers 70 and 70′ which will indicate that the entire vernier resistance wire 28 is included in the operating circuit. The knob K may be operated to include any amount of the vernier resistance wire 28 in the operating circuit without changing the amount of the resistance unit 2

already included in said operating circuit, and the amount of the vernier resistance wire 28 included in the operating circuit will be indicated by the angular position of the indicator 69 relative to the indicator 50 as the distance between the apexes of said indicators will be approximately equal to the amount of the resistance wire 28 included in the operating circuit. The wiper 65 of the vernier unit V may be caused to wipe over the vernier resistance wire 28 through the rotation of the knob K to infinitesimally increase or decrease the resistance in the operating circuit and the amount of the vernier resistance element included in the operating circuit will always be indicated by the angular position of the indicators 50 and 69.

The wiper 65 of the vernier unit V is held in any of its adjusted positions by holding means in the form of a dished washer 75 which is slipped over the shaft 63 and inserted between the collar 64 and the leg 37. This dished washer 75 has a spring effect and holds the wiper 65 in any of its adjusted positions. The unit R as before described is limited in its extreme "on" position and its "off" or normal position by the engagement of the end 24′ of the screw 24 with the stop pin 73.

To mount my rheostat as a unit in position the knob K and indicator 50 may be removed and the shaft 63 inserted through a suitable opening in a mounting member 76, shown in dotted lines in Fig. 2, whereby the sleeve 14 engages said opening and a screw 77 is provided which extends through an orifice in the mounting member 76 and has screw-threaded engagement with the leg 36.

While I have described a preferred embodiment of my invention as illustrated I do not wish to be limited to the exact structure as shown and described but intend to cover all modifications and changes which may come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is as follows:

1. The combination of a mounting panel and a rheostat mounted at the rear thereof, a mounting frame for said rheostat, a rotary shaft supported by said mounting frame and extending through said panel, an operating knob attached to said shaft, a resistance element and a rotatable supporting member for said resistance element supported on a rotatable sleeve loosely supported on said rotary shaft and extending through said panel, a terminal block on said mounting frame, a contact member secured to said terminal block and having an arcuate end engaging said resistance element and having flanged sides engaging said terminal block to prevent rotation of said wiper relative to said block, an indicator supported on said rotatable sleeve at the front of said panel, a second resistance element secured to said rotatable supporting member, a contact wiper secured to said rotary shaft for engaging said second resistance element, an indicating means rotatable with said shaft for indicating the position of engagement of said contact wiper and said second resistance element, the position of said wiper with reference to said second resistance element being indicated by the position of the second indicator relative to the said first indicator.

2. The combination of a mounting panel and a rheostat including a resistance element mounted at the back of said panel, rotatable supporting means for said resistance element, a terminal block, a contact member secured to said terminal block by means of a screw and having flanged sides to prevent rotation of said wiper relative to said block, said wiper having an arcuate end adapted to engage said resistance element, indicating means at the front of said panel for indicating the amount of said resistance element included in a circuit, a second resistance element secured on said rotatable supporting means, means for effectively including said second resistance element in the circuit with said first resistance element, indicating means at the front of the panel for indicating the amount of said second resistance element effectively included in the circuit of said first resistance element, and a single operating knob for controlling said resistance elements and said indicating means.

3. The combination of a panel having a rheostat supported at the rear thereof, said rheostat including a resistance element adapted to be included in an electrical circuit to increase the resistance thereof, a second resistance element forming a part of said rheostat and associated with said first resistance element and adapted to be included in the electrical circuit in different amounts and independent of said first resistance element, wipers for contacting with said resistances, a terminal block, one of said wipers being secured to said terminal block and having flanged sides to prevent relative rotation of said wiper and said block and having an arcuate end for engagement with said first resistance element, indicating means at the front of said panel associated with each of said resistances for indicating the amount of said first resistance element included in the electrical circuit and also for indicating the amount of said second resistance element included in said electrical circuit, and a single shaft provided with an operating knob for controlling said resistance elements and said indicating means.

4. The combination of a mounting panel and of a rheostat supported at the rear thereof, said rheostat including a pair of resistance elements associated with each other and adapted to be included in an electrical

circuit by degrees and independently of each other, a terminal block, a contact member secured to said terminal block by means of a screw and having flanged sides to prevent rotation of said wiper relative to said block, said wiper having an arcuate end adapted to engage said resistance element, rotatable supporting means for said resistance elements, means at the front of said panel for indicating the amount of said resistance elements included in the electrical circuit and also to indicate when said resistance elements are excluded from the electrical circuit, and a single operating shaft provided with a knob for controlling said resistance elements and said indicating means.

5. The combination of a panel and a rheostat mounted at the rear thereof, a resistance element for said rheostat, supporting means for said resistance element including a rotatable sleeve extending through said panel, an indicator attached to said rotatable sleeve at the front of said panel, a second resistance element secured to said supporting means, a terminal block, a contact member secured to said terminal block by means of a screw and having flanged sides to prevent rotation of said wiper relative to said block, said wiper having an arcuate end adapted to engage said resistance element, a single rotary shaft for rotatably supporting said supporting means and extending through said panel, a second indicator supported on said rotary shaft at the front of said panel, means for partially or wholly including said first resistance element in an operating circuit, said first indicator adapted to indicate the amount of said first resistance element included in said circuit, means for including said second resistance element wholly or partially in said electrical circuit independent of said first resistance element, said indicators visualizing by their positions relative to each other the amount of said second resistance element included in said electrical circuit, and a single knob for said shaft for controlling said resistance elements and said indicators.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 31st day of March, 1924.

HENRY G. EISLER.