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SHAPED BODIES FOR ELECTRIC PURPOSES, PARTICULARLY LEADING-IN WIRES AND BARS FOR ELECTRIC CURRENT

Paul Schwarzkopf, Reutte, Austria

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4 Claims. (Cl. 75—22)

This invention relates to improvements in shaped bodies for electric purposes, particularly leading-in wires and bars for electric current. In particular, but not exclusively, this invention relates to leading-in wires into bulbs for vacuum vessels such as incandescent lamps, amplifiers, rectifiers, X-ray tubes. Furthermore, wires or bars made according to this invention are of utility in spark plugs for leading the current through the insulating body of such spark plug to the electrode positioned inside the combustion chamber or cylinder of the engine.

It is an object of the invention to obtain a leading-in wire which may be sealed into the wall, or other body through which it is to be led in such a way that within a given range of temperature a secure closure is achieved.

It is another object of the invention to produce a leading-in wire to which the material of the wall or body through which the wire is led adheres tightly particularly gas-tightly.

It is another object of the invention to produce such leading-in wires in a cheap and reliable uniform way.

According to this invention leading-in wires and bars for electric current are produced of the purest initial materials consisting of iron, nickel and cobalt. This material is mixed in a proper ratio which imparts the desired properties to the resulting wire or bar. These properties are in the first place a desired temperature expansion which is identical, or almost identical with that of the material of the body, or wall, through which the wire is to be led.

Thus this temperature expansion may be almost identical with that of glass, or china, or a soap-stone containing insulating material or other electrical insulating material used in the art of manufacturing bulbs and spark plugs and similar articles calling for a tight seal.

Another property thus imparted to the resulting wire, or bar, consists in the absence of any impurity which might cause the development of gases in detrimental volume during the melting-in, or sealing process, or during heating of the vessel in operation. Such gases, if evolved, may cause formation of bubbles and fine channels either in superficial layers of the leading-in wire, or bar, through which either gases from inside the bulb, or the combustion chamber, may escape into the surrounding atmosphere, or, if a vacuum is created inside the vessel, the atmospheric air may intrude into the vessel and deteriorate the vacuum.

The initial mass thus composed will then be intimately mixed in drums, or ball mills, for several hours and sometimes for days. In order to prevent the admixture of undesired material and impurities, such drums, or mills, or the walls thereof are made of iron, or cobalt, or nickel, or a composition of two or three of these metals. Thereby these metals are employed as pure as possible, so that no impurities in any substantial amount are brought into the mixture during its comminuting.

Thereupon the mixture is pressed into the desired shape, and then heated to a compacting temperature which is however below melting temperature. Advantageously this temperature should not exceed high sintering temperature of the mixture and be kept below about 1300° to 1400° C.

Compositions of matter of this type have previously been suggested, but only made by fusing the mixture. Such fusion has to be performed in crucibles of highly refractory material which contains manganese, silicon or carbon. At the melting temperatures material of the crucible is inevitably absorbed by the melt, and the bodies finally obtained contain therefore impurities like silicon, manganese or carbon in amounts ranging from about 0.3 to 0.5% and more. Leading-in wires made of such previously melted bodies will cause the disadvantages mentioned above including formation of channels and not tight places, and prevent uniform adhering of glass, or other material to the wire or bar. The impurities may also give cause to undesired chemical combinations and conversions inside the bulb, and they will also influence the physical properties of the material as to temperature expansion etc.

According to this invention bodies, particularly leading-in wires and bars are obtained with a content of carbon, silicon, manganese or other impurities of similar undesired effect, if at all present, and to be measured by any given means, of not exceeding one tenth of 1%, and ordinarily below about 0.05%. Such mere feeble traces cannot alter the properties of the final alloy as intended by making the initial mixture, and they cannot evolve any detrimental volume of gas during the sealing, or melting-in process; neither can they chemically combine in any detrimental way with other elements present either in the wall or on the inside of the device in which they are used. They can neither alter the expansion properties nor the ductility of the alloy.

The bodies obtained by the heat treatment may be of any given shape and can then be transformed into any desired other shape, par-

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ticularly by mechanical working such as hammering and drawing. Thereby wires of any desired diameter, or bars, may be obtained.

The pure initial material used for the purposes of the invention may consist in chemically pure cobalt, iron and nickel. By the treatment described above any introduction of undesired impurities or other additions is avoided. At sintering temperature the body is incapable of absorbing any substantial amounts, such as 0.3% to 0.5% of impurities.

Instead of starting with chemically pure materials, one may use compounds of cobalt, or nickel, or iron which decompose below or at temperatures employed during compacting, such as sintering temperature, and which escape without leaving any undesired traces or residues of gases in the material. Thus for instance oxalates of the initial material may be employed which are reduced to the pure material at sintering temperature.

If undesired free carbon be evolved by such compounds, hydrogen may be led through the mixture of the powder at low red heat, or any other gas may be employed which combines with the carbon and evaporates in form of vapors or gases at given temperatures. Any other reducing treatment may be employed. In addition thereto, or instead of it, a vacuum may be applied during the sintering period so as to remove any residues of gases.

If high sintering treatment is applied for a sufficient length of time some diffusion of the metals and formation of mixed crystals may occur. Such formation of mixed crystals will be expedited by using the finest metal powder obtained by wet grinding the metal in ball mills for several days.

If one starts with oxides, oxalates or other chemical combinations of the metal used according to the invention which are capable of being reduced, the formation of mixed crystals can be more easily obtained at sintering temperature because the pure metals resulting from the reducing treatment are extremely fine and therefore ready to permeate each other to some degree.

In particular a solution may be made of iron, nickel, and/or cobalt compounds, and precipitated by addition of ammonium oxalate whereupon the mixture of oxalates so obtained is reduced and thermically treated at raised temperatures, preferably just below melting temperature so that finally an iron-nickel-cobalt alloy of highest purity results.

Instead of oxides and oxalates also carbonates and other compounds of the constituents of the alloy may be used. The body obtained may be transformed into wires, or bars, as mentioned above, but also into sheets, stripes, or any other shape. If desired there may be admixed pure molybdenum and/or pure tungsten in amounts from 0.5% to 25% but preferably only up to 5%. Thereby the expansion properties can be additionally adjusted at will.

A composition suitable for a leading-in wire consists for instance of 20% nickel, 10% cobalt, 70% iron. A composition suitable for instance for a middle electrode in spark plugs consists of 30% nickel, 20% cobalt, 50% iron.

It is to be understood however that the invention is not limited to any such example given above, but is to be understood in the broader spirit of the following claims.

What I claim is:

1. An alloy for electrical purposes consisting of about 20% to 30% nickel, about 10% to 20% cobalt and about 50% to 70% iron as components, and containing undesired impurities such as silicon, manganese or carbon in amounts substantially below 0.3%, said components sintered in their chemically purest state at temperatures close to about 1300° to 1400° C.

2. A wire for electrical purposes, particularly a leading-in wire, consisting of an alloy of about 20% to 30% nickel, about 10% to 20% cobalt and about 50% to 70% iron as components and containing undesired impurities such as silicon, manganese or carbon in amounts substantially below 0.3%, said components sintered in their chemically purest state at temperatures close to about 1300° to 1400° C.

3. A bar for electrical purposes, particularly for leading-in electrical current, consisting of an alloy of about 20% to 30% nickel, about 10% to 20% cobalt and about 50% to 70% iron as components and containing undesired impurities such as silicon, manganese or carbon in amounts substantially below 0.3%, said components sintered in their chemically purest state at temperatures close to about 1300° to 1400° C.

4. A spark plug provided with a conductor passing the insulating body of the electrode, said conductor consisting of an alloy of about 20% to 30% nickel, about 10% to 20% cobalt and about 50% to 70% iron as components and containing undesired impurities such as silicon, manganese or carbon in amounts substantially below 0.3%, said components sintered in their chemically purest state at temperatures close to about 1300° to 1400° C.

PAUL SCHWARZKOPF.