

UNITED STATES PATENT OFFICE

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ALLOY FOR ELECTRICAL CONTACTS

No Drawing.

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This invention relates to alloys for use in connection with electrical apparatus such as electrical contacts.

An object of the invention is to reduce the cost and improve the efficiency of electrical contact materials.

This application is a continuation in part of my copending application, Serial No. 713,691 filed May 16, 1924.

10 Considerable difficulty has been experienced in the use of electrical contact materials on relays, switches and similar apparatus.

In the case of the noble metals which are frequently used as contact materials, the continuous making and breaking of the contacts produces minute sparks which cause the material to be transferred from one contact to another, thus causing a fine needle point to be built up on one contact which ultimately causes a permanent short circuit across the contacts. Furthermore, owing to excessive heating, such materials become vaporized thus resulting in the deleterious pitting of the contact members.

Difficulties are also experienced in the use of base metals as contact materials due to the fact that these metals oxidize quite readily and build up a film of oxide on the contact which causes the false operation of the relay and an increase in the contact resistance.

An illustration of the difficulties heretofore met may be found in the case of telephone and telegraph terminal and repeating relays. The current employed for operating such relays is frequently small and consequently the contact pressures are so small that there is considerable heating which results in transferring material from one contact to another.

15 In accordance with this invention, an electrical contact is made of an alloy comprising at least one metal of the iron group and at least one metal of the platinum group. It has been found that alloys composed of metals of the iron group and metals of the platinum group, in accordance with the invention, possess the strength, hardness, resiliency, and homogeneity of composition necessary in contact metals and when properly proportioned will oxidize just sufficiently to

prevent the transfer of material from one contact to another and at the same time will not possess contact resistance which is unsatisfactorily high. Furthermore, owing to the absence of excessive heating due to the diminished transfer of material between contacts the pitting of the contacts is greatly diminished thus increasing their period of service.

A homogeneity of composition is essential in contact alloys since the actual contact area at any one time is extremely small and it is impossible to obtain consistent results where appreciable non-uniformity exists. In the case of many alloys heretofore proposed even a severe mechanical working does not produce a homogeneity of structure sufficient for contact purposes.

The proportions of metals of the iron group and metals of the platinum groups which may be employed in forming the contact alloys of the invention may be considerably varied, changes in such proportions of course, varying the contact resistance, the tendency to oxidize and the tendency towards transfer of material between the contacts of the particular alloy formed. It has been found as a general rule, the higher the platinum group metal content, the lower appears to be the contact resistance and the less appears to be the tendency to oxidize, while higher contact resistances and a greater tendency to oxidize appear to be produced with lower platinum group contacts. It has been further noted that as a rule the alloy shows a tendency toward a greater transfer of material between contacts with higher platinum group metal contents.

Alloys composed of a comparatively large amount by weight of metal of the platinum group and a smaller amount by weight of metal of the iron group have been found to be satisfactory. An alloy for example, composed of 45 atomic percent metal of the platinum group and 55 atomic percent iron group metal forms a satisfactory contact element. As the platinum group metal content is increased approaching 94 atomic percent, the tendency of the alloy to be transferred between the contact elements is found to increase rapidly. Contacts formed, for in-

stance, of metallic compositions such as (weight percentages):

	Palladium 30%—Nickel 70%
5	Palladium 40%—Nickel 60%
	Palladium 70%—Nickel 30%
	Palladium 93%—Nickel 7%
	Platinum 98%—Nickel 2%
	Platinum 93%—Nickel 7%
10	Palladium 66%—Fe 34%
	Platinum 78%—Fe 22%

have been found to possess substantially low contact resistance at the same time showing just sufficient tendency to oxidize, to substantially eliminate transfer of material between contacts and to be satisfactorily cheap. The several examples given have been found by applicant to possess the desired characteristics. However, no one of these compositions can be said to be preferred for all purposes over the others and percentages intermediate to those given or differing widely from them and yet within the limits defined by the claims, may be used to secure the advantages of the invention, the percentages chosen depending upon the particular conditions met in each instance.

The preferred proportions will depend upon the particular use to which the contact element is to be applied. It is, of course, always desirable to have the platinum group content high in order to produce low contact resistance and it will depend upon the restrictions placed on the tendency of the alloy to transfer between contacts and the cost restrictions, (since high platinum group content alloys are more expensive), as to the proportions of platinum group and iron group metal employed. It will be appreciated therefore, that it is not intended to impose any restrictions upon the proportions of the ingredients employed other than those set forth in the claims.

The invention in its preferred form comprises a binary alloy containing a metal of the platinum and a metal of the iron group. By the platinum group is meant the noble metals of the eighth periodic group according to Mendelejeff's arrangement which comprise ruthenium, rhodium, palladium, osmium, iridium and platinum. Palladium is considered preferable because of its density and because it is less expensive and more readily available than other metals of the group. By the iron group is meant the base metals of the eighth periodic group which comprise iron, nickel and cobalt.

A particular type of circuit on which the alloys of the invention have been found especially satisfactory as contacts, is that where the contacts suffer from a condenser discharge during closure. On such circuits even such low nickel content alloys as palladium 93, nickel 7% and platinum 98, nickel 2% have been found satisfactory.

It is to be understood that small amounts of other metals may be added to the alloy without departing in any way from the invention. For example, the hardness of the alloy may be increased in ways known in the art such as by the addition of small amounts of a second base metal such as zinc.

Furthermore, ordinary commercial palladium often contains traces of other metals such as gold, silver and platinum, and hence the presence of small quantities of such metals in the alloy is not to be construed as a departure from the scope and spirit of the invention.

What is claimed is:

1. A contact element composed of a homogeneous binary alloy comprising as essential elements thereof, metal of the platinum group and metal of the iron group.
2. A contact element composed of a homogeneous binary alloy comprising as essential elements thereof, palladium and nickel.
3. A contact element composed of a homogeneous binary alloy comprising as essential elements thereof, a metal of the platinum group and a metal of the iron group.
4. A contact element composed of a homogeneous binary alloy comprising palladium and a metal of the iron group.
5. A contact element composed of a binary alloy comprising palladium and nickel.
6. A contact metal composed of a homogeneous binary alloy, consisting of the following metals in substantially the following atomic percentages: metal of the iron group 6 to 80%, metal of the platinum group 20 to 94%.
7. A contact element composed of a homogeneous binary alloy consisting of, substantially 6 to 80 atomic percent of nickel and metal of the platinum group.
8. A contact element composed of a binary alloy comprising metal of the platinum group and metal of the iron group, the amount of metal of the platinum group being substantially from 20 to 94 atomic percent.
9. A contact element composed of a binary alloy consisting of palladium and a metal of the iron group which contains substantially 45 atomic percent of palladium.
10. A contact element composed of an alloy of the following metals in substantially the following proportions by weight: Palladium 30 to 70%, nickel 70 to 30%.

In witness whereof, I hereunto subscribe my name this 10th day of July, A. D. 1925.

EDWIN F. KINGSBURY.