No. 895,857. PATENTED AUG. 11, 1908.

J. L. R. HAYDEN.

RESISTANCE UNIT.

APPLICATION FILED MAR. 29, 1907.

Fig. 1.

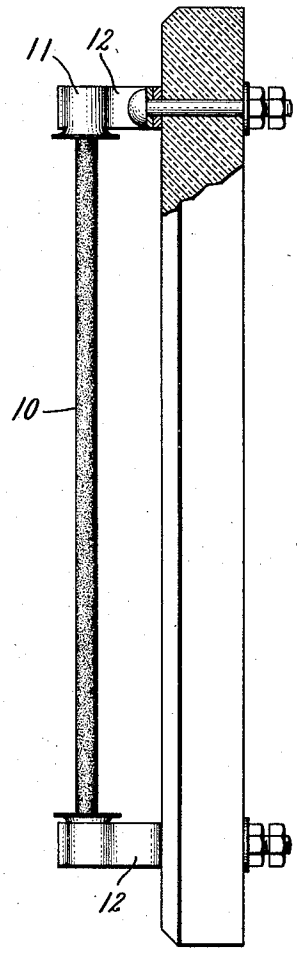


Fig. 2.

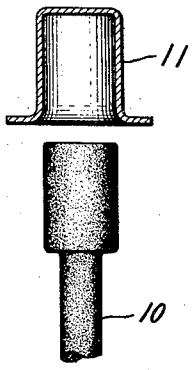
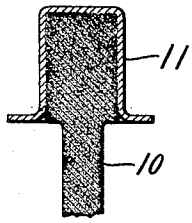


Fig. 3.



Witnesses:

George H. Tilden.

J. Ellis Glen.

Inventor:

Joseph L.R. Hayden,

by Albert B. Davis

Att'y.

UNITED STATES PATENT OFFICE.

JOSEPH L. R. HAYDEN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RESISTANCE UNIT.

No. 895,857. Specification of Letters Patent. Patented Aug. 11, 1908.

Application filed March 29, 1907. Serial No. 365,301.

To all whom it may concern:

Be it known that I, JOSEPH L. R. HAYDEN, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Resistance Units, of which the following is a specification.

This invention relates to resistance units for electric circuits and the process of forming the same, and has for its object the provision of an inexpensive unit which will have a high resistance, stand a high temperature without injury, and which may be connected in circuit in a reliable and efficient manner.

My invention relates more specifically to the forming of terminals on resistances of the type known as stick resistance.

Many types of stick resistance have been proposed and used, the most successful of which is silicon. This resistance, especially in its cast form, has been found almost ideal for many uses especially where a large amount of energy is to be dissipated. One of the greatest difficulties, however, with the cast silicon rod has been the formation of proper conducting terminals. The silicon rods are often operated at a high temperature, and the difficulty with the terminals has been that they either could not stand the temperature, or the different coefficients of expansion of the terminal and the silicon would cause an imperfect joint. I have found that a very efficient and inexpensive terminal for silicon rods may be made by causing the metal to unite or weld with the silicon so as to form an autogenic union between them. I have found that an exceedingly efficient terminal may be formed by applying an iron terminal to the rod and then raising the temperature until there is a chemical reaction between the iron and the silicon whereby ferro-silicon is produced. The heating may be accomplished in many ways, one of which is to pass an electric current through the rod so as to heat the same at the terminal.

Referring to the drawing, in which I have shown one form of my invention, Figure 1 is an elevation partly in section of my improved resistance unit mounted upon an insulating base; Fig. 2 is a view of the rod and terminal, the latter being in section; and Fig. 3 is a sectional view of the rod with the terminal applied.

Referring to the drawing, 10 is a stick or rod of resistance material, preferably cast silicon, having enlarged ends adapted to receive the conducting terminal. For purpose of illustration, I have shown this terminal in the form of a cap 11 which may be of any conducting metal, although I have found that iron serves the purpose very well. The cap is spun from sheet metal of a size large enough to fit easily over the enlarged end of the rod. The temperature is then raised to a very bright or nearly white red heat. This may be done by passing a current of sufficient density to give the heat required, through the rod which is set in conducting clips 12 so that the current will pass from the clip to the terminal thence through the rod to the clip and terminal on the opposite end.

The high temperature causes the silicon and iron to chemically combine without either the iron or the silicon melting, *i. e.*, there is no fusing together of the metals. In this case, the elements combine to form ferro-silicon which binds the elements together in a perfect joint. In this way the rod and the terminal are autogenically united by a chemical union, and the joint will stand at least a bright red heat without injury and it will not be impaired by differences in coefficients of expansion. I find the best results are obtained when the iron caps are not perfectly clean or free from oxid, as the latter acts after the manner of a flux in facilitating the union. Resistance sticks having terminals of this character may be easily adapted for use in electric circuits, lightning arresters and the like by simply placing them in clips which are preferably yielding so as to allow expansion and contraction of the rod.

It is understood, of course, that various modifications of the invention above described 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. An electrical resistance comprising a cast silicon rod having an iron terminal in intimate conducting relation thereto.

2. An electrical resistance composed of silicon having an iron conducting terminal autogenically connected thereto.

3. An electrical resistance composed of cast silicon having an iron conducting terminal welded thereto.

4. An electrical resistance comprising a cast silicon rod having an iron cap welded thereto.

5. An electrical resistance composed of silicon having a metallic terminal chemically united thereto.

6. An electrical resistance composed of cast silicon having a metallic terminal chemically united thereto.

7. An electrical resistance composed of cast silicon having an iron terminal chemically united thereto.

8. An electrical resistance comprising a silicon rod, a metallic terminal thereon and a chemical compound of the silicon and the metal forming a joint between the rod and the terminal.

9. An electrical resistance comprising a silicon rod and an iron terminal secured thereto by a joint of ferro-silicon.

10. An electrical resistance comprising a silicon rod having an iron cap secured thereto by welding the two elements.

11. An electrical resistance comprising a silicon rod having a metallic cap secured thereto by chemically uniting the two elements.

12. The process of forming a metallic terminal on a silicon rod, which consists in heating the metal in contact with the silicon until there is a chemical action between the elements.

13. The process of securing a conducting terminal to cast silicon which consists in heating the same in contact with each other until they are chemically united.

14. The process of securing an iron terminal to a silicon rod, which consists in heating the same in contact with each other until a compound of iron and silicon is formed.

15. The process of securing a metallic terminal to a silicon rod, which consists in applying the terminal to the rod and passing a current through the joint to heat the same until a chemical reaction takes place.

16. The process of securing an iron terminal to a silicon rod, which consists in applying the terminal to the rod and passing a current through the joint until ferro-silicon is formed between the elements.

In witness whereof, I have hereunto set my hand this 28th day of March, 1907.

JOSEPH L. R. HAYDEN.

Witnesses:

HELEN ORFORD,

MARGARET E. WOOLLEY.