

UNITED STATES PATENT OFFICE.

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MISCH-METAL WIRE.

Application filed January 29, 1925. Serial No. 5,595.

This invention relates to the production of misch metal in a form suitable for introduction into vacuum devices to serve as a clean-up agent therein, and more particularly to misch metal wire in ribbon form and the method of fabricating the same.

In copending application Serial No. 679,489, Marden et al, filed December 8, 1923, entitled Clean-up and activation by misch metal and the rare earth metals, and assigned to the Westinghouse Lamp Company, there is described the use of a metal of the cerium group of rare earth metals, such as misch metal, for cleaning up residual gases and vapors in vacuum devices by which the period required for exhausting such devices may be materially reduced. It has been found, moreover, as fully set forth in the above application, that misch metal is superior to other known clean-up agents for the removal of the gases usually present in evacuated devices, such as radio tubes, electric lamps, etc., and is particularly effective in cleaning-up the large quantities of carbon dioxide and other gases evolved in the production of oxide coated filaments by the reduction of the carbonates of the alkaline earth metals, in the discharge device, as set forth in copending application Serial No. 587,270, Duncan MacRae, filed September 11, 1922, entitled Electron emitting device and method of making, and assigned to the Westinghouse Lamp Company.

Briefly, the method of utilizing the metallic clean-up agents which has been found most convenient in practice, is by attaching a small piece of the clean-up material to a metal part of the mount such as the plate of a radio tube, by welding, soldering, pasting or in any other suitable manner and after sealing the mount into the bulb and evacuating the device, vaporizing the clean-up material, preferably by high frequency induction.

For this purpose, it is highly desirable that the metallic clean-up material be obtainable in the form of sheets or ribbon which may be readily cut into the desired size for attachment to the mount.

Misch metal, of which cerium is the principal ingredient, is a bi-product of the gas mantle industry and is comparatively inexpensive. As obtained on the market it contains some iron, 50 to 60% cerium, and

smaller amounts of the other metals of the cerium group of rare earth metals, such as lanthanum, neodymium, praseodymium, etc. In this impure condition it cannot be worked by rolling, swaging, or other well known methods, directly into wire or sheets. Moreover, the cost of removing the iron and other impurities so as to render the cerium or other metals of the cerium group, sufficiently pure for direct cold-working thereof would render the price of the misch metal prohibitive.

Heretofore, small pieces of misch metal, suitable for attachment to the plates of radio tubes, have been obtained by shaving the blocks of misch metal, as they are obtained on the market, into thin pieces which could be broken into smaller sizes and welded to the mount. The pieces obtained in this manner, however, are uneven in shape, difficult to obtain in sufficient quantity for commercial use and involve much wastage. Moreover, the quantity of metal cannot be controlled since these irregular shavings vary greatly in sizes. It is essential that the amount of misch metal used be not much in excess of that required to effect the clean-up of gases since the surplus metal forms a film on the bulb which is objectionable in appearance and when using nickel plates, the misch metal alloys with the nickel and when present in too great quantities, melts through the plate.

One of the objects of this invention is to produce misch metal in a convenient and economical form for introduction into evacuated devices in predetermined quantities.

Another object is to produce a wire or ribbon composed chiefly of metal of the cerium group of rare earth metals.

Another object is to produce misch metal in wire form.

Another object is to provide a method of producing wires or ribbons composed of misch metal.

Another object is to provide an improved method of introducing misch metal into evacuated devices.

Other objects and advantages will hereinafter appear.

We have found that the melting point of commercial misch metal is not sharp but that it melts gradually around 600 to 650° C. In accordance with our invention, the misch

metal is heated in an extrusion press to a softening temperature below the melting point thereof at which temperature the misch metal extrudes quite freely from the press.

Since the misch metal reacts with the atmosphere at the temperatures of extrusion, it is necessary that the wire be extruded into an environment inert with respect thereto, such as carbon dioxide, forming gas or into oil or other inert fluid by which the air may be excluded.

The orifice of the die used in the press may be round or flat so as to produce either a round wire or a flat wire. We have found, however, that the mechanical difficulties incident to the process may be more readily overcome by using round dies, preferably of from 50 to 70 mil diameter although other sizes may be used with equal facility.

In case the wire is extruded through a round orifice, it may be flattened by rolling to render it better adapted for attachment to the metal parts of the evacuated device. However, the number of times the wire may be passed through the rolls is limited since the metal cracks up readily.

The wire produced by this process is uniform in size and may be produced in any desired lengths.

In order that this invention may be more fully understood, reference will be had to the accompanying drawing in which,

Fig. 1 is a view partly in section of apparatus adapted for the production of misch metal wire; and

Fig. 2 is a drop perspective of the mold and die used in the apparatus in Fig. 1.

The extrusion press shown in Fig. 1 comprises a table or support 1 carrying the mold 2, a pressure head 3 and a receptacle or tube 4 for receiving the extruded metal and excluding the air therefrom.

The mold 2 is preferably formed in two parts 5 and 6 each containing a semi-cylindrical recess 7, adapted when the two halves are faced together to form a cylinder for the reception of the misch metal 8. A die 9 having an orifice 10 through which the metal is to be extruded, rests upon a shoulder 11 in the bottom of the mold. The two halves of the mold are held together in proper alignment by pins (not shown) passing through aligned opening 12 in the parts 5 and 6 of the mold. A plunger 13 fitting in the mold serves, when the misch metal is sufficiently heated, to force the metal through the die 9 and into the tube 4, high pressure being transmitted to the plunger 13 directly by the press head 3.

The mold and its contents may be heated by electric heating elements 14 arranged on each side thereof and a heating element 15 arranged beneath the mold. By this arrangement, it will be noted a concentration

of heat is obtained at the lower part of the mold where the extrusion takes place. The heating elements 14 and 15 may be composed of asbestos or other refractory insulating material and having heating coils 16 embedded therein. An asbestos block 17 or other heat insulating material may be provided for the top of the mold to assist in retaining the heat therein.

The lower end of the mold, the bottom heater 15 and the table 1 have aligned openings 18, 19 and 20 respectively, formed therein to permit the passage of the extruded wire therethrough.

The two halves of the mold are pressed tightly together so as to prevent the misch metal from being squeezed between the abutting faces, by pressure plates 21 arranged on each side thereof and designed to exert an inward pressure by screws 22 threaded in the blocks 23 carried by the table 1.

An inert atmosphere may be maintained in the receiving tube 4 by a gas connection 25. Any suitable gas which does not react with the heated metal, such as carbon dioxide, may be used.

The pressure required to force the misch metal through the die is dependent upon the temperature of the metal and the size of the orifice in the die. For the production of from 50 to 70 mil wire we have found that very satisfactory results may be obtained by maintaining the misch metal at a temperature of about 500° C. and applying a pressure of from 7 to 8 tons per square inch to the plunger 13. In this particular instance a plunger of about $\frac{7}{8}$ inches in diameter was used.

The misch metal wire may be obtained in continuous lengths from the tube 4 and for convenience in attaching to the metal parts of radio tubes, etc., may be flattened by passing between rollers and severed into short pieces, or if desired, may be extruded directly through slotted dies.

The short flattened pieces of the extruded misch metal may be welded or otherwise attached to the plate or other metal part of radio tubes, lamps, or other evacuated devices and after exhaustion may be vaporized to clean-up the residual gases therein, as fully set forth in the application of Marden et al, referred to above.

Obviously, this invention is susceptible of other embodiments and may be practiced with other apparatus without departing therefrom.

What is claimed is:

1. A clean-up material composed chiefly of cerium in the form of a wire.
2. A clean-up material composed chiefly of a metal of the cerium group of the rare earth metals in wire form.
3. A clean-up material for evacuated devices consisting of misch metal wire.

4. A clean-up material for evacuated devices composed of misch metal in the form of a flattened wire.

5. A clean-up material for evacuated devices composed of misch metal in thin, regular form.

6. The method of producing misch metal bodies consisting in heating the metal to

just below its melting point in an inert environment and pressing the heated metal into the desired form. 10

In testimony whereof, we have hereunto subscribed our names this 28th day of January 1925.

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