Nov. 15, 1955 E. M. BELLOTT 2,723,926

METHOD OF WINDING A TUNGSTEN COIL ON AN IRON MANDREL

Filed Oct. 30, 1952

Fig. 1.

OLD METHOD

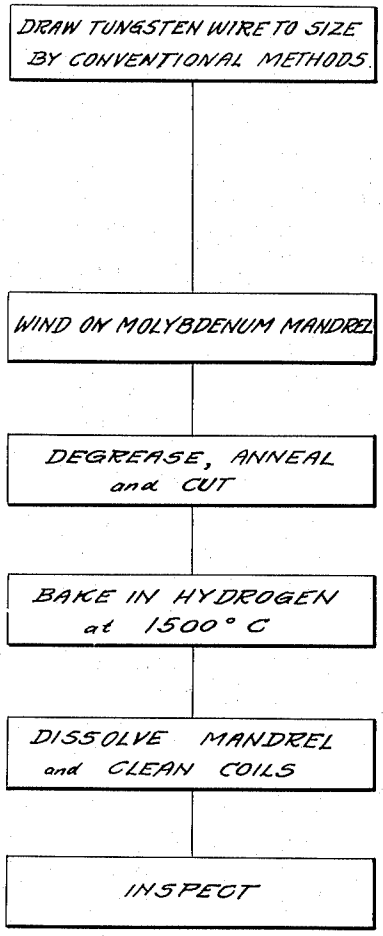


Fig. 2.

PRESENT METHOD

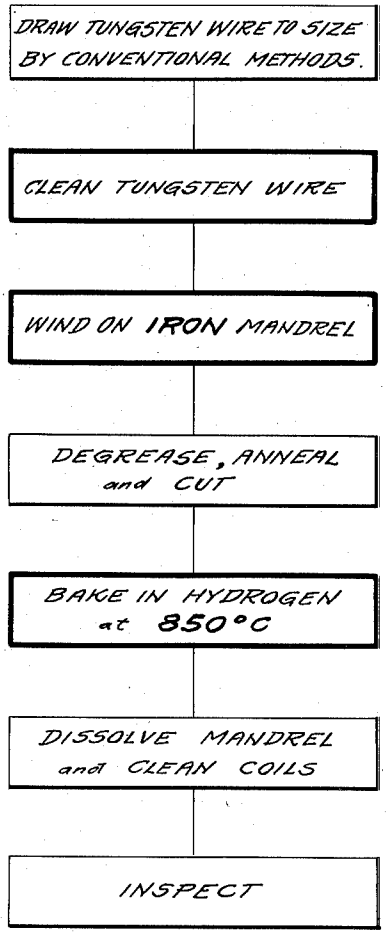
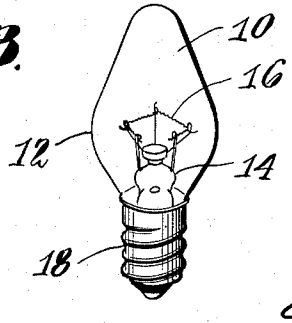


Fig. 3.



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United States Patent Office 2,723,926
Patented Nov. 15, 1955

2,723,926

METHOD OF WINDING A TUNGSTEN COIL ON AN IRON MANDREL

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Application October 30, 1952, Serial No. 317,741

2 Claims. (Cl. 148—11.5)

This invention relates to coil winding and, more particularly, to a method for manufacturing miniature incandescent filament coils on an iron mandrel.

One of the requirements for the automatic mounting of the lamp filaments on the lead-in wires of a stem is that the filament be coiled about a straight axis and have uniform length. In the past, it has been customary to wind the filament wire on a molybdenum mandrel, bake the wound coil in a hydrogen atmosphere at 1500° C. and then dissolve out the mandrel in an acid solution, suitably a mixture of sulphuric and nitric acids. The molybdenum mandrel was employed to permit the high temperature bake of the wound coil thus setting the filament structure, insuring that it would be coiled about a straight axis with uniformly spaced turns, and also cleaning the coil by reducing (in the hydrogen atmosphere) the oxide formed thereon.

One disadvantage in the use of the molybdenum mandrel is its excessive cost. This is extremely undesirable in the present high speed, mass production, low unit cost manufacture of incandescent lamps and, more particularly, miniature incandescent lamps.

Hence, it has been found advantageous according to my invention to employ a method of coil winding on an iron mandrel. This method comprises essentially: (1) drawing the tungsten wire to the proper size or diameter in the conventional manner; (2) electrolytically cleaning the tungsten wire; (3) winding the clean tungsten wire on an iron mandrel; (4) degreasing, annealing and cutting to length; (5) baking the coils in a hydrogen atmosphere at 850° C.; (6) dissolving out the iron mandrel in hydrochloric acid and cleaning the coils; and (7) inspecting the coils.

The hydrogen bake at 850° C., employed in conjunction with cleaning of the tungsten wire prior to the winding thereof on the iron mandrel, satisfactorily removes the absorbed gases and surface contaminants from tungsten wire, insures a straight clean filament which is uniform in length, after the mandrel has been dissolved, with considerable saving in cost of manufacture.

In its general aspect, the present invention has as its object the elimination of disadvantages and defects of the prior art coil winding on a molybdenum mandrel.

A specific object of the invention is an improved method of incandescent lamp coil winding on an iron mandrel.

Another object is an improved method of filament coil winding with an iron mandrel comprising; drawing the wire to the proper size, electrolytically cleaning the tungsten wire, automatically winding the wire into a coil on an iron mandrel, degreasing, annealing and cutting the coil to the proper length, baking the wound coil in a hydrogen atmosphere at 850° C., dissolving the mandrel and cleaning the coil in hydrochloric acid and trisodium phosphate, and finally inspecting the coils.

Other objects of the invention will become apparent to those skilled in the art as the description thereof proceeds, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawing:

Fig. 1 is a flow chart of the prior art method of coil winding on a molybdenum mandrel.

Fig. 2 is a flow chart of the method of my invention for winding the filament coil on an iron mandrel.

Fig. 3 is a perspective view of a miniature incandescent lamp showing a fllament therein wound by the method of my invention.

The old method of filament manufacture, charted in Fig. 1, comprises essentially the following steps: (1) drawing the tungsten wire in successive steps by means of conventional wire drawing dies to the required size or filament wire diameter, (2) winding the drawn tungsten wire on a molybdenum mandrel on an automatic coil winding machine, (3) degreasing the wound coil in a conventional hot degreasing bath or tank, annealing the degreased coil in a hydrogen furnace, and cutting the coil to the proper length in a trimming or cutting device, (4) baking the formed coil in a dry hydrogen furnace at about 1500° C., (5) immersing the baked coil in a solution of sulphuric and nitric acid to dissolve out the molybdenum mandrel and cleaning the coil in a caustic solution to neutralize the acid bath, and (6) inspecting the cleaned coil in a visual projection testing apparatus.

The improved cost-reducing method of my invention, charted in Fig. 2, for winding a filament coil on an iron mandrel may comprise: (1) drawing the tungsten wire to the proper wire diameter in the conventional way, (2) electrolytically cleaning the tungsten wire, washing in hot water, immersing in a caustic solution, washing again in hot water, neutralizing the caustic bath with hydrochloric acid, and drying in an air oven, (3) winding the clean tungsten wire into a coil on an iron mandrel on an automatic coil winding machine; (4) degreasing, annealing in wet hydrogen at about 850° C. at the rate of approximately 22½ ft./min. and cutting to length the wound coil in a conventional manner; (5) baking the clean coil in a wet hydrogen furnace at about 850° C. for approximately 10 minutes to set the filament structure curved about a straight axis with uniformly spaced turns to insure uniform length and to remove absorbed gases and surface contaminants therefrom; (6) dissolving out the iron mandrel and cleaning the coil by alternately immersing it in trisodium phosphate, hot water, and hydrochloric acid; (7) inspecting the coil in a conventional manner.

In Fig. 3 a conventional miniature lamp, such as a Xmas tree lamp, is designated by the reference numeral **10**. This lamp **10** comprises a vitreous envelope **12**, a lamp mount **14** sealed to the open end of the envelope **12** and having mounted thereon a filament **16** manufactured by the method of my invention, and suitably a base **18** secured by a conventional cement about the envelope and mount seal.

While a preferred embodiment of my invention has been disclosed it will be understood that modifications may be made within the spirit and scope of the invention.

I claim:

1. The method of fabricating a coil and mandrel assembly comprising electrolytically cleaning tungsten wire to remove surface contaminants therefrom, winding the clean tungsten wire on an iron mandrel; degreasing the wound coil, annealing the coil in wet hydrogen at about 850° C. to remove all stresses and strains therein, cutting the wound coil to length, baking the annealed coil in wet hydrogen at about 850° C. for approximately 10 minutes to set the coil structure about a straight axis with uniformly spaced turns to insure uniform length and to remove absorbed gases therefrom.

2. The method of fabricating a coil and mandrel assembly comprising electrolytically cleaning tungsten wire to remove surface contaminants therefrom, washing said wire in hot water, immersing said wire in a caustic solu-

tion, washing said wire again in hot water, neutralizing the caustic on said wire in hydrochloric acid and drying the wire in an air oven, winding the clean tungsten wire on an iron mandrel; degreasing the wound coil, annealing the coil in wet hydrogen at about 850° C. to remove all stresses and strains therein, cutting the wound coil to length, baking the annealed coil in wet hydrogen at about 850° C. for approximately 10 minutes to set the coil structure about a straight axis with uniformly spaced turns to insure uniform length and to remove absorbed gases therefrom.

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