Sept. 2, 1958 L. H. MATTHIAS 2,850,605

VARIABLE RESISTANCE CONTROLLER

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Fig. 1.

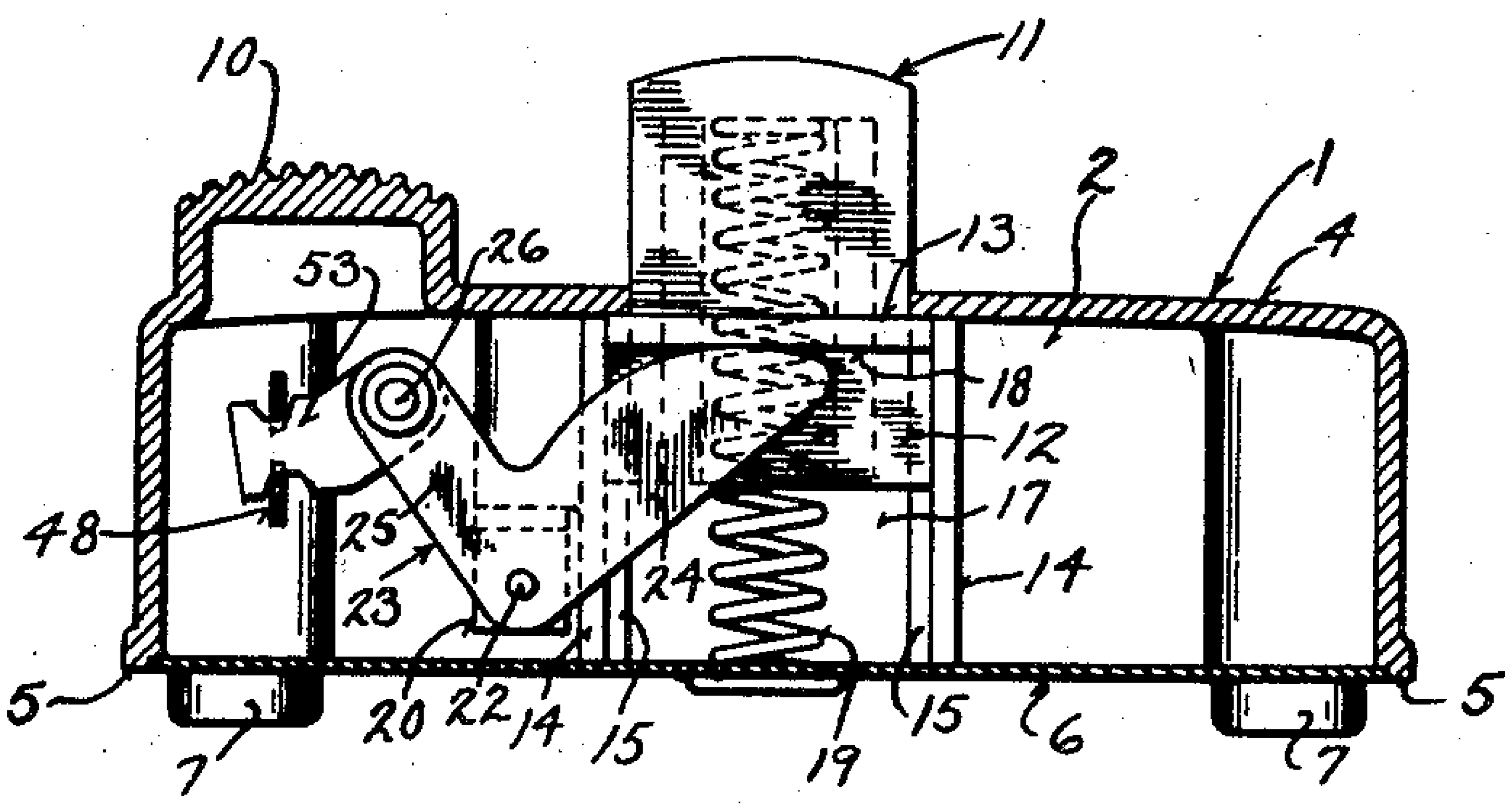


Fig. 2.

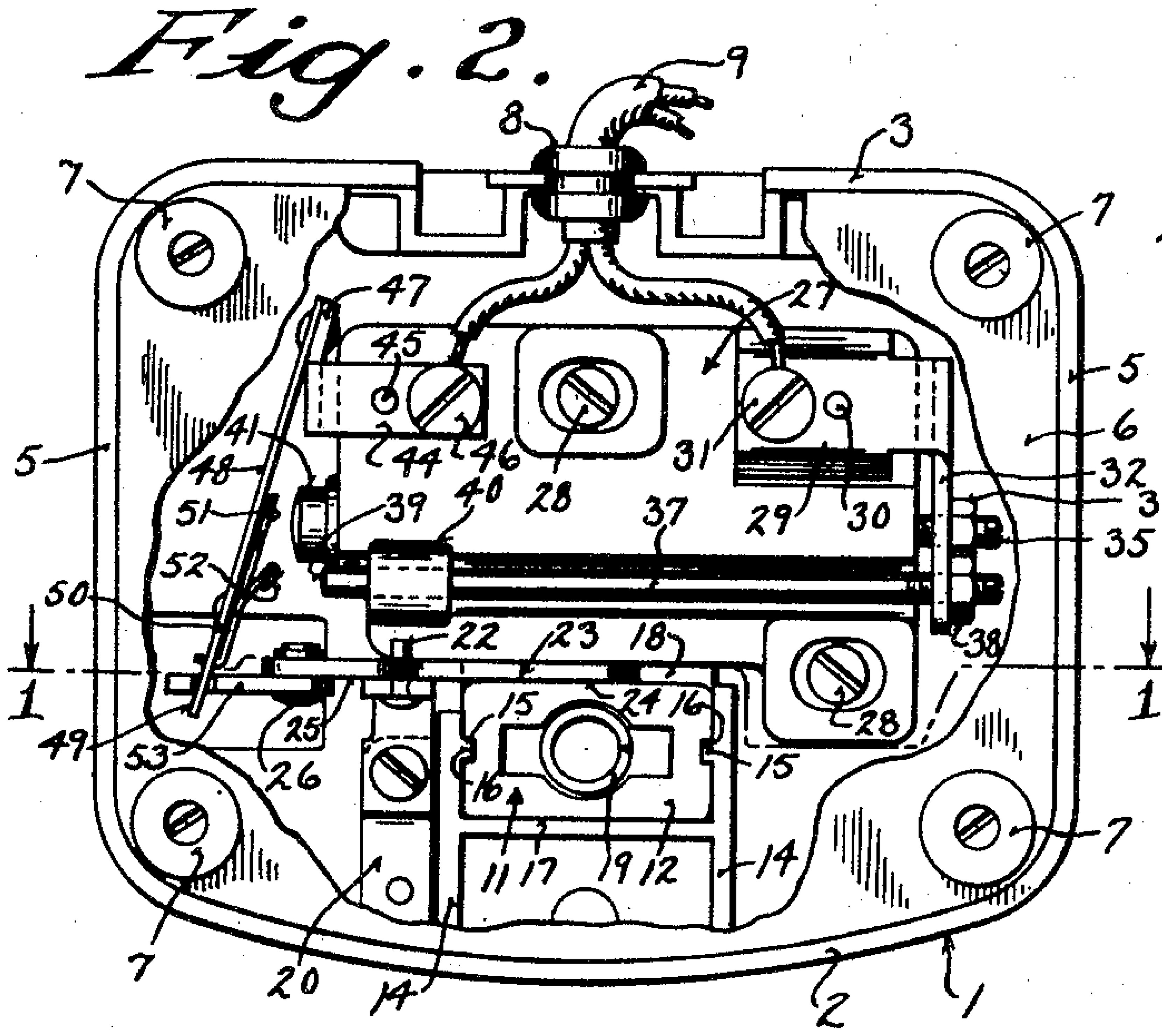


Fig. 4.

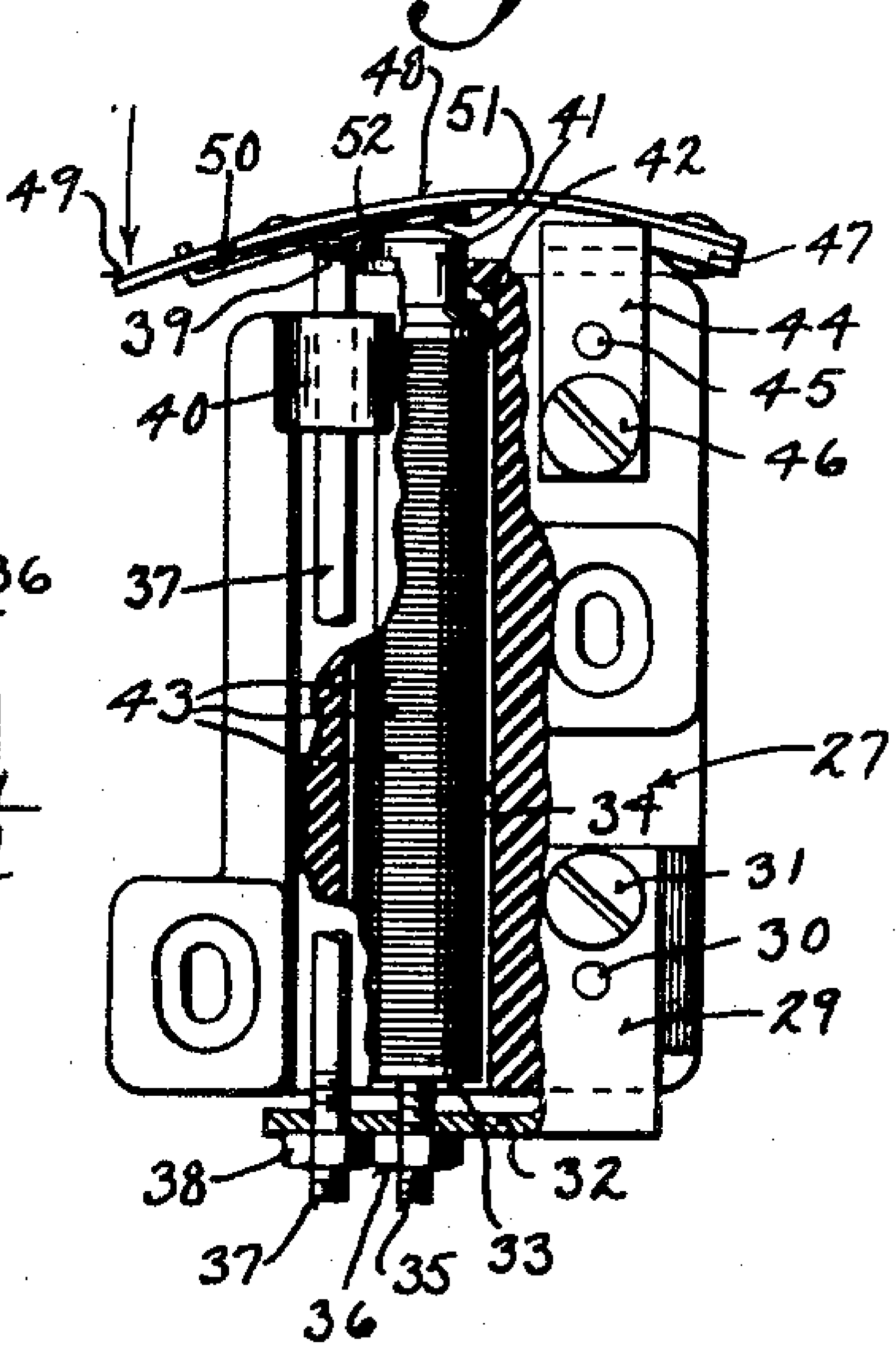
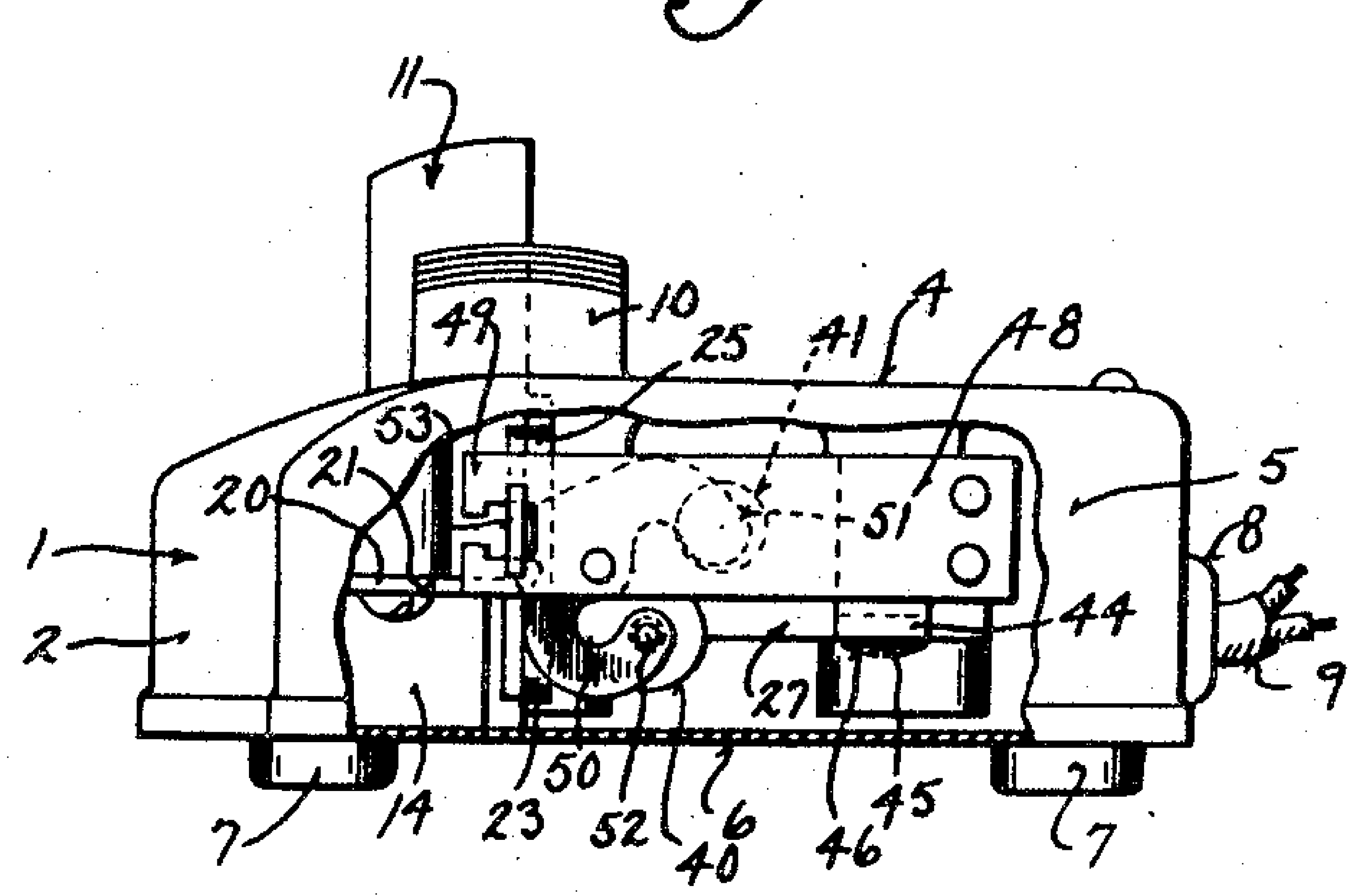


Fig. 3.



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VARIABLE RESISTANCE CONTROLLER

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6 Claims. (Cl. 201—52)

This invention relates to variable resistance controllers as may be utilized in a motor circuit to control motor speed, and it more specifically resides in a control having a carbon disc pile rheostat with a resilient leaf fixed at one end extending across an end of the pile and terminating in a deflectable end movable longitudinally of the pile so that upon movement of the deflectable end the leaf is brought into engagement with the pile to apply a compressive force that causes a change in resistance of the pile, the leaf including contact means that engages the pile to complete a circuit through the pile and which is also adapted to engage with a member shunting the pile upon occurrence of a continued movement of the deflectable end of said leaf.

Treadle operated rheostats are commonly employed for control of sewing machines and other small motors, where it is desired to have a range of speed control for the apparatus to be driven. The resistance of the rheostat is inserted in the motor circuit to reduce voltage at the motor terminals. A treadle operating button is depressed to cause a reduction in resistance and hence an increase in motor speed, and for full rated speed the resistance in the control is shunted by a short circuit path that effectively removes the current limiting resistance from the active circuit. It has been common practice to employ a carbon disc pile for the variable resistance element, that is characterized by a stepless change in resistance with applied pressure to give a corresponding stepless speed control for the motor. The present invention relates to a treadle control embodying such a carbon pile rheostat.

It is an object of this invention to provide a variable resistance controller wherein a single carbon pile provides requisite resistance for a full range of speed of the motor to be controlled.

It is another object of this invention to provide a variable resistance controller having easily manipulated adjustments for the spacing of contact members, to obtain the desired stroke for the carbon pile compressing member between initial circuit closure and the shunting of the carbon pile from the active circuit.

It is another object of this invention to provide a variable resistance controller, that includes a carbon pile, of a reduced number of elements that may be easily and quickly assembled for ease of manufacture.

It is another object of this invention to provide a variable resistance controller with a carbon pile rheostat that requires but a single leaf spring that mounts the operating contacts and biases such contacts to open position and disposes the operating linkage between an operating member and the contacts to a normal position corresponding to contact open position.

These and other objects and advantages of this invention will appear in the description to follow. In the description reference is made to the accompanying drawing, which forms a part hereof, and in which there is shown by way of illustration and not of limitation a specific form in which the invention may be practiced.

In the drawing:

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Fig. 1 is a view in elevation and in section of a variable resistance controller embodying the invention viewed through the plane 1—1 shown in Fig. 2,

Fig. 2 is a bottom view with portions of the bottom cover broken away of the controller shown in Fig. 1,

Fig. 3 is a side view in elevation with portions of the side wall broken away of the controller shown in Figs. 1 and 2, and

Fig. 4 is a bottom view with parts broken away and in section of an insulator assembly comprising a portion of the controller.

Referring now to the drawings, there is shown a cast base 1 having a curved front wall 2, a rear wall 3, and a top wall 4 and a pair of side walls 5. A bottom cover 6 held in place by foot pads 7 encloses the interior of the base 1. The rear wall 3 has an opening in which is inserted a grommet 8 that passes a two conductor cord 9. Protruding upwardly from the top wall 4 is a foot rest 10 and disposed to the side of the rest 10 is a vertically movable operating button 11.

The button 11 extends through a complementary opening in the top wall 4 to a level above the foot rest 10, when in an elevated position as shown in Figs. 1 and 3, and is depressable downwardly from such elevated position to within the base 1. As shown in Fig. 1, the operating button 11 has a base portion 12 housed at all times within the base 1 of a greater width than the upper protruding portion, to present a stop ledge 13 that limits the upward travel of the button 11 by engagement with the underside of the top wall 5. The base portion 12 is guided for vertical movement between a pair of spaced partitions 14 extending rearwardly from the front wall 2, that each present a vertical guiding tongue 15 adapted to fit within a complementary kerf 16 formed in the base portion 12. Another partition 17, closely spaced to the front of the base portion 12 of the button 11, extends between the partitions 14 to strengthen the same. At the back of the operating button 11, the stop ledge 13 extends rearwardly to overhang the base portion 12 to present a downwardly facing horizontal caming surface 18, that is shown in Figs. 1 and 2. The button 11 is recessed and open at the bottom to receive a compression spring 19 that bears at its lower end against the bottom cover 6 and urges the button 11 into the elevated position shown.

A bracket 20 that is secured to a ledge 21, alongside one of the partitions 14, presents a pivot pin 22 that carries a bell crank lever 23. The bell crank lever 23 includes an obliquely rising cam lever arm 24, of which one side has a cam-like contour that bears upwardly against the caming surface 18 of the operating button 11. Hence, depression of the button 11 will move the caming surface 18 downwardly against the cam-like contour of the arm 24 to cause a pivot of the bell crank lever 23. The bell crank lever 23 also includes a lever arm 25 that carries a pivot pin 26 at its outer end. The lever arm 25 is disposed at such an angle that a rotation of the bell crank lever 23 by a depression of the operating button 11 will cause the outer end of the lever arm 25 to move with a predominant component of direction that is horizontal, such that the vertical component of direction is only minor.

A formed porcelain insulator 27 is secured to the underside of the top wall 4 by a pair of mounting bolts 28. A first terminal 29 is secured at the underside of one end of the insulator 27 by means of a bolt 30 and one lead of the cord 9 is attached to the terminal 29 by means of a terminal screw 31. A plate 32 formed as an integral extension of the first terminal 29 extends along one side of the insulator 27 to support a contact disc 33 disposed within the mouth of a circular cylindrical opening 34 that extends through the entire length of the insulator 27, as clearly shown in Fig. 4. Extending from the disc 33 is a threaded stud 35 that passes through and is in threaded engagement with the plate 32. The stud 35 protrudes from the plate 32 to mount a lock nut 36. Thus, the position of the contact disc 33 is adjustable and upon adjustment it may be secured in place by bringing up the lock nut 36 tightly against the plate 32.

The plate 32 is also in threaded engagement with a low resistance shunt rod 37 that is secured in position by a second lock nut 38. The shunt rod 37 parallels the opening 34 and lies alongside the porcelain insulator 27 to present a contact end 39 positioned adjacent the entrance of the opening 34 opposite the mouth in which the disc 33 is disposed. To retain the contact end 39 in position the shunt rod 37 is extended through a guide 40 that is an integral part of the insulator 27 and to position the contact end 39 longitudinally with respect to the opening 34 the lock nut 38 is loosened and the rod 37 turned until the contact end 39 is in desired position. The nut 38 is then brought up tightly against the plate 32.

As shown in Fig. 4, a carbon button 41 is inserted in the entrance of the opening 34 adjacent the contact end 39 of the rod 37. This entrance of the opening 34 is of reduced diameter, and the button 41 is correspondingly necked to present a base portion 42 of a diameter greater than the mouth of the opening 34, to prohibit the button 41 from passing outwardly from the opening 34. A column of adjacent abutting thin carbon discs 43 is inserted in the opening 34 between the button 41 and the contact disc 33. The discs 43 are referred to as a carbon pile that presents an electrical path of variable resistance. The resistance varies inversely with compressive pressure applied to the ends of the pile, in well known manner. There is thus provided a stepless variable resistance that is ideal for speed control of sewing machine motors and the like.

A second terminal 44 is attached to the porcelain insulator 27 by means of a mounting bolt 45, and a terminal screw 46 secures one lead of the cord 9 to the terminal 44. The terminal 44 is provided with an integral wing 47 to which is affixed a stationary end of a deflectable leaf spring conductor 48. The leaf spring conductor 48 extends from its fixed end toward and across the protruding end of the carbon button 41 and has a notched deflectable end 49 to the side of the button 41 opposite that side on which the fixed end is disposed. When in its unflexed position the leaf spring conductor 48 is spaced from the end of the button 41, as shown in Fig. 2, and a contact member 50 is attached to the leaf spring conductor 48 to present a first contact 51 disposed for engagement with the end of the button 41 and a second contact 52 disposed for engagement with the contact end 39 of the shunt rod 37. In order to impart a deflection to the leaf spring conductor 48, to cause engagement of the contacts 51 and 52 with the button 41 and the rod 37, a link is pivoted at one end upon the pivot pin 26 of the bell crank lever arm 23 and is engaged at the opposite end with the notched end 49 of the leaf spring conductor 48. Movement of the bell crank lever arm 25 in response to a depression of the button 11 will cause a deflection of the leaf spring conductor 48 for contact engagement and application of compressive force to the carbon pile.

The controller, that has been described, may be inserted in the input circuit of a motor to be operated and provides a treadle control for governing motor speed. The sole of one's shoe is placed upon the foot rest 10 and the button 11 is depressed by a tilting motion of the foot. To initiate start of the motor, the operating button 11 is depressed and the bell crank lever 23 is rotated by the downward motion of the camming surface 18 against the cam lever arm 24. The bell crank lever arm 25 is rotated clockwise, as viewed in Fig. 1, with a predominant horizontal motion for the free end. The connecting link 53 imparts a horizontal deflecting movement to the leaf spring conductor 48, whereby the contact 51 of the contact member 50 is brought against the head of the carbon button 41. Upon closure of the contact 51 with the button 41 the motor circuit is closed and the motor will turn over. The circuit for the controller runs from the terminal 44 through the leaf spring conductor 48, the contact member 50, the carbon button and discs 41, 43, the contact disc 33 with stud 35, the plate 32 and the terminal 29. At initial closure of the contact 51 with the button 41 the endwise compression upon the carbon pile is at a minimum, thus the resistance in the motor circuit is a maximum and motor speed consequently will be at the minimum of the range of control. Continued depression of the button 11 will further deflect the leaf spring conductor 48 and increased compressive force from the conductor 48 will be applied through the contact member 50 to the carbon pile. Resistance is thereby decreased and motor speed increases. As deflection of the conductor 48 is continued the second contact 52 will close with the contact end 39 of the shunt rod 37, as shown in Fig. 4, to set up a low resistance circuit shunting the carbon pile that effectively removes the pile from the active motor circuit. Motor speed will now rise to maximum speed.

As operating pressure is removed from the button 11 the coil spring 19 will raise the button 11 to its upper position. The leaf spring conductor 48 will straighten and carry the link member 53 therewith to cause a rotation of the bell crank lever 23. The rotation of the bell crank lever 23 in response to the bias force of the leaf spring conductor 48 retains the cam arm 24 seated against the camming surface 18 of the button 11. Consequently, the controller will exhibit an immediate response to either a downward or upward movement of the button 11, and the necessary spring bias for the operating linkage that follows the motion of the operating button 11 is derived from the resilient leaf spring 48 that also provides the resiliency required for satisfactory engagement with the carbon pile.

The stroke of the deflectable end of the spring leaf conductor 48 between initial closure of the motor circuit and the shunting of the carbon pile is readily adjusted by positioning the contact disc 33 and the shunt rod 37, as hereinbefore described. This control of stroke gives a control of compressive force applied to the pile, and the stroke will remain nearly constant over a substantial period of usage. The retention of a constant stroke is enhanced by carrying both the contact 51 that engages with the carbon pile button 41, and the shorting contact 52 on the same member, namely, the leaf spring 48.

I claim:

1. In a variable resistance controller the combination comprising an insulating support, a carbon pile having a contact button at one end carried by said support exhibiting a change in resistance with variation in pressure applied thereto, a pair of terminals on said support, electrical connections between the end of said pile opposite the contact button and the first of said terminals, a low resistance shunt member extending alongside said pile electrically joined at one end to the first of said terminals and presenting a contact face at the opposite end which is adjacent the contact button of said pile, a resilient leaf spring fixed at one end to the second of said terminals to be stationary and extending toward and across the end of the pile opposite that end joined to the first of said terminals and terminating in a deflectable end movable longitudinally of the carbon pile whereby a movement of the deflectable end carries the resilient leaf against the end of the pile to compress the same, and contact means electrically connected to the second of said terminals forming a part of said resilient leaf moved therewith to first contact said carbon pile and to secondly contact the contact face of said low resistance shunt member upon a compression of said pile having occurred from a deflection of said resilient leaf.

2. In a variable resistance controller the combination

comprising an insulating support, a carbon pile having a contact button at one end to receive a compressive force carried by said support and exhibiting a change in resistance with variation in pressure applied thereto, a pair of terminals, connections between the end of said pile opposite the contact button and the first of said terminals, a low resistance shunt member electrically joined to the first of said terminals and presenting a contact face adjacent to said contact button, a flat leaf spring normally spaced longitudinally with respect to the carbon pile from said contact button deflectable toward and away from the button with a fixed end to one side of said contact button and a free end to the opposite side of the button whereby a deflecting movement of the free end longitudinally of the carbon pile carries the leaf spring against the end of the pile to contact and compress the same, said leaf spring including contact means engageable with said contact button and the contact face of said shunt member in electrical connection with the second of said terminals, and an operating member cooperatively engaged with the free end of said leaf spring displaceable to impart movement of the free end to carry the same toward the carbon pile and deflect the leaf spring for contacting engagement of said contact means with said carbon button and application of a compressive force upon the pile, whereby continued displacement of the operating member causes continued deflection of said leaf spring and engagement of said contact means with said contact face of said shunt member upon substantial compressive force having been applied to said pile.

3. In a variable resistance controller the combination comprising an insulating support having an opening extending therethrough, a carbon pile housed within said opening with a contact button extending from one end, a terminal plate alongside the end of said opening opposite that from which said buton extends, a contact disc attached to said plate extending within said opening for contacting engagement with said pile and adjustable in position for control of the location of the pile, a low resistance shunt rod adjustably secured at one end to said plate extending parallel to said pile and terminating in a contact face adjacent the end of said opening from which said contact button extends, a leaf spring fixed at one end extending transversely of said carbon pile across the contact button of the pile to be normally spaced therefrom and terminating in a deflectable end on the side of said button opposite that of the fixed end whereby movement of the deflectable end toward the carbon pile carries the leaf spring against the contact button of the pile to electrically contact and compress the same, and contact means forming a part of said resilient leaf moved therewith to contact said contact face of said shunt rod upon a compression of said pile having occurred from a movement of the deflectable end of said leaf spring bringing said leaf spring against the contact button of said pile.

4. In a variable resistance controller the combination comprising a base, an insulating support within said base, a carbon pile carried by said support, a resilient leaf fixed at one end and extending transversely of said carbon pile toward and across an end of the pile to terminate in a deflectable end whereby movement of the deflectable end longitudinally of the pile carries the resilient leaf against the pile to contact and compress the same, an operating button protruding from said base depressable for retraction into said base with a surface thereof immediately adjacent to said insulating support at a position medial the ends of the carbon pile and having a step to provide a gap therebetween and a camming ledge within said gap facing in the direction of travel of said button when depressed, a pivoted bell crank having a first arm extending within said gap for guided movement longitudinal to said pile and bearing against said ledge to cause rotation of said crank upon a depression of said button, said bell crank having a second arm with an extended end that is moved upon a pivot of said bell crank with a substantial component of direction that is normal to the surface of said resilient leaf, and a link pivoted to the extended end of said second arm of said bell crank cooperatively engaged with said resilient leaf to draw the leaf against said pile upon a depression of said button.

5. In a variable resistance controller the combination comprising a carbon pile including a plurality of conductive carbon discs stacked one against another that presents a contact button at one end, a resilient bendable cantilever leaf normally spaced from and extending across said contact button fixed at one end to one side of the button and deflectable at the opposite end to the opposite side of the button for movement longitudinally of said pile, said leaf including a first contact portion for engagement with said contact button of said carbon pile and a second contact portion carried at a point that is beyond said first contact portion toward the deflectable end of the leaf, a shunting member having an end adjacent said contact button in position to be engaged by said second contact portion of said leaf and electrically connected with the end of said pile opposite said contact button, and operating means cooperatively engaged with the deflectable end of said leaf adapted to deflect said leaf for bringing said first contact portion into engagement with said contact button and application of a compressive force to said pile, whereby continued deflection of said leaf bends the portion between the deflectable end and the engagement with said contact button to bring the second contact portion of the leaf into engagement with said shunting member.

6. In a variable resistance controller the combination comprising an insulating support with an opening therethrough; a carbon pile housed within said opening presenting a contact button at one end of the opening; a terminal plate alongside the end of the opening opposite said contact button which has a portion in contacting engagement with the end of said pile opposite said contact button; a stiff shunting member having a contact end adjacent said contact button and extending parallel to the pile with the opposite end electrically connected with said terminal plate, the connection with the terminal plate being a threaded connection whereby the position of the shunting member may be adjusted; a resilient bendable leaf normally spaced from both said contact button and said shunting member contact end adapted to be brought into engagement with each, and to electrically connect the button with the shunting member contact end; and operating means cooperatively engaged with the leaf adapted to move the leaf into contact with the button and to deflect the leaf to apply a force to the carbon pile, whereby continued deflection brings the leaf into contact with said shunting member contact end.

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