

UNITED STATES PATENT OFFICE

2,094,570

ELECTRIC CONTACT

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No Drawing. Application July 1, 1936,
Serial No. 88,496

10 Claims. (Cl. 200—166)

5 The present invention relates to circuit making and breaking electrodes for electrical apparatus and more particularly to improved metallic compositions or alloys for use in making such electrodes.

The primary object of the invention is to provide circuit making and breaking contacts having improved characteristics and long life in service.

10 Contacts formed of either tungsten or platinum alone when operating in service which requires 1,000,000 contact operating cycles in 24 hours must receive frequent maintenance and in fact will not operate for 24 hours without attention. Very hard alloy contacts, for example
15 those made of tungsten carbide combined with cobalt and tungsten carbide combined with platinum group metals require attention about every 30 days in the service just mentioned.

20 A further object of the invention therefore is to provide an electrical contact which will operate in high speed service for long periods of time without requiring attention. Contacts of the present invention will operate in service requiring 1,000,000 contact operating cycles in 24
25 hours for 8 months or over without attention.

Electrical contacts of the prior art formed of tungsten alloys are subject to localized accretion of material on one contact, reducing the operating gap and in time preventing separation of
30 the contacts.

Accordingly, another important object of the invention is to provide a tungsten alloy contact which is free from any tendency to transfer material from its contact surface to another cooperating contact surface.
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More specifically, objects of the invention are to provide electrical contacts having relatively low electrical resistance, a high degree of hardness to resist mechanical wear, a high melting
40 point to prevent fusion from service arcing possible under certain conditions of use and combining also to a degree not heretofore obtained in alloy contacts, the ability to preserve the original contact surface contour.

45 Tungsten alloy contacts have been made of a sintered alloy comprising tungsten initially in a granular or powdered condition and a metal from the platinum group, also initially in a granular or powdered condition. In prior art tungsten alloy
50 contacts made up in the manner just stated, transfer of metal from one contact to another in service is caused by deterioration at the boundaries of the minute grains of tungsten. This deterioration in time permits the grains to be separated with comparative ease from the main body
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of the contact. This separation, we have discovered, is caused by either one of two conditions. The first condition is an insufficient alloying of the added metal with the tungsten so that some of the grain boundaries are imperfectly
5 coated. The second condition is an excess of the added metal which may actually lie between the grains so as to physically separate them. Also, where too much added metal is present, it occupies portions of the working face of the contact, and these portions however minute, are
10 transferred to the working face of a cooperating contact.

By the present invention the tendency toward accretion is substantially eliminated by using
15 only such an amount of platinum group metal that all of the tungsten grain boundaries throughout the contact will be covered with a solution comprising tungsten and the added platinum group metal without leaving an uncombined
20 excess of added metal.

The discovery that for feeble currents of the order of one quarter of an ampere or less, contacts are most suitable when the tungsten has an exceedingly small grain size is a further important feature of the invention. The preferred
25 size of tungsten grain for contacts to be used for low current is approximately .00015 inch. If the size of the individual tungsten grains in the contact material is larger than .0004 inch, the
30 contact is susceptible to excessive erosion. Grain sizes in the upper range between these two limits may also be suitable for contacts carrying heavy currents but are not as satisfactory for light current operation whereas the operating speeds
35 are high. Contacts suitable for larger currents have a grain size between the first mentioned preferred size and the maximum size.

It is essential in producing contacts in accordance with the present invention, that each grain
40 or minute particle of tungsten present a surface which consists only of a solution of the added noble metal and the tungsten. By this grain structure intimate and perfect cohesion is secured between the grains or particles of the contact, and the contact presents a relatively uniform working surface.
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In carrying out the invention, contact material is formed from tungsten and from 2 to 8%
50 by weight of a noble metal of the platinum group. By the term "metal of the platinum group" is meant rhodium, ruthenium, platinum, osmium and iridium which are the preferred added metals to be used in contacts embodying the in-
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vention. The materials employed consist of finely divided particles of substantially pure tungsten and the required amount of the selected platinum metal also in a finely divided form.

5 The comminuted metals are prepared in accordance with well known practices, preferably by powdering in a ball mill or equivalent apparatus for approximately seventy-two hours, after which the powder is passed through a fine mesh

10 screen having openings approximately .0017 inch in size. The powdered materials of which the contact is to be made are thoroughly intermixed in a ball mill for approximately 24 hours. The intermixed metals are molded to a desired

15 form, usually that of a finished contact, under a pressure of from 30,000 to 120,000 lbs. per square inch. The molded contacts are then sintered in accordance with a well known practice in an atmosphere of hydrogen at a temperature less than 5000° F., which is approximately the melting point of tungsten. The preferred sintering temperature is approximately

20 2900° F. with a point somewhat below the melting point of tungsten as the upper limit. For example, contacts which operate successfully in severe service are produced in accordance with the present invention by sintering at a temperature of 3000° F., the sintering time being approximately two hours. However, contacts produced by sintering at temperatures of 2800° F. and under show signs of early failure. Contacts produced in accordance with the invention are ready for use following the sintering operation

25 as it is not necessary to polish or otherwise prepare them for service.

The procedure just described is used when producing contacts embodying any one of the named platinum group metals.

40 It will be seen from the foregoing that contacts produced in accordance with the present invention are particularly useful for high speed operation when handling small currents and that in any service for which the contact is

45 designed uniform wear is experienced at the contact surface without any tendency toward local accretion.

We claim:

1. An electrical contact element consisting of finely divided tungsten and a noble metal from the platinum group, the boundaries of the tungsten particles being composed of a solution of tungsten and the noble metal, the cohesive union between all particles of the contact being provided only by said solution whereby cohesion between said particles is uniform throughout the contact and on the exposed working surface thereof.
2. The contact as defined by claim 1 wherein said noble metal is platinum comprising from two to eight per cent by weight of said contact.
3. The contact as defined by claim 1 wherein said noble metal is rhodium comprising from two to eight per cent by weight of said contact.
4. The contact as defined by claim 1 wherein said noble metal is osmium comprising from two to eight per cent by weight of said contact.
5. An electrical contact element composed of a homogeneous alloy comprising substantially 92 to 98% of finely divided tungsten and 2 to 8% of a metal of the platinum group, substantially the total quantity of the platinum group metal being combined in solution with the tungsten.
6. The contact as defined by claim 5 wherein said noble metal is platinum.
7. The contact as defined by claim 5 wherein said noble metal is rhodium.
8. The contact as defined by claim 5 wherein said noble metal is osmium.
9. An electrical contact composed of a homogeneous sintered mass of finely divided tungsten, the said tungsten being combined by solution with an entire quantity of added noble metal from the platinum group.
10. An electrical contact composed of a sintered mass of finely divided tungsten having a grain size of approximately .00015 inch and not over .0004 inch, the said tungsten being combined by solution with a uniformly distributed quantity of a noble metal from the platinum group.

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