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ALLOY METAL

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This invention relates to a new alloy composition in the form of rod, sheet and wire, or any other convenient shape or casting, said wire being especially useful in the incandescent lamp, radio and television industry, as well as for electrical contact purposes.

The invention provides a substantially non-corrosive alloy which can be mechanically worked to any suitable shape or into the form of wire, especially of fine diameter, the wire being especially adapted for use as an improved grid wire for radio tubes and as an improved support wire for power tubes. In this respect it may be substituted for the much more expensive molybdenum or tungsten wire.

Essentially our improved alloy metal comprises Monel metal to which we add refractory metals such as tungsten and molybdenum and a small proportion of manganese. These additions of refractory metals in no way impair the non-corrosive property of the Monel metal and at the same time impart to the metal a certain amount of hardness and a considerable amount of tensile strength, so that the resultant alloy may be drawn down to much finer sizes of wire and so that said wires can be used in operations where the wire is subjected to considerable stretch.

As above mentioned, our improved alloy metal may also be used for contact points and other electrical purposes because of its non-corrosive characteristics and because of the increased hardness that has been imparted to the Monel metal through the addition of the refractory metals molybdenum and tungsten. The addition of these refractory metals, furthermore, increases the resistance of the composition, also the tensile strength of the wire and the elastic limit of the same.

The added manganese is so adjusted or controlled that at no time will it exceed 5%, and preferably ranges from ½% to 2%. The presence of the manganese improves the mechanical working of the metal and imparts a high electronic work function which is of particular advantage when the wire is used as grid wire for radio tubes.

The refractory metals added to the Monel metal consist essentially of metals of the sixth group of the periodic system, especially such refractory metals as are non-corrosive at room temperature. In its preferred form our improved alloy comprises Monel metal and added molybdenum and a small percent of tungsten. The addition of these refractory metals usually ranges from 5% to 20%.

The Monel metal consists essentially of 28% copper and 72% nickel. Our improved alloy, therefore, consists substantially of about 62% nickel, 25% copper, 10% molybdenum, 1% tungsten and 2% manganese. The alloy may, however, also be adjusted so the molybdenum and tungsten content may even be raised to as high as 20%.

The alloy may be produced according to methods well known in the art, our preferred method, however, being to take a bar of Monel metal either in cast form or in rod form, boring said bar out and introducing into the center of the bar the ingredients to be added, namely, molybdenum, tungsten and manganese, preferably in the form of small pieces. It is preferable to close the casting or cavity so that air does not have free access to the tungsten and molybdenum before the Monel metal is brought up to a fusion point.

The Monel bar or rod, together with the additional ingredients, are placed into a suitable crucible, preferably of lime, which in turn is heated up either in a gas, oil or electric furnace, the latter preferably of the induction type, to a temperature high enough to melt the Monel metal, which in turn dissolves the refractory metal constituents, the molten mass being stirred with a suitable rod of tungsten, molybdenum or silicon.

After the mass has reached the molten condition and the molybdenum, tungsten and manganese are uniformly dissolved and stirred into the molten metal, the resultant alloy may then be poured into a suitable mold, depending upon the shape of bar that is to be formed.

Our alloy composition may also be produced by mixing the powders of the various constituents of our alloy in the proper proportion and then ball-milling and pressing the same and sintering at a temperture slightly below the melting point of the bar until a uniform homogeneous sintered alloyed bar is produced.

The resultant composition is a silvery looking, non-magnetic, non-corrosive metal which may then be mechanically worked into any suitable shape. It is usually annealed and may also be drawn down into very fine wire with intermediate annealing. If the wire is to be used for radio tube purposes, it is degasified by heating the same at a yellow heat in an atmosphere of hydrogen, thereby dispelling all objectionable occluded gases and saturating the wire with

hydrogen. The degasified wire is then excellently suited for use as grid wire and support wire in radio tubes.

The alloy may also be rolled down into very thin sheet metal with intermediate annealing, which sheet may be punched out into various forms and may be used for contact surfaces in electrical circuits and even for the purpose of brazing refractory metals together, or brazing together high temperature thermostatic metals.

It gives excellent results especially for the welding together of nickel chrome compositions. The addition of the refractory metals, such as molybdenum and tungsten, uranium, etc., tends to increase the hardness of the Monel metal and also tends to degasify the alloy. Our resultant alloy in its final state is usually composed of the standard Monel metal (28% copper and 72% nickel), having added thereto ½% to 3% manganese, 4% to 20% molybdenum and 1% to 5% tungsten.

Our new alloy, when worked into fine wire to be used as grid wires in radio tubes, will result in grids that will give lower grid emission than the grid wires at present known in the art, thereby giving improved radio tube performance.

This wire is particularly well suited to function as improved grid wire when its surface is etched chemically or electrolytically or coated with a thin film of carbonaceous coating. By etching or coating the surface, or by a combination of both etching and coating with carbon, the surface of the wire radiates heat at an increased rate more than it would if it were a bright wire, thereby reducing the operating temperature of the grid. This is highly desirable in the multi-grid type of tube, where excessive localized heating impairs the proper functioning of the tube.

This etching may be done by drawing the wire through an electrolytic bath composed of an alkaline ferro-cyanide or other suitable electrolyte, the wire constituting one side of the circuit. After etching and washing, the wire may be drawn through a colloidal suspension of graphite or carbon or a deflocculated graphite paste, thereby coating the wire with a thin film of this carbon paste, then drawing the same over a flame and baking it intimately onto the wire.

As an alternative method of coating the wire, we may heat the wire in a carbonaceous atmosphere, thereby depositing a thin film of carbon on the surface of either the clean or the etched wire.

What we claim as new is:—

1. A non-corrosive alloy comprising 62% nickel, 25% copper, 2% manganese, 10% molybdenum and 1% tungsten.

2. An alloy comprising ½% to 5% manganese, 4% to 20% molybdenum and 1% to 5% tungsten, the balance of the alloy comprising Monel metal composed of substantially 28% copper and substantially 72% nickel.

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