Nov. 24, 1959 W. GRATTIDGE 2,914,640

ELECTRICAL CONTACTS

Filed Oct. 25, 1956

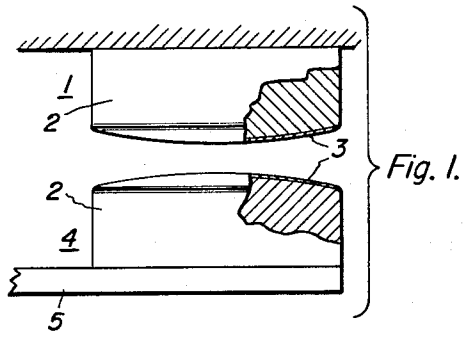


Fig. 1.

Fig 2

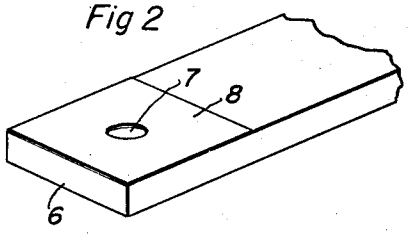


Fig 3

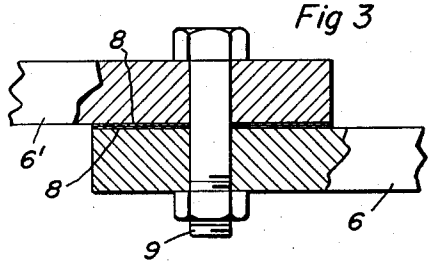
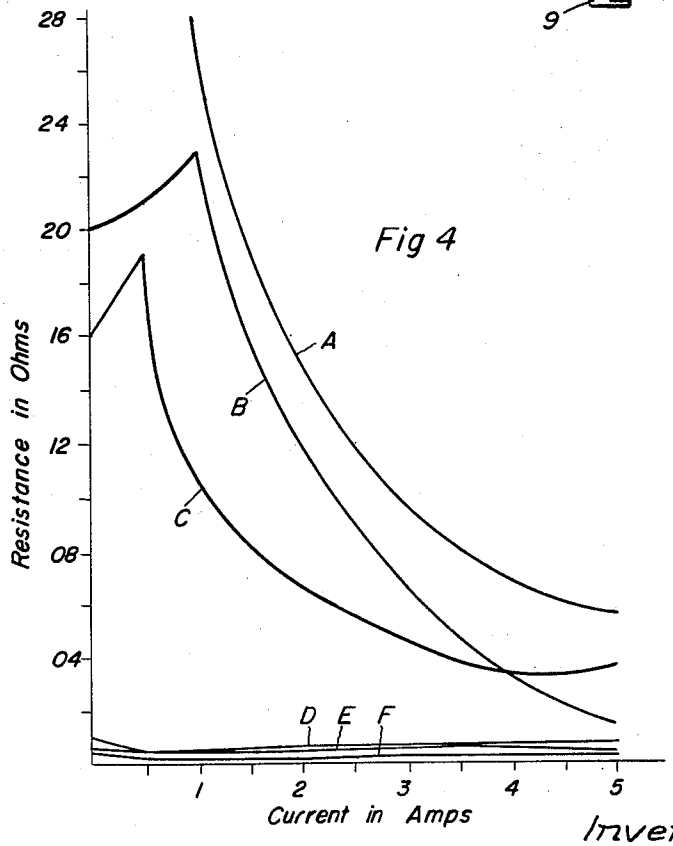


Fig 4



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ELECTRICAL CONTACTS

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3 Claims. (Cl. 200—166)

The present invention relates to electrical contacts, more particularly to an improved composite body type of contact, particularly suitable for use in relatively movable or arcing contact installations.

Tungsten is a widely used electrical contact material and is hard, refractory and reasonably resistant to pitting and build-up of metal as a result of arcing. Pure tungsten contacts, however, possess relatively high electrical resistance at low current densities and, in addition, this resistance at low current densities may be quite erratic. In the prior art this disadvantage of tungsten has been overcome to some extent by the use of a silver coating over the tungsten. However, silver itself has some disadvantages. It is not as good mechanically as tungsten and is less refractory. Also, surface oxides and contaminations from the atmosphere or surroundings which are built up on the silver during use tend to modify its characteristics and make it less satisfactory.

In accordance with my invention, I provide contacts having mating surfaces of rhenium by providing a surface of rhenium over a backing of tungsten. The resulting contacts offer characteristics, as far as resistance goes, similar to those of silver but exhibit mechanical and refractory properties more nearly like those of tungsten. Rhenium is a refractory metal similar in some respects to tungsten but its oxide which forms on the deposited layer during use has resistance approaching that of silver. Rhenium-surfaced contacts are also very resistant to corrosion either when used in air or immersed in a dielectric liquid. Accordingly, the resulting contact offers advantages over either the pure tungsten or silver coated contacts. Further objects and advantages which characterize my invention in addition to those already discussed will become apparent as the following description proceeds, reference being had to the accompanying drawing in which:

Fig. 1 is an elevational view, partially broken away, of a pair of relatively movable contacts shown in open position;

Fig. 2 illustrates a perspective view of a bus-bar or similar conductor embodying my invention;

Fig. 3 is an elevational view, partially in section, showing two bus-bars of the type illustrated in Fig. 2 bolted together to form a bus-bar connection, and

Fig. 4 illustrates resistance-versus-current characteristics of tungsten and rhenium coated tungsten.

Fig. 1 of the drawing shows my invention embodied in a pair of relatively movable contacts such as may be employed in a switch or circuit breaker. The fixed contact 1 includes a supporting body 2 which may be of any suitable conducting material but which is preferably of tungsten. The rounded contacting surface of the contact consists of a film 3 of electroplated rhenium. The movable contact 4 is of like construction and is supported from a movable contact arm 5. Corresponding parts of the fixed and movable contacts are designated by the same reference numerals.

While the rhenium may be applied in accordance with any suitable known method, I have found that an electroplating bath operated at 70° C. and including ammonium perrhenate in a water solution and acidified to a desired pH with sulfuric acid provides a satisfactory plating solution. The electrode material, such as the tungsten to be plated, is made the negative electrode while the positive electrode is of platinum. Any portion of the negative electrode which it is desired not to plate may be coated with a protective coating of a nonconducting material such as a suitable grease. Plating may be carried on with a current density of about 10 amperes per square decimeter of the negative electrode to be coated and for a time dependent upon the desired thickness. A desirable thickness for contact operation is in the order of .3 to .6 of a mil and such a thickness may be deposited in a period of about an hour under the conditions outlined above.

After the plating is complete, the coating may be stabilized by firing in hydrogen at a temperature of 950 to 1000° C. for a period of ten or fifteen minutes. The film thus applied and fired tends to become very slightly oxidized as it is exposed to the atmosphere. However, the oxide of rhenium formed has very good surface characteristics for contact material as its resistance is comparable to that of silver.

The resistance characteristics of a rhenium-coated contact prepared in accordance with the above example as compared with tungsten are illustrated in Fig. 4. The contact area utilized in compiling the data on which these curves are based was about .114 square centimeters so that the current of 5 amperes maximum represents a current density of about 43.8 amperes per square centimeter. Curves A, B and C represent the characteristics for three different tungsten contacts. It will be noted that the resistance values for the low current densities are both high and erratic. Curves D, E and F show similar curves for rhenium-plated tungsten and the resistance of these contacts is low and remains substantially constant down to the lowest current densities. This resistance characteristic coupled with the very desirable mechanical and refractory characteristics of rhenium combine to make the rhenium-coated contact exceptionally effective, particularly as an arcing contact.

In the foregoing specific example, tungsten has been described as the base metal for the contact and tungsten is preferred. However, for some applications copper or even steel are also suitable base materials and the advantages of the rhenium contact may be obtained in plating these materials also.

The advantages of rhenium are maximum in connection with relatively movable or arcing contacts but it may also be used to advantage in connection with stationary contacts. I have illustrated in Figs. 2 and 3 an embodiment of my invention relating to bus-bars. Fig. 2 is a perspective view of a bus-bar 6 of rectangular cross section and preferably formed of copper. The end portion of the bar is provided with an opening 7 for receiving a clamping bolt and the surface area surrounding this opening is, in accordance with the present invention, plated with a rhenium film designated by the numeral 8. This film has the properties previously described and makes a very good composite bus-bar structure for the end or joint area of the bar. In Fig. 3, two bars 6 and 6' are shown bolted together by a suitable clamping bolt 9, with the coated areas 8 in contact.

While I have described a particular embodiment of my invention, it will be apparent to those skilled in the art that changes and modifications may be made without departing from my invention in its broader aspects and I aim, therefore, in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

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

1. Mating electrical contacts of the relatively movable arcing type, each comprising a body of tungsten and a contacting surface consisting of an electroplated film of rhenium.

2. Mating electrical contacts of the relatively movable arcing type, each comprising a contacting surface coating consisting of rhenium formed on a body of metal other than rhenium.

3. An electrical contact comprising a contact surface

coating consisting of rhenium formed on a body of metal other than rhenium for engaging the contact surface coating of a similar contact.

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