June 23, 1953 F. A. GLASSOW 2,643,316

RESISTANCE UNIT

Filed Oct. 11, 1951

Fig. 1.

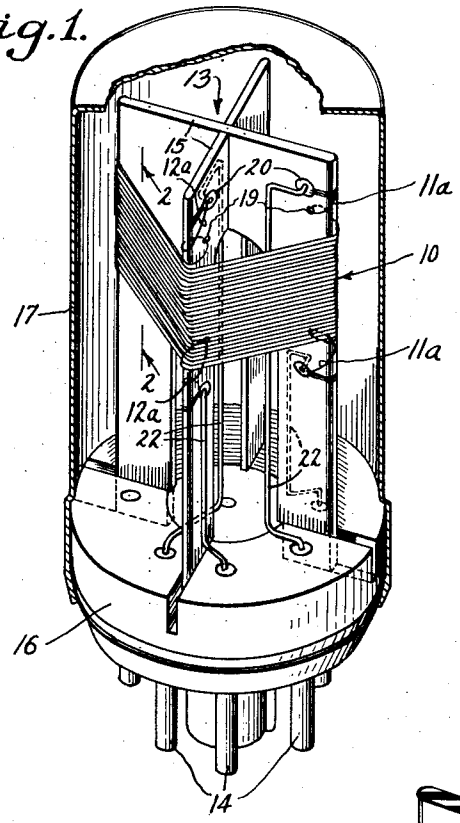


Fig. 2.

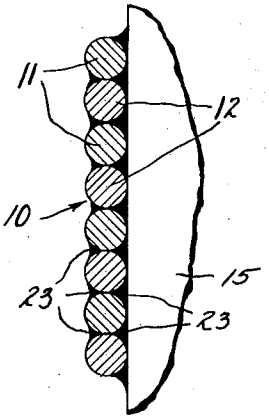


Fig. 3.

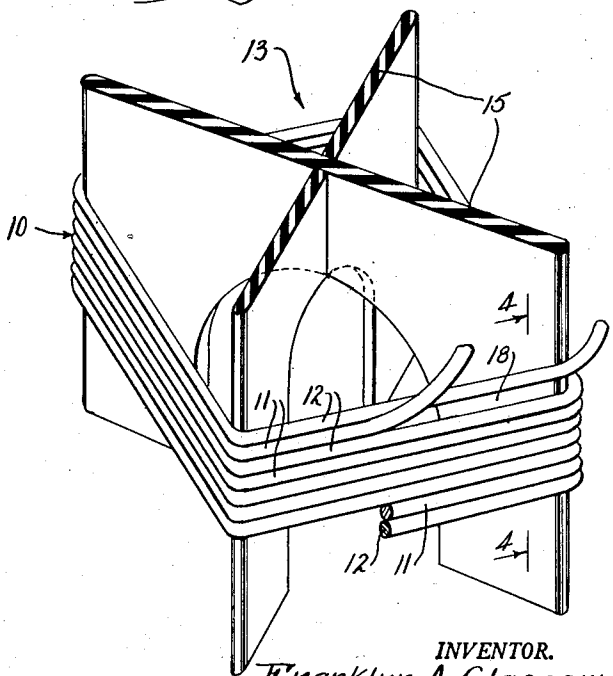
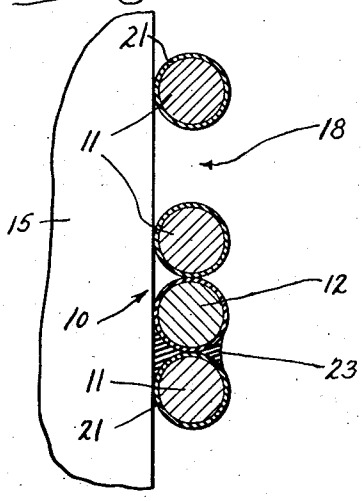


Fig. 4.



INVENTOR.
Franklyn A. Glassow
BY
Carlson, Pitzner, Hubbard & Wolfe
ATTORNEYS

Patented June 23, 1953 2,643,316

UNITED STATES PATENT OFFICE

2,643,316

RESISTANCE UNIT

Franklyn A. Glassow, Rockford, Ill., assignor to Barber-Colman Company, Rockford, Ill., a corporation of Illinois

Application October 11, 1951, Serial No. 250,927

1 Claim. (Cl. 201—63)

1

This invention relates to resistance units of the type used in measuring and control circuits and comprising one wire whose resistance varies with ambient temperature changes and another wire serving as a heater to alter the temperature of the first wire.

The general object is to provide a resistance unit of the above character which is much more sensitive than prior units, which is extremely rugged in construction when made of fine wire, and which is simple and economical to construct.

A more detailed object is to provide a unit of the above character in which each wire is disposed in intimate side by side heat exchanging contact with the other wire throughout the lengths of the two wires.

Another object is to form each wire into a helix with each turn of one wire lying in the channel formed between the adjacent turns of the other wire.

The invention also resides in the novel manner of supporting the two helical coils and in binding the same to their support.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of a tube incorporating the novel compound resistance of the present invention, the envelope being broken away to show the manner in which the resistance is mounted.

Fig. 2 is an enlarged sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary perspective view of the compound resistance.

Fig. 4 is a magnified sectional view taken along the line 4—4 of Fig. 3.

The improved resistance unit shown in the drawings and indicated by the numeral 10 comprises generally a temperature sensitive wire 11 and a heater wire 12 both of substantial length and mounted on a common support 13 having insulated terminals 14 thereon connected to the four ends of the wires. To provide large surface areas, the wires are very fine, being only a few thousandths of an inch in diameter. At least one and preferably both of the wires are covered by a coating 21 of electrical insulating enamel or varnish which is also very thin, for example, .00015 of an inch and is a relatively good heat conductor. The heater element 12 may be a so-called nichrome alloy while the wire 11 may be composed of metal sold under the trade name of Balco and having a resistance which

2

changes appreciably with variations in ambient temperature.

For purposes to appear later, the support 13 is of special construction comprising a plurality of angularly spaced radially disposed plates 15 rigid with each other and upstanding from the terminal base 16. If desired, the support with the resistance unit 10 thereon may be enclosed by a casing 17 also mounted on the base 16.

To provide for extremely rapid heat transfer between the two wire elements 11 and 12, the invention contemplates arranging the two wires on the support 13 in side by side contacting relation substantially throughout their lengths with each part of one wire disposed in a groove or channel 18 formed between two portions of the other wire. To this end, each of the wires is wound helically around the support so that the adjacent turns of the coil form the groove for receiving the other wire. Herein, the adjacent turns are spaced apart axially just far enough to receive the other wire, the channel 18 thus being defined by the opposed sides of the wires of adjacent turns. In the double helix thus formed, the adjacent surfaces of the two wires are separated from each other only by the enamel coatings 21 and, as a consequence, are disposed close together and in intimate heat exchanging relation throughout the full length of the coil.

Arrangement of the two wires in this manner is facilitated by laying the wires side by side and in contact with each other and holding the same under tension while they are being wound around the support 13. In such winding, the wires bend around the outer rounded edges of the plates 15, but such bending is not sufficient to break the enamel coatings. At opposite ends of the multiple turn helix thus formed, the end portions 11^a and 12^a of the two wires are separated and bent inwardly across the faces of the plates 15 and then threaded through holes 19 in the plates. Finally, the free ends of the wires are bared and soldered to buttons 20 which may be joined to the corresponding terminals 14 by conductors 22 extended along the plates and into the base 16. With such an arrangement, the two wires contact each other along their entire lengths and the resistance of the temperature sensitive wire 11 responds quickly to heat emitted by the heater wire 12 meeting the need in control circuits of high sensitivity.

To anchor the wires 11 and 12 firmly on the support and to further facilitate the exchange of heat between them, a coating 23 (Fig. 4) covers both sides of the double helical coil. This coat-

ing may best be applied in liquid form and may comprise enamel, silicone varnish, or the like. Each turn of the heater wire is thus secured firmly to the two adjacent turns of the temperature responsive wire forming a unitary relatively rigid tubular structure which is locked firmly onto the support **13**. The wires are thereby prevented from slipping on the support **13** and the intimate association of the wires is maintained during handling and usage of the device. The angular spacing of the plates leaves both sides of the double helical coil exposed enabling the latter to be coated on both sides. It will be observed that the coating **23** extends into the crevices between the wires only up to the points at which the insulating coatings **21** of the two wires contact each other without separating the wires. As a result, the distance between the wires is kept at a minimum as determined by the thickness of the insulating coatings **21**. Since the enamel used for the additional coating **23** is a good heat conductor, it also serves to transfer heat from the heater wire **12** to the temperature sensitive wire **11** increasing the sensitivity of the latter to temperature changes caused by the heater wire.

It will be apparent that a resistance unit of the above construction is extremely sensitive to the temperature changes effected by the heater wire **12**. By winding the two wires **11** and **12** in intimate heat exchanging relation throughout their lengths with each turn of the heater wire

closely associated with two turns of the temperature sensitive wire, the resistance of the latter will be changed quickly in response to a change in the temperature of the heater wire resulting from a variation in the flow of current therethrough. The angularly spaced plates **15** of the support **13** permit both sides of the double helical coil to receive a coating **23** to bind the turns of the wires together and to provide better heat transfer between the wires.

I claim as my invention:

The combination of, a heater wire, a second wire whose resistance varies with ambient temperature changes, at least one of said wires comprising a metallic conductor surrounded by a thin coating of electrical insulation thereon, and a support, said wires being wound helically around said support and lying side by side in mechanical contact substantially throughout their lengths to permit the rapid transfer of heat from each part of said heater wire to the two adjacent parts of said second wire.

FRANKLYN A. GLASSOW.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,841,332	Kranz	Jan. 12, 1932
1,902,427	Sawyer	Mar. 21, 1933
2,031,480	Hamada	Feb. 18, 1936
2,359,278	Allan et al.	Oct. 3, 1944