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METHOD OF PROVIDING MOLYBDENUM WIRE WITH A CARBON COATING

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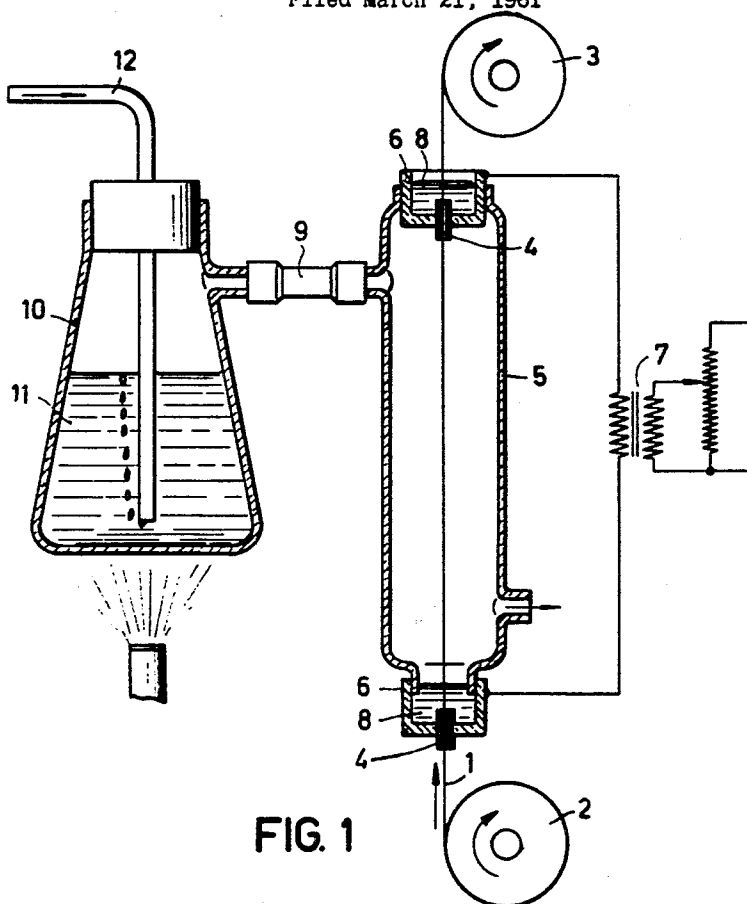
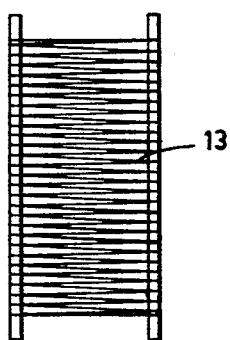


FIG. 2



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## METHOD OF PROVIDING MOLYBDENUM WIRE WITH A CARBON COATING

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3 Claims. (Cl. 117—226)

It is known that a wire consisting of tantalum, molybdenum or tungsten can be provided with a carbon coating by heating it in a gas atmosphere containing inter alia compounds of chlorine and carbon, for example an atmosphere of carbontetrachloride and hydrogen. In this process, the wire is heated to at least 1100° C. and the carbon coating may have a thickness of from 24 to 125 microns. Such wires are used for manufacturing grid-electrodes for electric discharge tubes which are heavily loaded electrically. Such a carbon-coated grid has a satisfactory heat radiation and a slight primary emission when heated to a high temperature.

Because such a wire, however, cannot readily be bent, preferably a grid made from bare wire is coated. However, this is a complicated process, since heating such a grid to the required high temperature provides difficulty.

Hence, a process is to be preferred in which the wire is provided with a carbon coating having satisfactory adherence and then worked into a grid. However, this cannot readily be done by the known method, in particular if molybdenum wire is used, since this, when heated to a temperature exceeding 1000° C., is subject to structural changes and becomes brittle. However, even when using an atmosphere of carbontetrachloride (CCl<sub>4</sub>), heating to at least 1100° C. is required to ensure a carbon coating having satisfactory adherence. When heating in an atmosphere of hydrocarbons a far higher temperature is required.

It has now been found that it is nevertheless possible to provide a molybdenum wire with a carbon coating having satisfactory adherence without the mechanical properties of the molybdenum being changed, so that the coated wire may readily be used for manufacturing with electrodes if, according to the invention the chlorine-carbon compound is chloroform (CHCl<sub>3</sub>) and the molybdenum wire is heated to a temperature below 1000° C. for so short a period of time that the thickness of the resulting carbon coating is less than two microns. It has been found that, when chloroform is used, heating to a temperature of from 800 to 950° C. is sufficient to deposit carbon on the wire in the form of a layer which adheres firmly, provided that the thickness does not exceed 2 microns. Preferably the thickness of the coating is about 1 micron. Thus, the wire may readily be bent into any required shape without the carbon coating being detached or damaged.

Only chloroform proves to be suitable for this method in contradistinction to the other chlorine carbon compounds.

In order that the invention may readily be carried into effect, an embodiment will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

FIGURE 1 shows an apparatus for coating molybdenum wire according to the invention, whilst

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FIGURE 2 shows a grid electrode made with the use of such a wire.

In FIGURE 1, a molybdenum wire 1 having a diameter of 100 microns runs from a take-off spool to a spool 3. The wire 1 is passed through glass tubes 4 and a vessel 5. The tubes 4 are secured in metal cups 6 connected to a current source 7 and filled with mercury 8. Since the mercury 8 does not wet the glass of the tubes 4, it does not flow away through these narrow tubes. The mercury 8 also acts as current supply conductors for the wire 1 within the vessel 5. The current source 7 is adjusted so that the wire 1 is heated to a temperature of from 800° C. to 950° C.

The vessel 5 is filled with a mixture of chloroform vapour and an inert gas, for example hydrogen, which mixture is obtained by passing hydrogen through a tube 12 into a chamber 10 through chloroform 11, a mixture of gas of vapour then flowing to the vessel 5 through a connecting pipe 9. The chloroform 11 may, if required, be heated in order to bring the vapour concentration to the required value.

It has been found that, if the wire 1 is heated to a temperature of from 800° C. to 950° C. and travels through the vapour mixture in the vessel 5 for about 1 second, a carbon coating having a thickness of about 1 micron is obtained, which adheres extremely firmly to the wire 1. Such a coated wire can simply be wound to produce a grid 13 of the kind shown in FIGURE 2.

It has been found that the carbon coating, if it becomes thicker than 2 microns, may crack or even scale off when the wire is bent about the stay rods.

What is claimed is:

1. A method of coating a molybdenum wire with carbon comprising the step of heating the molybdenum wire in an atmosphere consisting essentially of hydrogen and chloroform to a temperature not exceeding 1000° C. and at which the chloroform decomposes for a period of time during which a coating of carbon on the molybdenum wire not exceeding two microns in thickness is formed.

2. A method of coating a molybdenum wire with carbon comprising heating the molybdenum wire in an atmosphere consisting essentially of hydrogen and chloroform to a temperature of about 800° to 950° C. until a carbon coating one micron in thickness is formed on the molybdenum wire.

3. A method of coating a molybdenum wire with carbon comprising heating the molybdenum wire in an atmosphere consisting essentially of chloroform and hydrogen at a temperature not exceeding 1000° C. and at which the chloroform decomposes and carbon is deposited on the wire, and continuing to heat the wire at that temperature only long enough to form a coating not exceeding two microns in thickness.

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