

UNITED STATES PATENT OFFICE.

HANS KUŽEL, OF BADEN, NEAR VIENNA, AUSTRIA-HUNGARY.

SOLDER FOR INCANDESCENT-LAMP FILAMENTS.

No. 912,245.

Specification of Letters Patent.

Patented Feb. 9, 1909.

Application filed January 19, 1906. Serial No. 296,884.

To all whom it may concern:

Be it known that I, HANS KUŽEL, a subject of the Emperor of Germany, residing at Baden, near Vienna, Empire of Austria-Hungary, have invented certain new and useful Improvements in Solders for Incandescent-Lamp Filaments, of which the following is a specification.

My invention relates to the means for electrically connecting the carbon filaments of electric glow lamps with the supply wires, and the object of the invention is to obtain a good connection of a metallic character, which conducts the current better than the usual carbon cements and carbon coatings, and for this purpose I make use of a metallic material melting at a high temperature and which adheres equally well to the filament and to the metal supply wires.

I have found that metal carbids melting at high temperatures and their solid solutions in an excess of metal constitute the desired metallic connecting material. It has been found that the carbon compounds of the metals melting at extremely high temperatures such as manganese, chromium, molybdenum, tungsten, uranium, vanadium, tantalum, niobium, titanium, zirconium, nickel, cobalt, iron are particularly suitable for the above purpose. The carbids of all of these metals and the solid solutions of such carbids in an excess of metal have a certain affinity for carbon owing to the fact that they contain carbon themselves and very firmly adhere to carbon if applied thereto in a molten state. If for instance the ends of a carbon filament are dipped into molten carbid of tungsten prepared by the method of Moissan the pores of the carbon filament ends are soaked or filled with the carbid and after withdrawing the ends of the filament from the molten carbid it will be found that these ends are covered with a metallic coating. The thickness of this coating may be increased at will by repeatedly dipping the filament ends into the molten carbid and this coating so firmly adheres to the carbon that in most cases it cannot be removed from the same without destroying the carbon. If instead of a carbon filament a metal wire is dipped into the molten carbid it becomes also coated with the latter. If therefore the molten carbid is applied in any suitable manner to the ends of a carbon filament and its metallic (say nickel) supply wires while they

are held in juxtaposition or in contact with each other or temporarily secured to each other by any mechanical means such carbid will solder firmly together the two parts although they consist of heterogeneous materials and as the soldering knot may be made as large as may be desired a connection is established thereby, the electric resistance of which is the minimum of what may be practically obtained. The same result may be obtained if instead of a carbon filament a filament of some other material such as metal, boron or silicon, or instead of the carbid of tungsten another carbid melting at a very high temperature is used.

The carbid of tungsten or any other carbid used need not be employed in their pure state for the purposes of the present invention. The raw product obtained for instance by the methods of Moissan, in the above case for instance by reducing tungstic acid by carbon, and containing from 0.67 to 6.33% of carbon may be directly used, but those products which approximately correspond to the formula CW_2 are more suitable than the solid solutions of the carbid in the metal which are poorer in carbon and also more suitable than products richer in carbon because on the one hand the adhesion between the carbon and the molten metals depends upon the proportion of carbon contained in the metals as has been already recognized by Moissan while on the other hand the products richer in carbon are liable to give off carbon in the form of scaly graphite whereby the connection between the filament and the supply wire might be loosened.

Another form of carrying into practice the soldering together of filaments and their supply wires by means of carbids and their solid solutions consists in mixing such finely powdered substances with just a sufficient quantity of an agglomerant such as gum arabic solution of sugar or the like or with a colloidal metal or metals or with a colloidal oxid or oxids of a metal or metals so that a pasty mass is obtained and applying such mass to the point at which the two parts have to be connected. The mass is gradually heated to a white heat either in the ordinary way or by means of the electric current or of the voltaic arc and if required in the absence of air; either in vacuum or in gases or vapors such as illuminating gas,

hydrogen, nitrogen, benzin, vapors etc. whereby it is molten or sintered. A modification of this form of carrying into practice my invention consists in that the carbids or their solid solutions are not used when already formed but are formed in the course of the soldering process, that is to say, metals melting at a very high temperature and in a finely powdered state are mixed with carbon or an organic substance giving off carbon on being heated and with just sufficient quantity of an agglomerant so as to form a pasty mass. This mass is applied to the parts at the point where they are to be connected and heated as above described. The carbon present or given off combines with the metals used whereby carbids of the latter are formed. This modification is particularly suitable for metals capable of forming carbids very rich in carbon for instance for vanadium. From this a solder very suitable for the process described is obtained by mixing 90 parts of finely powdered vanadium, 5 parts of finely powdered graphite and 5 parts gum arabic with a little water so as to form a pasty mass which is used in the manner described. Instead of organic agglomerants also colloidal metals or—less advantageously—colloidal oxids may be employed as agglomerants.

I do not claim in this case the process of

electrically connecting the filaments to the leading-in wires, as that forms the subject of a divisional application for patent filed by me March 26, 1907, Pat. No. 898,979, Sept. 15, 1908.

Claims—

1. As a new means of connecting incandescent lamp filaments to their supply wires, a solder containing a carbid of a metal melting at a very high temperature, substantially as described.

2. As a new means of connecting incandescent lamp filaments to their supply wires, a solder containing carbids of metals melting at very high temperatures, substantially as described.

3. As a new means of connecting incandescent lamp filaments to their supply wires, a solder containing carbid of tungsten, substantially as described.

4. As a new means of connecting incandescent lamp filaments to their supply wires, a solder consisting of carbid of tungsten, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

HANS KUŽEL.

Witnesses:

T. GEORGE HARDY,
ALVESTO S. HOGUE.