Feb. 15, 1927. 1,618,015

W. KAISLING

RHEOSTAT

Filed Oct. 8, 1923

Fig. 3.

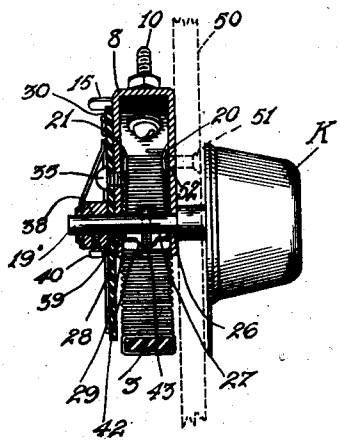


Fig. 1.

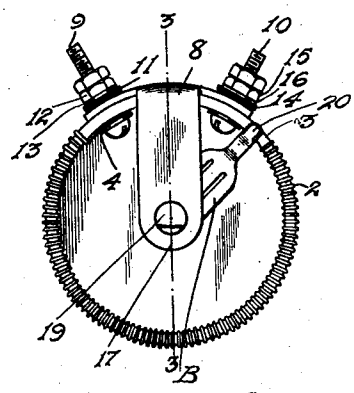
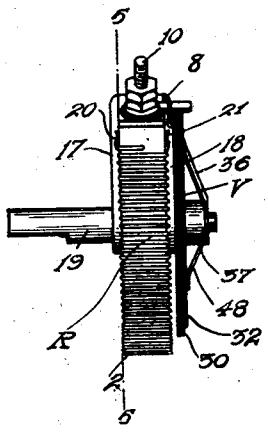


Fig. 2.



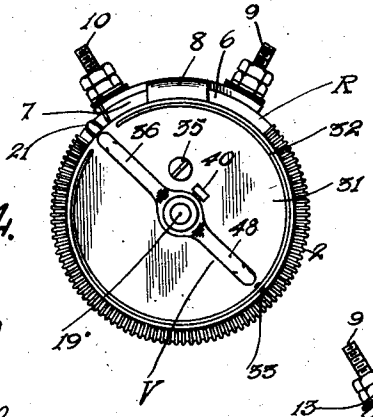


Fig. 4.

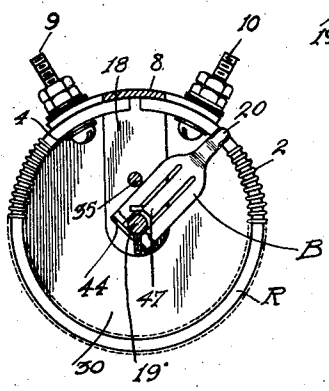


Fig. 5.

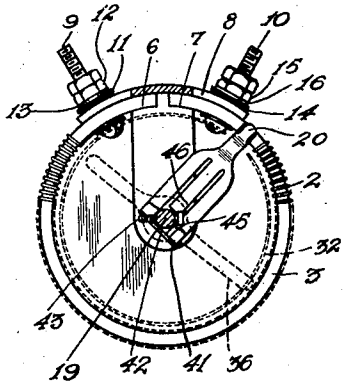


Fig. 6.

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Patented Feb. 15, 1927. 1,618,015

UNITED STATES PATENT OFFICE.

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RHEOSTAT.

Application filed October 8, 1923. Serial No. 667,093.

My invention relates to rheostats for varying the resistance in an electric circuit and is adapted particularly 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 but very durable and efficient.

Rheostats of the type employed in use for controlling the current flow through the filament of an electron tube are usually provided with a contact wiper and when the rheostat is operated to increase or decrease the amount of resistance in the circuit in which the rheostat is used, this increase or decrease in the amount of resistance is effected by a complete turn of the convolutions of the resistance coil. This means of adjustment is objectionable in that it is difficult in some instances to obtain the proper amount of resistance in the operating circuit. To overcome this objectionable feature I have designed an improved rheostat and a feature of my invention is the provision of a vernier attachment in the form of a single turn of wire (equal to several turns of the main resistance element) in series relation with the resistance coil of the rheostat and an auxiliary wiper associated therewith.

Another feature of my invention is the method of controlling the movement of the wiper associated with the vernier turn of wire to place the same in contact therewith, and the movement of the wiper associated with the main resistance coil. The movement of the wiper of the resistance coil and wiper of the vernier wire is under the control of a single unit, which after having been moved a certain degree may be rotated in either direction a limited distance without effecting the movement of the wiper associated with the main resistance coil and bring about the movement of the wiper associated with the vernier wire to further increase or decrease the resistance.

Another feature of my invention is the provision of novel means for holding the wipers of the rheostat in their adjusted position.

The above features, as well as others, will be more particularly pointed out in the ensuing specification, and for a more complete understanding of the same, 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 view of the rheostat of my invention illustrating it in its normal or off position.

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

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

Fig. 4 is a back plan view of the rheostat;

Fig. 5 is a sectional view along the line 5—5 of Fig. 2, and

Fig. 6 is a view similar to Fig. 5 but showing the rheostat in its off normal or on position.

Referring now more in detail to my invention as illustrated in the accompanying drawing, the rheostat of my invention comprises a resistance coil or unit 2 of a predetermined ohmic resistance wound upon a flat strip of insulating material 3, by suitable machine means, its ends 6 and 7 passing through suitable orifices in the strip 3 for holding purposes. The strip 3 which carries the resistance coil 2 after being wound is now formed into a substantially ring shaped member R by means of a suitable forming operation and its ends 6 and 7 are then secured to an arcuate shaped yoke member 8 by means of the screws 9 and 10. The screw 9 passes through a suitable orifice in the end 6 of the member R and extends through the yoke 8 but insulated therefrom by means of an insulating bushing 11, and a nut 12 having screw threaded engagement with the screw 9 secures the end 6 to the yoke 8. One end 4 of the resistance coil 2 is secured to the screw 9 and a terminal 13 resting between the nut 12 and bushing 11 provides connecting means to the resistance coil or unit 2. The screw 10 passes through suitable orifices in the end 7 of the member R and yoke 8 but insulated from the yoke 8 by an insulating bushing 14, and a nut 15 having screw threaded engagement with screw 10 secures the end 7 of the member R to the yoke 8. A terminal 16 rests between the bushing 14 and the nut 15 for the usual connection means.

The arcuate yoke member 8 is provided with a pair of integrally formed depending arms 17 and 18 substantially parallel with each other for supporting the rotatable shaft 19. I provide a U shaped wiper member B which rests between the arms 17 and 18 and its wiper arms 20 and 21 engage re-

spectively the peripheral portions of the convolutions of the resistance unit 2 and are formed to provide a spring effect for gripping the convolutions of the coil 2 so as to insure a good contactual engagement between the wiper arms 20 and 21 and the convolutions of the coil. The bridge 41 of the U shaped wiper member B is provided with a longitudinal slot 42 and a screw 43 having screw threaded engagement with the shaft 19 extending through the slot 42 and effects the rotation of the wiper member B as will presently be described. The rotatable shaft 19 is provided with a reduced portion 19' which passes through suitable orifices 26 and 27 in the arm 17 of the yoke 8 and wiper arm 20 of the wiper member B and orifices 28 and 29 of the wiper arm 21 of the wiper member B and arm 18 of the yoke member 8.

The vernier unit V of the rheostat of my invention comprises a disc 30 of suitable insulating material and secured to its face 31 near its peripheral edge is a turn of wire 32, its one end passing through a suitable orifice in the disc 30 and bent to secure the same to the disc 30. The other end also passes through an orifice in the disc 30 and is in turn soldered to the terminal 15 for purposes as will presently be described. Intermediate of the ends of the wire 32 the said wire rests in a slot of a pin 33 to hold the same against the disc 30 and also maintain its circular shape. The disc 30 and its wire 32 as a whole is secured to the arm 18 of the yoke member 8 by means of a screw 35 which screw has screw threaded engagement with a suitable tapped orifice in the arm 18. I also provide a wiper 36 which is adapted to contact with the wire 32 the said wiper being secured to a lug 37, which lug 37 is provided with a central orifice 38. The disc 30 is provided with a central orifice 39 through which the reduced portion 19' of the shaft 19 protrudes and is of a size to permit the lug 37 and its wiper 36 to be slipped over the shaft portion 19' as a whole and secured thereto by means of the set screw 40. The shoulder formed by the reduced portion of the shaft 19 rests against the face of the arm 17 of the yoke 8 and the lug 37 to which the wiper 36 is secured is fastened to the shaft 19 to prevent lateral movement of the shaft 19 but permits its rotation. A knob K is supported on the shaft 19 for rotating the same and for a detailed description of the method of supporting the knob reference may be had to an application of Emil J. Nielsen, Serial No. 603,927 filed November 29, 1922.

When the wiper arms 20 and 21 of the wiper member B associated with the resistance unit 2 and the wiper 36 associated with the vernier resistance unit V are in their off or normal position they are in the position as clearly illustrated in Figs. 1, 4 and 5. To operate the rheostat of my invention the knob K is grasped and rotated in a clockwise direction with reference to Figs. 1, 5 and 6 causing the shaft 19 to be rotated and as the wiper 36 of the vernier unit V is secured to the shaft 19 by means of the set screw 40 it is also rotated causing it to contact with its vernier resistance 32. The U shaped wiper member B is not rotated as it is loose on the shaft 19 and the first movement of the shaft 19 from its off position only effects the travel of the wiper 36 of the vernier unit V and the degree of travel of the wiper 36 before the wiper member B is rotated is governed by the length of the slot 42 in the bridge 41 of the wiper member B. Now as the shaft 19 continues rotating the screw 43 secured to it rotates through a predetermined degree of rotation governed by the length of the slot 42 before the movement of the wiper arms 20 and 21 is brought about. In the rheostat of my invention the shaft 19 travels through approximately ninety degrees of rotation before the screw 43 which extends through the slot 42 engages the edge 44 of the slot 42 in the bridge 41 of the wiper member B as clearly illustrated in Fig. 6. The further rotation of the shaft 19 now brings about the rotation of the wiper member B causing the wiper arms 20 and 21 thereof to engage the convolutions of the resistance unit 2, the wiper 36 of the vernier unit V being also rotated. When the knob K is rotated in a clockwise direction the wiper arms 20 and 21 engage successive convolutions of the resistance unit 2, causing the resistance of the electrical circuit in which the rheostat is used to be decreased and when the proper coarse adjustment is obtained, a finer adjustment may be obtained by the use of the vernier unit V of the rheostat of my invention.

From the above description it may be seen that the wiper 36 of the vernier unit V is approximately ninety degrees in advance of the wiper arms 20 and 21 of the wiper member B associated with the resistance unit 2 as the shaft 19 is rotated from its off position before the wiper member B is moved to engage the first convolutions of the resistance unit 2. Thus as the wiper member B is moved from its off position to its extreme "on" position in which position practically all of the resistance unit 2 is cut out the wiper member B has traveled through approximately two hundred and seventy degrees of rotation and as the wiper 36 of the vernier unit V is approximately ninety degrees in advance of the wiper arms 20 and 21 in its forward or clockwise movement, the wiper 36 of the vernier unit V rotates through approximately three hundred and sixty degrees of rotation. In a circuit in which a rheostat is used to control the current flow through the filament of an elec-

tron tube there is a critical point at which the tube will work at its maximum efficiency and that point is obtained by being able to adjust the resistance in the circuit so that just the proper amount of resistance may be cut in or out to obtain this maximum efficiency.

Now when the rheostat of my invention has been adjusted as above described to place the wiper arms 20 and 21 in position on the resistance unit 2 so that the approximate amount of resistance has been cut in the circuit I provide the vernier unit V whereby the further rotation of the wiper 36 of the vernier unit V may be rotated in a counter clockwise or clockwise direction to further increase or decrease the resistance until just the right amount of resistance is cut in the circuit as will now be described. After the wiper arms 20 and 21 have been adjusted to approximately cut in the proper amount of resistance of the unit 2 after having rotated the shaft 19 in a clockwise direction, the knob K may now be rotated in a counter clockwise direction through approximately ninety degrees of rotation without disturbing the adjustment of the wiper arms 20 and 21 of the wiper member B as the wiper member B is loose upon the shaft 19 and as the wiper 36 of the vernier unit V is fixed to the shaft 19 this counter clockwise rotation of the shaft 19 causes the wiper 36 to rotate in this direction and wipe over the wire 32 of the vernier unit V. The distance traveled by the wiper 36 over the wire 32 in its counter clockwise direction through its ninety degrees of rotation may be approximately the length of one or two convolutions of the resistance unit 2 so that it may readily be seen that as the wiper 36 is moved over the wire 32 in this counter clockwise direction it may be placed in an infinite number of positions on that portion of the wire 32 that is covered by the wiper 36 in its course of travel in its ninety degrees of counter clockwise rotation. It is also readily apparent that the wiper 36 of the vernier unit V may be rotated in either a clockwise or counter clockwise direction in this ninety degrees without disturbing the adjustment of the wiper arms 20 and 21 of the wiper member B that is in its adjusted position.

If in rotating the wiper member B its arms 20 and 21 are rotated beyond the approximate point of the proper amount of resistance to be used, the knob K is turned in a counter clockwise direction causing the shaft 19 to also rotate in a counter clockwise direction until the screw 43 secured to the shaft 19 engages the edge 45 of the slot 42 in the bridge 41 of the wiper member B. During this counter clockwise travel of the shaft the wiper 36 of the vernier unit V also travels in this direction. Further rotation of the shaft 19 in this direction after the screw 43 has engaged the edge 45 of the slot 42 causes the wiper member B to be rotated in a counter clockwise direction causing the wiper arms to engage successive convolutions of the resistance unit 2 until the approximate amount of resistance is cut in and to obtain a finer adjustment the shaft may now be rotated in a clockwise direction through ninety degrees of rotation to permit the wiper 36 of the vernier unit V to be rotated over the portion of the wire 32 covered by the degree of rotation of the wiper 36.

I also provide means for holding the wiper arms 20 and 21 in their adjusted position and to insure good electrical contact, as will now be described. The face of each wiper arm 20 and 21 is provided with an integrally formed tongue portion 46 which projects slightly above the face of each arm 20 and 21 so that when the wiper member B is inserted between the arms 17 and 18 of the yoke member 8 the tongues 46 of the wiper arms 20 and 21 are forced down against their normal tension, their ends 47 when the member B is in position engage the inner faces of the arms 17 and 18 thus producing frictional holding means for holding the wiper arms 20 and 21 in their adjusted position and for insuring good electrical contact. The wiper 36 of the vernier unit V is also provided with a frictional holding means for holding the wiper 36 in its adjusted position. The wiper 36 is provided with an integrally formed arm 48 diametrically opposite it and when the wiper 36 is secured in position on the shaft 19 the arm 48 engages the face of the disc 30 and the tension of the arm 48 is such as to produce frictional holding means between the arm 48 and face of the disc 30 to hold the wiper 36 in any of its adjusted positions, and to obviate a side thrust on the shaft of the device. The two arms insure good electrical contact of the wiper on wire 32 and at the same time prevents a side thrust on the shaft. The wiper member B is limited in its off position by means of the screw 35 which secured the disc 31 to the arm 18 of the yoke 8. This screw projects through the arm 18 and is engaged by the wiper arm 21 when the wiper member B is moved to its off position to limit its movement in that direction. The wiper arm 21 also engages the screw 35 when the wiper member B is moved its extreme "on" position to limit the movement of the wiper member B in this direction, thus the screw 35 which secures the disc 31 in position on the arm 18 of the yoke 8 also serves as a stop for the wiper member B.

In Fig. 3 I illustrate the rheostat mounted upon a panel 50 shown in dotted lines by means of a screw 51 which extends through a suitable orifice in the panel and has screw threaded engagement with a suitable tapped

orifice 52 in the arm 17 of the yoke member 8.

From the foregoing it is apparent that my device is so arranged that by simply turning the control knob the turns of wire on the main rheostat may be cut in or out and by a movement of the same knob the vernier wiper may be made to move over its turn of wire for the fine adjustment.

While I have described a preferred embodiment of my invention it is to be understood that I do not wish to be limited to the exact structure as shown and described, as changes will readily suggest themselves, and I therefore aim to cover all such changes and modifications as 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. A device of the character described including a supporting yoke, a resistance unit supported by said yoke, a wiper operatively associated with said resistance unit, a shaft for rotating said wiper, a second resistance unit supported by said yoke, and a wiper operatively associated with said second unit, a shaft for adjusting said wipers, said first wiper having integrally formed means consisting of a tongue member adapted to engage said supporting yoke to maintain the same in any adjusted position, said second wiper having integrally formed means consisting of an extending portion adapted to engage a supporting member to maintain the same in any adjusted position, and control means permitting the rotation of the wiper of said second resistance unit by said shaft from its adjusted position without affecting the adjusted position of the wiper of said first unit.

2. A device of the character described including a supporting yoke, a resistance unit supported by said yoke and a wiper associated therewith, a second resistance unit supported by said yoke and a wiper associated therewith, a shaft for advancing said wipers into engagement with their respective resistance units, said first wiper having integrally formed means consisting of a tongue portion adapted to engage the said yoke member to maintain the said wiper in any adjusted position, and control means to permit the movement of said second wiper in a clockwise direction or counter clockwise direction a predetermined degree without affecting the rotation of said first wiper.

3. A device of the character described including a rotary shaft, a mounting member supporting said shaft, a pair of resistance elements directly supported by said mounting member, a pair of contact elements for contacting with said resistance elements, one of said contact members being directly connected to said shaft, and the other member being loosely supported thereby so that the first contact member may be moved a predetermined distance without moving said second contact member, one of said contact members having integrally formed means consisting of a tongue portion adapted to engage said mounting member to maintain said wiper in any adjusted position, said other contact member having integrally formed means consisting of an extending portion adapted to engage said mounting member to maintain said wiper in any adjusted position.

4. A device of the character described including a mounting member, a pair of relatively stationary resistance elements connected to said mounting member, a rotary shaft supported by said mounting member, a double wiper for engaging one of said resistance elements and a single contact wiper for engaging the other of said resistance elements, said double wiper having integrally formed means consisting of a tongue portion adapted to engage said mounting member to maintain said double wiper in any adjusted position, said single wiper having integrally formed means consisting of an extending portion adapted to engage a supporting member to maintain said single contact wiper in any adjusted position.

5. A device of the character described including a plate of insulating material, a resistance element connected thereto, a double ended wiper having its one end adapted to engage said resistance element and its other end adapted to engage said plate of insulation to provide frictional means to maintain the wiper in said engagement with said resistance element, and a member for moving said wiper over said resistance element.

6. A device of the character described including a mounting member, a resistance element supported thereby, a rotary shaft supported by said mounting member, a wiper having a slot, a member extending through said shaft into said slot whereby the shaft may be rotated a predetermined distance while permitting the wiper to remain stationary and yielding contact means consisting of an integrally formed tongue portion adapted to co-act between said wiper and said mounting plate to maintain the wiper in any position to which it is rotated.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 4th day of October, 1923.

WILLIAM KAISLING.