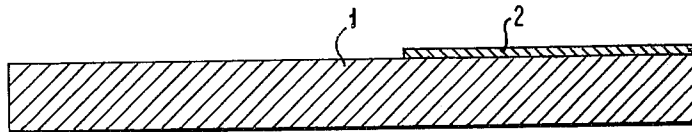


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LOW CURRENT ELECTRICAL CONTACT COMPRISING A
LAYER OF IRON-NICKEL ALLOY
AND A LAYER OF RUTHENIUM
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LOW CURRENT ELECTRICAL CONTACT COMPRISING A LAYER OF IRON-NICKEL ALLOY AND A LAYER OF RUTHENIUM

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2 Claims

ABSTRACT OF THE DISCLOSURE

Ruthenium (Ru) is vapor deposited directly on a springy magnetic contact carrier of iron-nickel alloy, at pressures of less than 10^{-1} , and preferably less than 10^{-4} , mm. Hg to form adjacent crystal columns extending in a direction essentially perpendicular to the surface of the contact carrier facing the ruthenium contact layer.

The present invention relates to electrical contacts and more particularly to electrical contacts for low current adapted to be encapsulated in a glass, or other carrier filled with a protective gas.

Low current relay contacts are used in large quantities in telephone, electronic controls, computers and similar electronic applications.

Low power contacts must have low contact resistance which does not change over the life of the relay contact element. The life of such contacts must be at least one hundred million operations (10^8). It is difficult to find contact materials which meet these requirements. Usual low current relay contacts consist of two components—a contact carrier and an actual contact layer. Magnetically operated electronic relay contacts utilize contact carriers of magnetic material, for example, resilient, springy carriers formed of an iron-nickel alloy. In certain applications, pole faces, or pole shoes of soft iron may serve as the contact carrier. The contact layer itself usually is a noble metal or a noble metal alloy, in order to prevent undesired reaction of the contact elements with the components of the inert gas filling the encapsulating space. Reaction products of the contact material with the protective gas increase the electrical resistance of the contact layer and contribute to arcing during switching, which rapidly destroys the contacting layer.

It has previously been proposed to utilize ruthenium contact layers in electrical wiping contacts. Ruthenium is precipitated on the contact carrier from an electrolytic solution. Galvanically precipitated ruthenium contact layers, however, are non-homogeneous and contain impurities. The contact layer is porous, and the pores of the ruthenium retain remnants of the electrolytic solution. Electrical resistance of such ruthenium contacts made by galvanic deposition is usually higher than that of compact ruthenium itself. The impurities and contaminants, as well as remnants of electrolytes in the contacting layer contribute to arcing during switching, so that contacts utilizing ruthenium are rapidly destroyed.

It is an object of the present invention to provide a low current relay contact, particularly for use in an inert, protective gas atmosphere, which has low contact resistance, high life, and is suitable for use with an extremely high number of switching cycles, for example in the hundreds of millions.

Subject matter of the present invention:

Briefly, ruthenium is vapor deposited on a contact carrier, for example of an iron-nickel alloy, at pressures of 10^{-1} mm. mercury, or less, to form a layer of from 1 to 30μ . The contact layer is formed to have adjacently located ruthenium crystal columns extending essentially perpendicular to the surface of the contact carrier, facing the contact layer.

It has been found, surprisingly, that a contact having ruthenium crystals extending in perpendicular direction, and directly deposited in a vapor phase at the low pressure of 10^{-1} mm. mercury, or even less than 10^{-4} mm. mercury are highly resistant to abrasion, so that the unavoidable wear due to sliding, or wiping is avoided. Additionally, and entirely unexpectedly, it has been found that surface adhesion and cold welding which is a problem with particularly pure metals, such as platinum or palladium could not be observed when the contacts have the above described characteristics, although ruthenium belongs to the group of the platinum metals. The electrical power threshold causing welding of the contacts, or adhesion in excess of the restoring force of the resilient contact carrier material is substantially higher in the ruthenium contact layers having the above referred to characteristics. Experiments have shown that the contacts will become soft only at substantially higher current densities than contacts utilizing other contacting layers. The contact in accordance with the present invention had the surprising and unusual characteristics of being capable of high current densities, in comparison to known contacts of similar size, with extremely high switching cycles, while retaining an in-varying, and low contact resistance throughout the life of hundreds of millions of switching cycles.

The single drawing illustrates, schematically, a contact in accordance with the present invention.

A contact carrier 1, for example of resilient, magnetic material, such as an iron-nickel alloy, has a contact layer 2 applied thereto. Contact layer 2 has a thickness of from about 1 to 30μ , and is a homogeneous layer of ruthenium, directly deposited on the contact carrier 1 by condensation by vapor deposition at a vacuum of 10^{-1} mm. mercury, or less, preferably at a very high vacuum of even less than 10^{-4} mm. mercury. The resultant contact layer 2 then will have essentially parallel crystal columns, extending in a direction perpendicular to the surface of contact carrier 1 facing layer 2.

We claim:

1. Low current electrical contact comprising (i) a contact carrier, said contact carrier comprising a resilient magnetic iron-nickel alloy; and (ii) a contact layer which comprises homogeneous, vapor deposited ruthenium of a thickness of from about 1 to 30μ , directly condensed on said carrier.

2. Contact according to claim 1 wherein the layer of ruthenium comprises adjacent crystal columns extending in essentially perpendicular direction to the surface of the contact area facing the contact layer.

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