

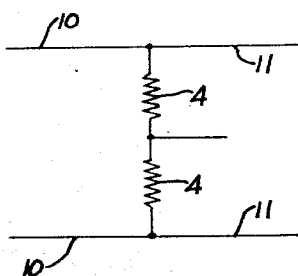
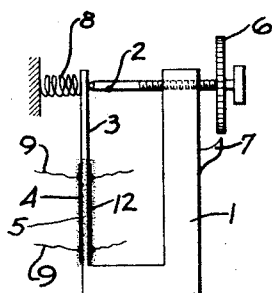
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RHEOSTAT

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RHEOSTAT

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4 Claims. (Cl. 201—48)

This invention relates generally to rheostats and more particularly to one in which a small change in resistance is desired, especially when it is necessary to know or measure a small change accurately. This application is a division of my copending application Serial No. 295,207, filed September 16, 1939.

Rheostats have heretofore been made in a great many forms and arrangements particularly in order to obtain gradual changes in resistance but these prior devices have been deficient in various respects such as involving variable contacts frequently in the form of sliding contacts. Moreover prior rheostats have been relatively expensive when sensitive type apparatus was attempted to be made particularly if such rheostats were to have a long life with great dependability and durability, as well as constancy of calibration such as stability of its zero reading as well as accuracy and sensitivity.

It is an object of my invention to provide an improved rheostat that is adapted to effect a gradual resistance change without a movable contact while at the same time maintaining a high degree of constancy of calibration, accuracy, sensitivity and ruggedness.

A further object is to provide an improved rheostat that is simple in construction, operation and maintenance and yet is able to vary its resistance along a continuous unbroken curve whose value will not fluctuate when an adjustment has been initially made.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawing in which:

Fig. 1 is a side elevation of one form of my improved rheostat; and

Fig. 2 is a diagrammatic line diagram showing the manner in which my rheostat may be embodied in a circuit.

My improved rheostat as disclosed herein for purposes of illustration employs a frame 1 carrying an adjustable screw 2 or equivalent means adapted to bend a flexible member 3 on which a strain sensitive filament 4 is mounted lengthwise in the direction of strain of said member during flexure thereof. This filament as disclosed in my said copending application is a fine metallic flexible wire generally about .001 to .003 of an inch in diameter whose electrical resistance varies in accordance with changes in strain with a substantial degree of linearity. This electrical strain sensitivity is well-known and practically all electrical conducting materials have this prop-

erty. Some materials that have been used are such as "Iso-elastic," "Advance" and "Nichrome" and others. The composition of such alloys are well-known in the art and may be found in metallurgical handbooks while the strain sensitivity factor of such materials may be either readily determined or found in the International critical tables.

A desired length of strain sensitive filament 4 is cemented vertically on one side of a flexible member 3 and the full effective length of the filament is bonded to member 3 by any suitable cement as indicated by the speckled area 5 surrounding the full length of the filament. Cements such as have been successfully used are shellac, "Duco household cement" and Bakelite cement.

By deflecting member 3 its strain is varied and the strain of filament 4 will be correspondingly varied thereby changing its resistance, this change in resistance being smooth and without interruption as well as being without sliding or variable contacts. To determine the extent of change of resistance screw 2 carries a dial 6 with suitable graduations on its periphery overlying a pointer 7. If desired, frame member 3 may be urged against a spring 8 thereby causing member 3 to follow the screw when the screw moves to the right beyond the neutral position of member 3. The resistance across suitable terminals 9 of the strain filament will be proportional to or directly related to the reading on dial 6 and hence the device will serve as a rheostat for relative small changes in the resistance filament 4. I have constructed a rheostat in accordance with the foregoing and produced and readily measured changes of its resistance as small as one part in ten million and as large as seven parts in one thousand by micrometer screw control. This was done without finding any hysteresis or creeping or zero changing regardless of whether the filament was acting in tension or compression or alternating from one to the other. Such a device is particularly suited for fine balancing of a Wheatstone bridge since it involves no contact difficulties.

To use the rheostat at a potentiometer, I connect two of the same in series as diagrammatically shown in Fig. 2 wherein the structure and the strain filaments 4, 4 are identical. A source of current is connected to terminals 10 and the output is taken from terminals 11. By varying the strain of either filament 4, 4 as through adjustment of their screw 2, it is possible to effect a usual potentiometer operation. However, a more

compact arrangement is to provide member 3 with a second strain filament 12 placed on the back side of frame member 3 whereby filament 12 receives a strain opposite to that of filament 4 during adjustment of screw 2. The filaments 4 and 12 are connected together in the same manner as the filaments 4, 4 of Fig. 2. Such a single unit multiple filament bending potentiometer has been successfully used as a bridge balancing medium, it having the advantage over the simple one-filament bending rheostat in that it gives a larger range for balancing and it is temperature compensated when the two filaments are connected as shown in Fig. 2.

Potentiometers as disclosed herein obviously may be used to balance automatically a bridge or an applied voltage change in the same manner as is commonly done in the art by various types of contact potentiometers, i. e., the potentiometer is connected to the moving or deflecting part of any usual recording system employing a servomechanism thereby forming a recording galvanometer or voltmeter as the case may be.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A rheostat comprising a member whose strain is adapted to be varied, means for varying the strain of said member, a continuous filament of solid material whose electrical resistance varies in accordance with changes in its strain and is adapted to be connected with a circuit in which it is desired to produce a variable rheostat resistance, and means for bonding said filament throughout its effective length to said member in the direction of strain thereof whereby variations in strain of said member effects an uninterrupted change of rheostat resistance of said filament along a continuous smooth line which is stable during either static or variable adjustments.

2. A bending rheostat comprising a flexible cantilever member, a continuous filament of solid material whose electrical resistance varies in response to changes in its strain and adapted to be

connected with a circuit in which it is desired to produce a variable rheostat resistance, and means for bonding said filament throughout its effective length to the surface of said flexible member in the direction of strain thereof whereby upon flexure of said member its strain is varied thereby to vary the resistance of said filament uninterruptedly to produce a change of rheostat resistance along a continuous smooth line.

3. A rheostat comprising in combination, a member having portions simultaneously subject to compression and tension strains, a pair of continuous filaments of solid material whose electrical resistance varies in accordance with changes in its strain and are adapted to be connected so that an increase in resistance in one filament and a decrease in resistance in the other filament will be cumulative in a circuit in which it is desired to produce a variable rheostat resistance, means for bonding said filaments throughout their effective lengths respectively on said compression and tension portions of said member whereby straining of said member simultaneously effects an increase of resistance in one filament and a decrease of resistance in the other to produce an uninterrupted change of rheostat resistance along a continuous smooth line.

4. A bending rheostat comprising a member adapted to be flexed so as to place one side thereof in tension and the other in compression, means for flexing said member, a pair of continuous filaments of solid material whose electrical resistance varies in accordance with strain thereof and are adapted to be connected so that an increase in resistance in one filament and a decrease in resistance in the other filament will be cumulative in a circuit in which it is desired to produce a variable rheostat resistance, and means for bonding said filaments throughout their effective lengths respectively to the opposite sides of said member in the direction of strain thereof whereby during flexure of said member the resistance of one of said filaments is increased and the resistance of the other is decreased to produce an uninterrupted change of rheostat resistance along a continuous smooth line.

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