W. L. BOND

CURRENT REGULATING DEVICE

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Inventor
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His Attorney.
My invention relates to current regulating devices, more particularly to variable resistance devices such as rheostats and potentiometers, and has for its object the provision of a current regulating device having a varying resistance per linear unit whereby a tapered or non-uniform current control may be obtained.

My invention has particular application to rheostats and potentiometers such as are used in radio receivers wherein the resistance element or conductor is in an annular form and the resistance is increased or decreased by means of an angularly movable contact arm.

In general, the sound output from a radio receiver is controlled by means of a variable resistance in some part of the circuit, and the well-known wire wound rheostat is often employed. A disadvantage of the ordinary wire wound rheostat is that such a rheostat does not allow a control of sound volume which is uniform throughout the range of the rheostat. This is due to the fact that the resistance of the rheostat is ordinarily a linear function of the angle of movement of the contact arm, whereas the sound output is not always a linear function of the resistance. It is therefore desirable to use a rheostat, the resistance variation of which is other than a linear function of the movement of the contact arm so that the variation in sound volume may be substantially proportional to the movement of the contact arm.

In carrying out my invention I have provided a current regulating device utilizing a plurality of resistance elements having different degrees of resistance per linear unit, the resistance elements being held in overlapping, parallel, electrically contacting relation.

For a more complete understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 is a rear elevation of a rheostat embodying my invention; Fig. 2 is a side elevation in section taken along the lines 2—2 of Fig. 1 looking in the direction of the arrows, and Fig. 3 is a perspective view showing the parts of the rheostat in detached, unassembled relation.

Referring to the drawing, in carrying out my invention in one form I have provided a rheostat comprising a base member 10, on which is secured a high resistance element or conductor 11, having a substantially constant resistance per linear unit, and a low resistance element or conductor 12 in overlapping, contacting relation with a portion of the high resistance element for varying the effective resistance per linear unit thereof. It is preferred that the base member 10 be made of porcelain although any other suitable insulating material may be used. An operating shaft 13 passes through the base member 10 at approximately the center thereof, and to one end of the shaft 13 is attached a movable contact arm 14. Contact terminals 16, 16 and 17 are provided, being connected respectively to the ends of the high resistance element 11 and to the contact arm 14. The base member 10 is preferably formed in one piece and is provided with apertures 18 through which suitable bolts, not shown, may pass in order to secure the rheostat to a panel or instrument board.

The operating shaft 13 passes through and is rotatably mounted in a headed metallic bushing 18, held in place in an aperture 20 by a nut 21. The shaft 13 is prevented from longitudinal movement through the bushing 19 by a split ring 22 in engagement with the bushing. One end of the shaft 13 contains a central indentation and a transverse slot 23. As shown more clearly in Fig. 3, an aperture 24 in the contact arm 14 is of a size and shape such that the contact arm may be pushed over the end of the shaft 13 co-operating with the slot 23 and after assembling, the end of the shaft 13 is peened over, thus holding the contact arm 14 securely to the end of the operating shaft. The contact arm 14 has integral therewith small projections 25 and by the engaging of these projections with the enlarged end of the terminal 17, as shown in Fig. 2, an efficient wiping contact is obtained. The terminal 17 is secured to the base by means of a rivet 26.

The base member 10 is substantially circular in form but contains an indentation or groove 28 of predetermined length in its periphery extending, as shown, around ap-
proximately one-third of the periphery. The
groove 28 is of the proper shape and size to
hold the low resistance element 12.

The high resistance element 11 comprises
an insulating strip or core 29 about which is
wound a high resistance conductor 30. The
high resistance element is of substantially
circular shape and of a width slightly greater
than the width of the periphery of the base
10. The low resistance element 12 comprises
an insulating strip 31 about which is wound
a low resistance conductor 32. The strips 29
and 31 are preferably made of a phenolic
insulating material. While I have shown
the low resistance conductor 32 as being made
of a wire larger than the wire forming the
high resistance winding 30, I do not wish to
be limited to this particular arrangement
since the resistance element may take other
forms. For instance, the resistance element 12
might be wound with the same size or even
smaller wire than the resistance element 11
depending on the effective resistance desired.

The high resistance element 11 may be wound
either with bare wire or with insulated wire.
If insulated wire is used, the inside and the
exposed edge of the element 11 should be
cleaned of the insulation. The low resistance
element 12 is preferably wound with bare
wire.

The metallic terminals 15 and 16 are L-
shaped and one end of each terminal is cut as
shown in Fig. 3, forming two projections 33
and 34. The projection 33 contains a small
hole into which the end of the high resistance
conductor 30 is placed and preferably sol-
dered. Stop members 36 integral with the
terminal 17 act to stop or limit the angular
movement of the contact arm 14. One end of
the terminal 17 is enlarged and contains an
aperture 37 through which the shaft 13 passes,
the enlarged end of the terminal serving as a
bearing for the projections 25 on the contact
arm as described hereinbefore. The outer
ends of the terminals 15, 16 and 17 are cut
and bent as shown in Fig. 3 to facilitate the
soldering thereto of external connections.

In order to secure the various parts of my
device in position a metallic clamping member
38, substantially circular in shape and con-
taining extensions 39 and 40, is provided.
The extensions 39 and 40 contain apertures
through which a bolt 41 is placed and by
screwing this bolt into a nut 42 the member
38 is clamped securely around the high re-
sistance element 11, thus holding the low re-
sistance element 12 in the groove 28 between
the high resistance element 11 and the base
10. A flexible insulating strip 43 of approxi-
mately the same width as the clamping mem-
ber 38 is adapted to be placed between the
clamping member 38 and the high resistance
element 11.

In assembling the parts of my rheostat the
low resistance element 12 is placed in the
groove 28 of the base 10, after which the high
resistance element 11 is placed around the
periphery of the base member thus holding
the low resistance element 12 in place. The
terminals 15 and 16 will be clamped between
the high resistance element 11 and the base
10 in grooves 44 in the base 10 provided for
them. The insulating strip 43 and clamping
member 38 are then placed around the outside
of the high resistance element 11 and by
means of the bolt 41 the resistance elements 11
and 12 and the terminals 15 and 16 are thus
securely clamped in place. The projections
33 and 34 at the ends of the terminals 15
and 16 are then bent upwardly at right an-
gles against the right-hand surface of the base
10 as viewed in Fig. 2.

It will be observed that the winding 39
of the low resistance element 12 is held,
throughout the length of the low resistance
element, in parallel, electrically contacting
relation with the inside of approximately one-
third of the winding 30 forming the high
resistance element 11, the bare surfaces of
the two windings being pressed against each
other due to the clamping action of the ring
38. The groove 28 is of a width such that,
when the resistance elements are in posi-
tion, the outer edge of element 12 will be
placed inwardly from the contact-making
edge of the element 11, that is, the low re-
sistance element 12 will not be engaged by
the contact arm 14 as this arm moves over
and in contact with the high resistance ele-
ment 11.

Assuming that the contact arm 14 is moved
from starting position at a uniform rate in
a counter-clockwise direction, as viewing Fig.
1, the effective resistance between terminal 15
and terminal 17 will increase uniformly at
a certain rate until the end of the contact arm
passes the point at which the upper end of
the low resistance element 12 engages the
high resistance element 11. From this point
the resistance will also increase uniformly but
at a higher rate. This is due to the fact that
the two resistance elements are in parallel
throughout the length of the low resistance
element 12 and the effective resistance will
thus be lower than the high resistance of the
high resistance element alone.

While I have shown my current regulating
device with terminals at each end of the re-
sistance so that the device may be used as a
potentiometer, the device may obviously be
used as a rheostat by making connections
only to the terminals 16 and 17.

Certain features of the specific embodi-
ment of my invention disclosed are described
and claimed in a copending application of
Donald R. De Tar, Serial No. 294,777, filed
July 20, 1928, and assigned to the same as-
signee as this invention.

While I have described my invention as
embodied in concrete form and operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention to the above embodiment, but that various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

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

1. A rheostat comprising a main resistance element, a movable contact member cooperating therewith, and an auxiliary resistance element electrically connected substantially throughout its length in parallel with a portion of said main resistance element so as to vary the ratio of the change of resistance upon corresponding movement of said contact member over the different portions of said main resistance element.

2. A current regulating device comprising a plurality of resistance elements having different resistances per linear unit, means for holding one of said resistance elements substantially throughout its length in parallel, electrically contacting relation with a portion of the other, and means for including the different portions of said other resistance element in a circuit.

3. A rheostat comprising a pair of resistance elements, each of said elements comprising an insulating support and a resistance conductor wound on said support, means for holding one of said resistance elements substantially throughout its length in longitudinal electrical contacting engagement with a portion of the other, and means for progressively including the different portions of said other resistance element in a circuit.

4. A rheostat comprising a pair of resistance elements, each of said elements comprising an insulating support and a bare wire resistance conductor wound on said support, means for holding one of said resistance elements substantially throughout its length in longitudinal engagement with a portion of the other so as to bring the turns of the two elements in electrical contacting relation, and means for progressively including the different portions of said other resistance element in a circuit.

5. A current regulating device comprising an insulating base, a high resistance element mounted on said base, a movable contact member cooperating therewith, and a low resistance element mounted in contact substantially throughout its length in parallel, electrically contacting relation with a portion of said first mentioned element so as to vary the ratio of change of resistance upon movement of said contact member over the different portions of said high resistance element.

6. A current regulating device comprising