Oct. 25, 1938. R. A. BEACH 2,134,323

RHEOSTAT

Filed April 15, 1936 2 Sheets-Sheet 1

Fig. 1

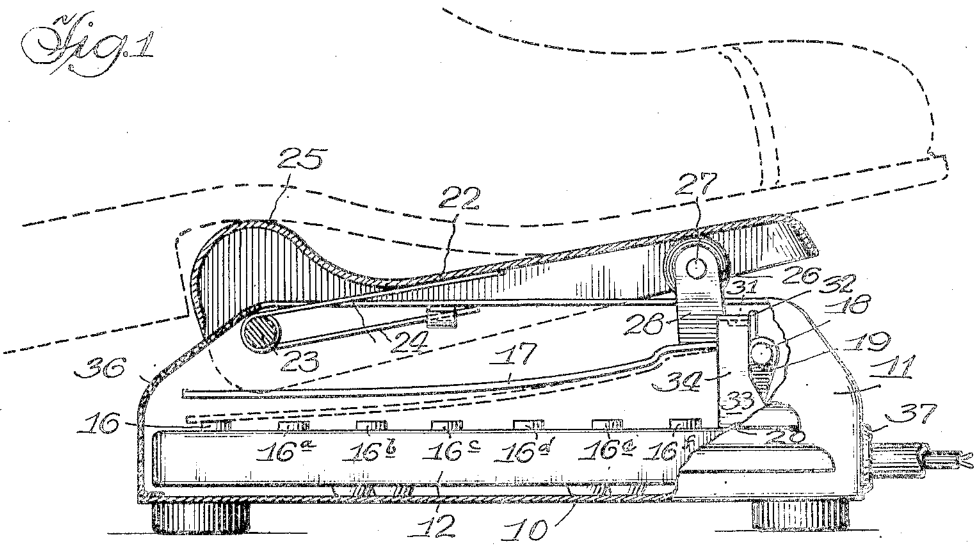


Fig. 2

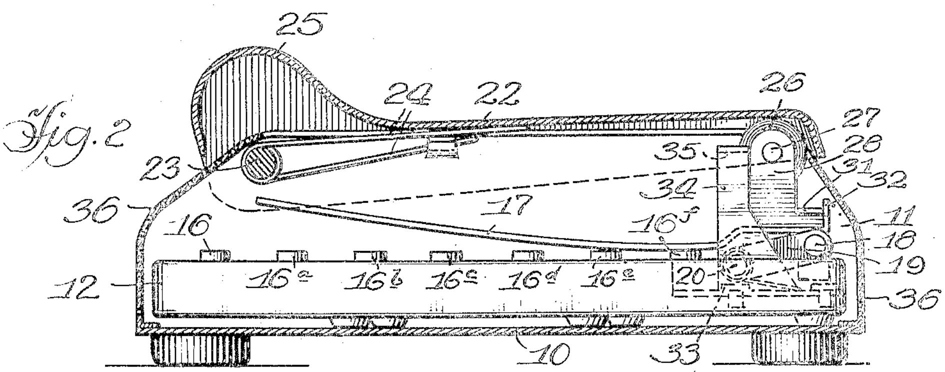
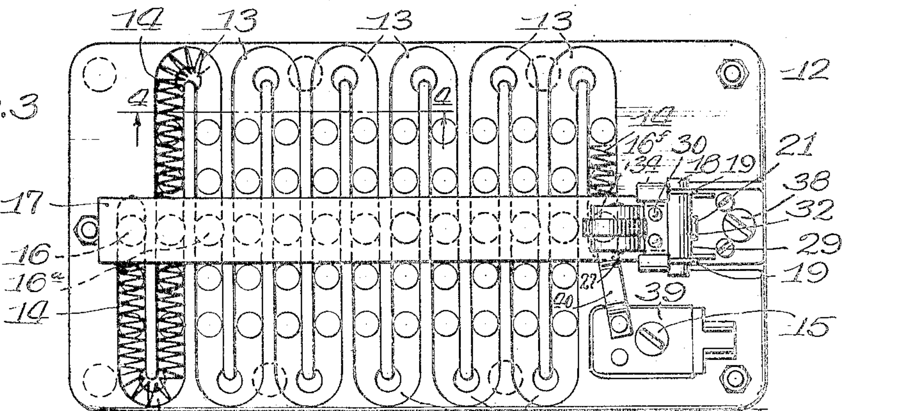


Fig. 3



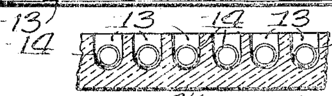


Fig. 4

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Fig. 5

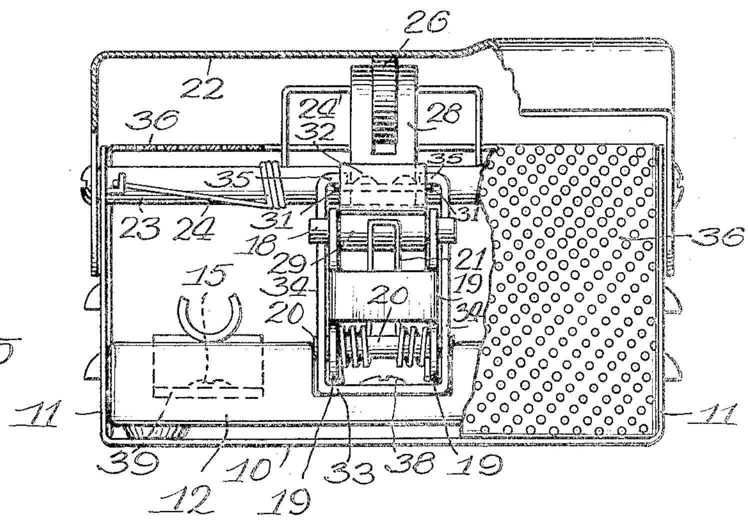


Fig. 8

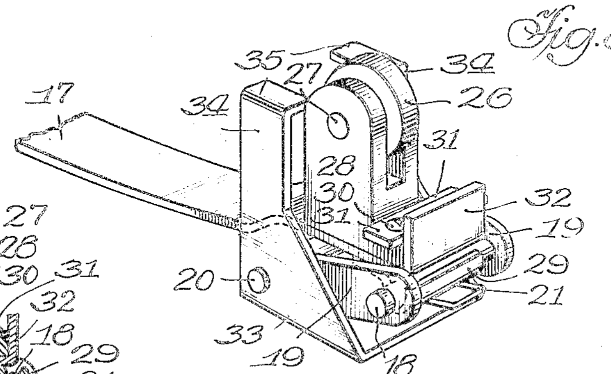


Fig. 6

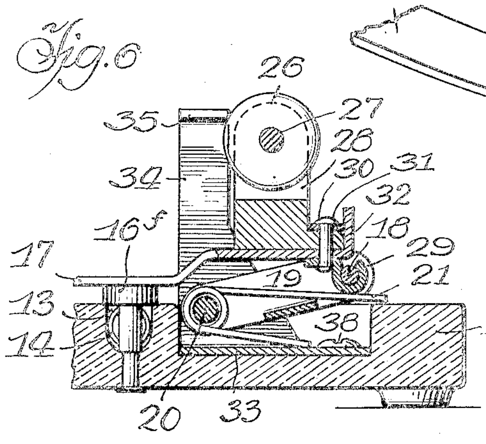
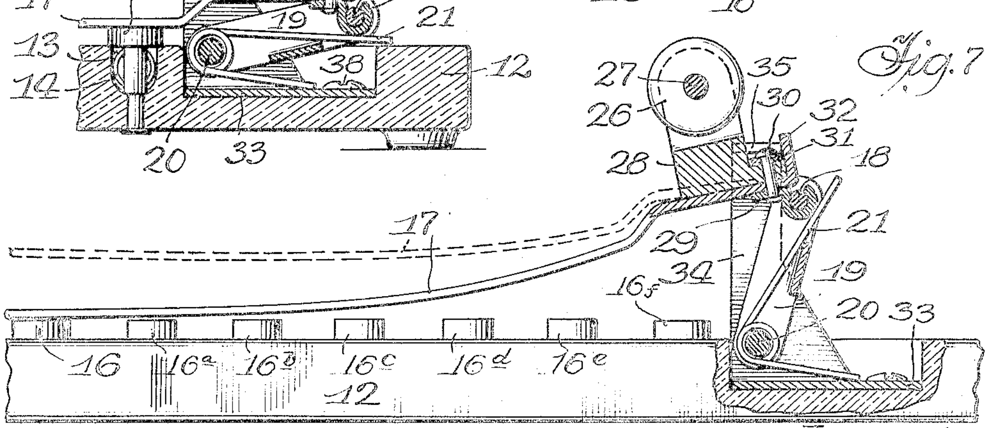


Fig. 7



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UNITED STATES PATENT OFFICE

2,134,323

RHEOSTAT

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Application April 15, 1936, Serial No. 74,583

7 Claims. (Cl. 201—55)

This invention relates to improvements in rheostats and more particularly to a structure in which the circuit closing contact members have a rocking action with respect to each other. Such a design lends itself favorably to incorporation in a foot control rheostat of sturdy construction, enabling the operator to rest his entire foot on the treadle on top of the device, in operating the rheostat, which position is less fatiguing than to rest the heel on the floor and the ball of the foot on the treadle, in moving the latter up and down.

One object of the invention, therefore, is to provide a rheostat having as one main element, a row of contacts connected to sections of a resistor, and having as another element a contact arm long enough to span all of the contacts in the row, these two elements being mounted to rock one over the other and so shaped as to engage each other for a small part of their length only, the point of contact traveling back and forth during the rocking action, in one direction or the other, to vary the effective length of the resistance included in the circuit.

Another object is to provide a rheostat in which the contact arm is curved and the row of contacts is tangential to the same and is mounted to rock on said contacts from one end of the row to the other in a plane at right angles to the surfaces of said contacts.

A further object is to provide a rheostat of this construction in which the contact slides lengthwise a certain extent while it is rocking, to maintain the contact surfaces clean.

Another object is to provide a rheostat of this type, in which the arm is normally held out of engagement with the contacts but is pressed against the same as a step preliminary to the rocking action, and also is withdrawn with a quick movement, at the end of the reverse rocking action, to avoid arcing.

Another object is to provide in a rheostat of this character, an arm mounted at one end on a pivoted link, yieldingly arranged to be swung toward the supporting base on which the row of fixed contacts are mounted, whereby a rocking and wiping action results when pressure is applied at a suitable point.

A further object is to mount the various parts of the device in a housing having a foot treadle thereon, and suitably connected to the movable parts to apply the desired actuating pressure.

An additional object is to provide a small, compact housing for the mechanism described, the treadle and the housing being strong enough to support the operator's weight, and the treadle being designed to prevent slipping of the foot thereon.

Other objects and advantages will be recognized from a consideration of the more detailed description hereinafter given of a commercial embodiment of the invention.

In the drawings:

Fig. 1 is a sectional elevation of the device; Fig. 2 is a similar view with the treadle depressed; Fig. 3 is a top view of the structure with the housing removed; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5 is an end elevation on a somewhat larger scale; Fig. 6 is a longitudinal section through the pivotal support for the switch arm; Fig. 7 is an elevation partly in section of the switch arm, contacts and the mounting therefor; and Fig. 8 is a perspective view of the yielding support for the contact arm.

The device operates in general by pressing a curved contact member against a row of fixed contacts and rocking the same over said fixed contacts to make electrical connection with the latter, one after the other, and at the same time sliding the curved contact over said fixed contacts to effect the engagement with a wiping action, thus keeping the contacts clean. When the pressure is released the curved contact is rocked in the opposite direction and immediately raised from the end contact in the row of fixed contacts with a quick movement, to minimize arcing.

In the drawings, the device is shown as provided, with a sheet metal base 10 having upturned side flanges 11 forming a channel which receives a plate of refractory material 12 which may be made of porcelain having back and forth grooves 13 therein forming a long channel to receive a resistance element 14. This resistor may have the form of a helically wound wire electrically connected at one end to a circuit terminal 15 and at the other end to the end one of a series of contacts 16. There are a number of these contacts, 16, 16^a, 16^b, . . . 16^f, mounted on the porcelain base and arranged in a row and with their upper or contact surfaces preferably in the same horizontal plane. These individual contact members are connected to the resistor at intermediate portions in the length thereof in a manner which is well understood, or, where said resistor is made in short lengths, each length will have its opposite ends connected adjacent fixed contacts.

The contact arm 17, which has a rocking and sliding motion relatively to said fixed contacts, is made preferably from a strip of metal, such as bronze. Said strip has, therefore, a certain resiliency whereby it may bend somewhat when considerable pressure is applied to it but the resiliency thereof is not depended on to effect engagement with the fixed contacts. The rocking motion is relied on and therefore, for some purposes, a stiff, rigid contact bar or plate may be used, having a curved edge to rock over the contacts, in a plane at right angles to the surfaces of said fixed contacts presented for engagement. As shown in Fig. 1, in the dotted line position of the

contact 17 and in the full line position in Fig. 2, the distance between the rocking contact and the fixed contacts increases progressively from one end of the series to the other in either of the two extreme positions of the contact arm and when the engagement takes place near the middle of said contact arm the spacing increases progressively toward opposite ends of the row of fixed contacts. The arrangement shown is the preferred one in which the switch arm is curved and the engaging surfaces of the series of fixed contacts are in the same plane. It will be apparent, however, that said fixed contacts may also represent a curved line, i. e. the arc of a circle, for example, as long as the radius of said circle is greater than the radius of curvature of the rocking contact. Also, the line connecting the fixed contact surfaces may curve away from the rocking strip if desired. Also, the relative arrangement of the single contact arm and the series of individual contacts may be reversed. In other words, either may rock over the other, or both may rock against each other, the rocking action in either case serving to decrease or to increase the effective length of the resistor in the circuit where the device is used as a rheostat or serving to open and close successive circuits for any desired purpose.

To enable the contact arm 17 to be rocked, one end of it is yieldingly mounted so that said contact may be pressed toward the base. In the illustrative embodiment of the invention shown in the drawings and referring in particular to Figs. 1, 2 and 7, the right hand end of the contact arm is pivotally supported by a shaft 18, which in turn is carried in the upper end of a double arm link 19, pivoted at its lower end to a relatively fixed shaft 20. Thus it will be seen that pressure applied to said contact arm near the right hand end thereof will swing the pivoted link 19 from the position shown in Fig. 1 to the position shown in Fig. 2, causing the curved contact to rock over the fixed contacts. The initial movement of said contact arm is from its normally inoperative position to its dotted line position in Fig. 1, in which it engages the fixed contact 16 at the left hand end of the row of contacts. Increased downward pressure causes said contact arm, as a whole, to begin to slide, the right hand end to descend, and the left hand end to engage the second contact 16^a as well as the first contact, spanning the two, and concurrently the downward swinging movement of the link 19 causes said contact arm to rock and engage the remainder of the fixed contacts in succession and to draw said contact arm to the right, also causing it to wipe over said fixed contacts, thereby keeping them clean. During the rocking motion at least one fixed contact is always in engagement with the sliding and rocking contact and during part of the movement of the latter it bridges two fixed contacts. Thus there is no arcing when the curved contact opens the local circuit between itself and any one fixed contact, as there is always a shunt circuit around the latter, due to the engagement of the rocking arm with the next adjacent fixed contact.

When the pressure is released, the pivoted arm 19 is restored to its initial position by a spring 21 (See Figs. 5, 6 and 7) which is coiled around the shaft 20, as shown. This spring rocks the contact arm 17 from the position shown in Fig. 2 to the dotted line position in Fig. 1 and immediately thereafter raises it to full line position, as hereinafter described, thus minimizing any arcing tendency between the contact arm and the fixed contact 16 at the end of the row.

The pressure applied to the contact arm 17 may be made available either manually or otherwise and in the case of the rheostat shown it is applied preferably by pressure of the operator's foot, as shown in dotted lines in Fig. 1. The housing or channel member 10, 11, has a cap 22 pivoted thereto about a rod 23, serving as a treadle, and normally held in uppermost position by a suitable spring 24. A rounded transverse rib or hump 25 is pressed out of the treadle to prevent the shoe of the operator from slipping. The under side of the treadle engages a roller 26 of insulating material, mounted on a pin 27 in the upper end of the bracket 28, made preferably of Bakelite, the base of the latter being screwed or riveted to the rocking contact arm 17. The roller minimizes friction when the treadle is depressed against the action of its spring 24 and against the resistance of the spring 21.

Referring to the details of the pivotal mounting of the contact arm 17 about the shaft 18, said arm has a sheet metal hinge member 29 (see Fig. 7) held thereto by rivets 30, which rivets also secure a plate or stop 31 to a ledge on the Bakelite bracket 28. The end of the contact arm 17 is bent up at 32 over said ledge, as shown in Figs. 5, 6 and 7. These figures also show the hinged member 29 bent around the shaft 18 which is mounted in the links 19. The shaft 20 at the lower end of these links is mounted in a sheet metal support 33, secured to the porcelain plate, as shown in Fig. 6. The upward parallel extensions 34 of said support are turned inwardly to form stops at 35. Considering the centers or axes of the three pins or shafts 18, 20 and 27, shown in Fig. 7, it will be seen that imaginary lines connecting these three points represent a toggle. The force applied to the point 27, directed toward the point 20, will tend to close the toggle, as the point 18 is eccentric or to one side of the line of pressure. The spring 21 tends to straighten the toggle, and as the parts are being restored and reach the full line position shown in Fig. 7, the turned up end 32 of contact arm 17, strikes the sides of the stops 35, whereupon the continued pressure of the spring 21 tends to straighten the toggle, resulting in a further very small movement which causes the left hand end of the contact arm 17 to lift from the fixed contact 16, with a quick snap action. Further straightening of the toggle is prevented by the ends of the shaft 18 striking the uprights 34. The transverse plate 31 comes into position between the arms 34, as shown in Fig. 5, to prevent any substantial further movement of the contact arm 17, by striking the stops 35, if the rheostat is turned upside down.

It will be seen that the roller-supporting bracket 28 is mounted near the right hand end of the contact arm 17 near its pivotal support 18, thereby affording a suitable leverage in rocking the latter about said support. Also, any moderate pressure applied to said roller from above, results in a quick closing of the circuit through the contact 16, i. e. the slight downward movement of the roller is multiplied by the long leverage supplied by said contact arm.

In addition to the pivoted treadle 22 at the top of the device, the channel shaped housing is provided with a top or cover in the form of a perforated plate 36 having its ends bent down at the front and rear, and shown in part in Fig. 5 and also in section in Figs. 1 and 2. Part of the flat top portion of said perforated cover is cut

away to permit the roller and its insulating supporting bracket to protrude therethrough without interference, (Fig. 1) whereby said roller may engage the under side of the treadle. Said cover plate has a bushing 37 at one end, shown in Figs. 1 and 2, through which the conductors extend which pass to terminal screws 15 and 38, shown in Fig. 3. The terminal screw 15 is mounted in a small plate 39, electrically connected by a jumper 40 to the end of the helical resistance wire 14.

The circuit may be traced from terminal screw 15 and jumper 40, through the reistance wire 14 throughout the length thereof to the end contact 16 or to some one of the remaining contacts 16^a, 16^b, etc., returning through the curved contact arm 17, which short circuits some of said contacts in its several different positions, to the pivotal pin at one end and through the sheet metal support 33 to the terminal screw 38.

The base and housing are made strong enough to avoid injury, even if the operator should apply his entire weight to the foot treadle. When the foot, as shown in Fig. 1, is pressed on the treadle, the rounded ridge fits under the instep in front of the heel, making it very convenient to rock the foot downwardly and thus speed up the motor which is driving the machine the operator is using. This is particularly advantageous where the operator has to stand.

In the form shown, and referring to the dotted line position of the rocking arm in Fig. 1 for illustration, it will be seen that a spring normally holds one end of the rocking arm in uppermost position and the force applied by the foot overcomes said spring and effects the rocking action. However, the reverse arrangement may be effected wherein a spring pulls downwardly on one end of said rocking arm and the tendency of the other end to lift is resisted by the pressure of the treadle, which pressure is relaxed by the operator's foot, thus varying the effective length of the resistor.

Certain mechanical parts described herein may be used without the complete combination or may be used in other combinatons, as will be evident. Various changes and rearrangements of parts may be made within the scope of the invention, other than those suggested herein. The terms "horizontal", "vertical", "up", "down", etc., are used in a descriptive rather than a limiting sense, to facilitate an understanding of the operation.

I claim:

1. A rheostat comprising a row of fixed contacts, a resistor, connections from said contacts to different parts of said resistor, a switch arm having a curved surface to rock over said contacts, a pivoted support for said switch arm, connected to one end only thereof and normally holding said end at a distance from said contacts, with the free end closer thereto but also out of engagement therewith, a yielding mounting for said pivotal support and a foot pedal connected to said pivotally supported end to press said switch and arm toward said contacts and rock said arm over said contacts from said other end toward said pivotally mounted end.

2. A rheostat comprising a series of contacts in substantially the same plane, a curved contact arm adjacent the same, a link pivoted to one end of said contact arm and to a fixed support, resilient means normally holding said contact arm out of engagement with said contacts, and means for swinging said link about its support and depressing said arm against said contacts, whereby said arm is rocked over the same to engage them successively and may simultaneously slide over the same with a wiping contact.

3. In combination, a row of contacts, an arc-shaped arm of electrically conducting material adjacent thereto, a yieldingly mounted pivot at the end of said row to which one end only of said arm is attached, the other end of said arm extending over the contact at the other end of said row, whereby downward pressure on an intermediate part of said arm will lower said end into engagement with said end contact and will rock said arm over said row of contacts one after the other.

4. In a device of the class described, a base, a row of contacts thereon, a pivoted member at one end of said row, a curved contact arm pivoted to the free end of said pivoted member and spaced from said row of contacts, the other end of said arm engaging the contact at the opposite end of said row, whereby pressure on an intermediate part of said arm toward said row of contacts will rock the said arm and will swing said pivotal support toward said base, a spring tending to restore said pivoted member to initial position, whereby relaxation of said pressure will tend to rock said contact arm back to initial position, an extension on said rocking arm near its pivoted end, and means including a fixed abutment to be engaged by said extension at the end of the return movement to move said other end of said contact arm from the end contact.

5. In a device of the class described, a horizontal row of contacts, an arm above the same having a curved contact surface, a link at one end of said arm pivoted thereto, whereby said link may swing from near vertical to near horizontal position, an upwardly projecting stop on said contact arm and an abutment above the path of the return movement of said arm to be engaged thereby and raise the other end of said arm from the contact engaged thereby and thus open the circuit with a quick movement.

6. In a device of the class described, a contact arm, an actuating roller mounted thereon near one end, a link pivotally connected to said end, a pivotal support for the other end of said link whereby the axes of said roller and said two pivots form a three point toggle and whereby pressure on the two outside points of said toggle toward each other will close the toggle and rock said arm, and means including a stop on said arm and a fixed abutment engaged thereby during the straightening of said toggle to raise the other end of said arm.

7. In a device of the class described, a supporting bracket having two arms with abutments thereon, two link members pivoted to said bracket at one end and having a pin connecting the other ends, said pin projecting beyond said links to form stops, a contact arm hinged to said pin, a series of contacts beneath the same to be engaged thereby, a roller support with a roller thereon mounted on said arm to be depressed by a pedal and hence cause said arm to engage said contacts, lateral extensions on said roller support to engage said abutments during the upward swinging of said links, to limit such movement, the ends of said pin engaging said arms immediately thereafter at a point below the point of engagement first mentioned, whereby said contact arm is swung about its hinged support to lift it quickly from said contacts.

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