Dec. 9, 1941. D. T. SIEGEL 2,265,821

PRECISION RESISTOR

Filed March 29, 1940

Fig. 1.

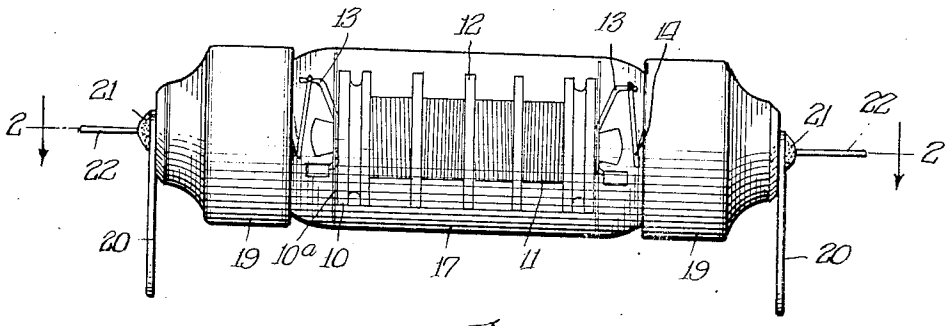


Fig. 2

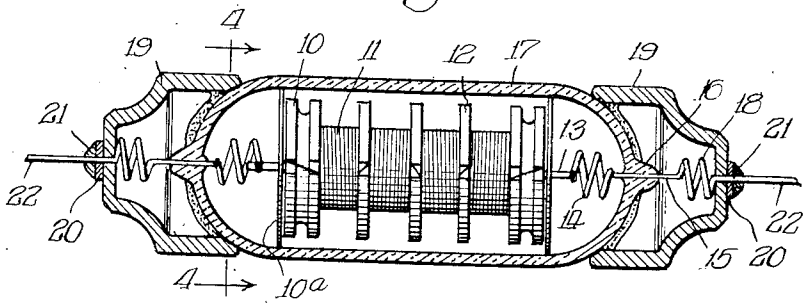


Fig. 3

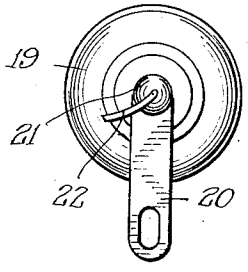
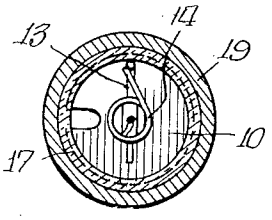


Fig. 4



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PRECISION RESISTOR

David T. Siegel, Chicago, Ill.

Application March 29, 1940, Serial No. 326,563

8 Claims. (Cl. 201—67)

My invention relates to resistors and particularly to a resistor that is hermetically sealed within a glass envelope.

For certain kinds of electrical work it is desirable to provide for relatively high precision of resistance, and experience has shown that much greater stability of resistance may be secured if the device is hermetically sealed within a glass or other impervious envelope. I have, therefore, in furtherance of this object, provided an accurately wound spool of resistance wire and confined the spool within and out of contact with a glass envelope provided for freedom of movement of the spool relative to the tube within which it is confined.

In addition I have provided caps for the respective ends of the glass tube to facilitate the support of terminals, and within the caps I likewise provide for limited relative movement that occurs following a change of temperature. By providing for such relative movement the possibility of breaking the seal between the glass envelope and the wire connector to the resistor is eliminated.

The invention will be more readily understood by reference to the accompanying drawing; in which,

Fig. 1 is a side elevation of a precision resistor such as contemplated;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1;

Fig. 3 is an end view; and,

Fig. 4 is a sectional view on the line 4—4 of Fig. 2.

In the construction shown I provide a spool 10, composed of a dielectric material, the resistance wire 11 being wound thereon in a desired length, the wire being wound in opposite directions between the separating discs 12. The wire is carried across the discs through notches formed therein and out of the ends of the spool through corresponding notches in the end members of the spool. Usually the resistance wire is very fine and the connection thereof to the terminals is made through a wire of much smaller diameter. Thus the terminal ends of the resistance wire are joined to supporting arms 13 to which are connected the supporting wires having coils 14 therein. This wire is of sufficient strength and rigidity to support the spool axially within the glass cylinder out of contact with the walls thereof. As a means for shielding the resistance wire from the high degree of heat that develops when the glass tube is sealed, I provide mica discs 10a at the ends of the spool, the discs fitting the inside diameter of the tube, but with sufficient clearance at the central point of engagement with the projections from the ends of the spool to permit of limited movement of the spool.

The wires have a straight portion 15 which passes through the sealing teats 16 of the glass envelope 17 at the respective ends of the envelope. The coil in the wire is provided for the purpose of taking up any relative movement between the glass cylinder and the spool that will occur during alternate heating and cooling of the unit, thus avoiding the possibility that the seal would be broken at the point where the wires pass through the glass walls.

The projecting connector wires are coiled outside of the ends of the tube, as at 18, and enclosed within caps 19 which are secured to the ends of the glass envelope by a suitable adhesive, as best shown in Fig. 2. A straight portion of the wires outside of the coil 18 is projected through the end walls of the caps, the coil abutting the end walls, and terminal pieces 20 are threaded over the wires and held firmly in place by means of a drop of solder 21 which joins the wire and the strip and firmly holds the strip in position, this for the reason that the wire cannot move outwardly through the cap. If desired, the glass envelope may be air evacuated, although this is not recommended if the best results are to be expected. In the manufacture of the lower resistance precision resistors, it is at times advisable to adjust the resistance to the extreme accuracy required, by adding a fraction of an inch of resistance wire on the outside of the unit. This can be accomplished by making the portion of wire represented by the coil 18 of resistance wire, the length being determined by the test following the sealing of the unit.

The coil within the cap provides for any relative movement between the cap and the glass cylinder and there will be, therefore, no expansion strains exerted that will tend to dislodge the caps from the cylinder. It will be understood that the character of the winding may be varied as required; that is to say, the winding may be in the form of two wires wound in parallel and in opposite directions, rather than the single wire wound as shown in the drawing.

The resistor constructed as described will be found to be of relatively high precision, will be substantially non-inductive, may be constructed with comparative economy and will adapt itself to the many uses to which such resistors are put.

I claim:

1. In a resistor, the combination of a spool carrying resistance wire, connector wires formed in a coil and joined to the terminal ends of said resistance wire, a glass envelope within which said spool and the coiled portion of said connector wires are hermetically sealed, caps secured to the ends of said envelope, said connector wires being coiled within the cap and projecting therethrough and terminals secured to the wires and fixed to said caps.

2. In combination, a spool and resistance wire wound thereon, connectors for the terminal ends of said resistor wire, a glass envelope within which said spool is hermetically sealed, said spool being supported within the envelope out of contact with the envelope, straight portions of said connector wires projecting through the walls of the glass envelope and being coiled outside of the envelope, caps overlying the ends of the envelope and cemented thereto and enclosing the exterior coiled portions of said connector wires, and means providing an electric connection with said connector wires.

3. In a resistor, the combination of a spool carrying resistance wire, connector wires formed in a coil and joined to the terminal ends of said resistance wire, a glass envelope within which said spool and the coiled portion of said connector wires are hermetically sealed, caps secured to the ends of said envelope, said connector wires being coiled within the cap and projecting therethrough, one or more of said connector wires being composed of resistance material.

4. In a precision resistor, the combination of a spool having turns of wire wound thereon, wire connectors for the terminal ends of said resistance wire, an air-impervious cylinder within which said spool is sealed, the connector wires for said resistance wire between the spool and the ends of the cylinder being of excess length and so disposed as to permit of limited relative longitudinal movement between the spool and cylinder, said connector wires passing through the end walls of the cylinder and being sealed therein, a dielectric cap secured to the end of the cylinder and within which one of the connector wires is sealed and a terminal carried by said cap and connected to the wire.

5. In combination, a glass envelope, a spool of resistance wire hermetically sealed within said envelope, said wire being of such degree of fineness as to be incapable of self-support, connector wires projecting through the walls of the envelope, said connector wires being of sufficient rigidity and acting to support the spool and its contained resistance wire in a substantially centered position within the envelope, and having sufficient excess length so disposed as to permit of limited relative longitudinal movement between the spool and the envelope.

6. In combination, a glass envelope, a spool of resistance wire hermetically sealed within said envelope, connector wires projecting through the walls of the envelope, said connector wires being of sufficient rigidity and acting to support the spool and its contained resistance wire in a substantially centered position within the envelope, and having sufficient excess length so disposed as to permit of limited relative longitudinal movement between the spool and the envelope, and heat insulating discs mounted at the ends of said spool, said discs substantially fitting the glass envelope and being axially apertured whereby to permit freedom of movement of the spool.

7. In combination, a glass envelope, a spool of resistance wire within said envelope said wire being of such degree of fineness as to be incapable of self-support, the diameter of the spool being substantially less than the inside diameter of the envelope, connector wires projecting through and sealed in the end walls of the envelope and composed of wire of sufficient rigidity and acting to resiliently support the spool in spaced relation from the walls of the envelope, at least one of said wires being coiled to permit of relative movement between the envelope and spool, caps sealed to the respective ends of the envelope, said connector wires being coiled within the caps and projecting therethrough.

8. In combination, a glass envelope, a spool of resistance wire within said envelope, the diameter of the spool being substantially less than the inside diameter of the envelope, connector wires projecting through and sealed in the end walls of the envelope and composed of wire of sufficient rigidity and acting to resiliently support the spool in spaced relation from the walls of the envelope, at least one of said wires being coiled to permit of relative movement between the envelope and spool, caps sealed to the respective ends of the envelope, said connector wires being coiled within the cap and projecting therethrough, and mica discs at the respective ends of the spool, said discs having an axial opening of sufficient size to permit limited radial movement of the spool and connector wires, said discs serving as heat insulators during the process of sealing the envelope.

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